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Effect of soil and water conservation measures on growth and yield of arecanut under sloppy terrain of Assam

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Arecanut (*Areca catechu* Linn.) is one of the major cash crops of Assam. Most of the farmers of Assam grow arecanut in their homestead garden. Though Assam contributes a major share in the total arecanut production in the country, its productivity is low. In Assam, the area under this crop is about 0.73 lakh ha, and production of 0.69 lakh tonnes with a productivity of 952 kg per ha. Though Assam contributes significantly to the arecanut sector, the productivity is very low compared to the national average of 1.22 tonnes per ha. Among the various factors for low productivity, its cultivation in sloppy land coupled with rainfed situation are the major factors. Arecanut crop is very sensitive to moisture stress, which causes reduction in growth and yield to larger extent. Heavy rain coupled with high runoff of soil loss aggravate the situation. If proper soil and water conservation measures are adopted in those sloppy areas, the growth and yield of arecanut could be improved. Practically, there is no such information regarding soil and water conservation in arecanut gardens under Assam conditions. Keeping these points in view, an experiment was undertaken in the farmers' field to study the effect of different soil and water conservation measures on the performance of arecanut seedlings and bearing palms.

Two experiments were conducted in farmer's field in the village Lalmati under Rani Development Block of Kamrup District of Assam. The experimental site was having a slope of 25-28%, red sandy loam in texture, medium in available N, P and K with slightly acidic soil reaction. The average annual rainfall in the region ranges between 2500 to 3000 mm and most of the rainfall occurs during South West monsoon (June to August/September). There is a dry spell form October to March with occasional showers from March to May. The annual rainfall received during the experimental period in the area was 2158.4 mm (during 2003), 1651.4 mm (during 2004) and 1169.6 mm (during 2005). The rainfall received during 2003 to 2005 was below the normal rainfall of the region.

Experiment I: Evaluation of soil and water conservation measures under arecanut seedlings

The treatments comprised of five soil and water conservation measures and one control.

T_1 = Control

T_2 = Trench with one layer of coconut husk

T_3 = Catch pit with one row of pineapple in the down stream

T_4 = Bunding with pineapple

T_5 = Staggered bunding (with soil and coconut husk) and

T_6 = Half moon bund

The treatments were laid out in randomized block design with three replications.

The arecanut seedlings were transplanted in the month of March, 2003 and the different soil and water conservation structures were made during April, 2003. Each treatment comprised of 12 seedlings. The morphological data of the experimental seedlings were recorded at the time of transplanting and later one and two years after treatment imposition.

The seedlings were managed with recommended package of practices and grown under rainfed condition. During critical dry period life saving irrigation was provided to all seedlings.

The soil moisture content at 0-30cm depth under different treatments was recorded gravimetrically in the

seedling basin at monthly interval and expressed in percentage.

Experiment II: Evaluation of soil and water conservation measures in bearing arecanut garden

The above soil and water conservation measures were tested in bearing arecanut palms aged about 16 years, with 12 palms per treatment. The yield of palms was recorded during 2004 and 2005. The palms were managed with recommended package of practices and grown under rainfed condition.

Effect of soil and water conservation measures on growth and development of arecanut seedlings

Growth characters: The data pertaining to growth of seedlings is presented in Table 1, and it is evident from the data that the soil and water conservation measures have positive influence on growth characters of arecanut seedlings with respect to plant height and girth at base compared to control. Among the different soil and water conservation measures, catch pit with planting of pineapple in the down stream of the catch pit (T3) and trench with one layer of coconut husk (T2) were found most effective. The increment in height and girth at base was higher in T3 followed by T2 during first year and was higher in all soil and water conservation treatments during second year compared to control (Fig. 1). The other soil and water conservation measures had also recorded higher plant height and girth at base over control. The increase in growth parameters might be due to reduction in run off and better availability of soil moisture.

Soil moisture: It is evident from Table 2 that the different soil and water conservation treatments influenced the moisture content at the root zones of arecanut seedlings. Higher moisture content was observed in treatment T2 followed by T3 during the dry periods. Other treatments also had higher moisture content compared to control. Even with less rainfall during 2004 and 2005, the growth of seedlings was not affected due to conservation practices in all the treatments compared to control. Ghosh (1999) also reported higher soil moisture content with elliptical trench or circular trench methods along with mulching in cashew.

Table 2. Soil moisture content* (%) at the root zone of arecanut seedlings as influenced by different treatments

Treatments	2003		2004		2005	
	Nov.	Dec.	Nov.	Dec.	Jan.	Feb.
T1	16.14	14.58	15.40	13.57	9.50	6.50
T2	18.25	17.10	17.90	16.70	13.20	10.90
T3	18.04	16.99	17.90	16.40	13.00	10.20
T4	17.47	16.42	17.10	15.90	12.60	8.50
T5	16.98	15.78	16.85	15.75	12.80	8.90
T6	16.95	15.65	17.00	15.80	12.30	8.70

*Average of 5 palms per treatment

Table 1. Morphological characters as influenced by different *in situ* soil and water conservation measures

Treatments	Plant height (m)			Girth at base (cm)			Number of leaves		
	Initial	2004	2005	Initial	2004	2005	Initial	2004	2005
T1	1.16	1.43	2.30	12.24	13.92	28.33	4.9	5.5	6.3
T2	1.18	1.80	2.83	11.97	16.97	35.33	4.9	6.8	7.3
T3	1.02	1.67	3.06	10.83	16.67	38.66	4.9	6.5	7.7
T4	1.19	1.65	2.86	12.45	17.05	37.00	4.9	6.5	6.7
T5	1.23	1.75	2.93	12.00	17.50	36.33	5.0	6.7	7.0
T6	1.23	1.67	2.86	12.07	16.72	36.00	5.0	6.6	7.0
CD (P=0.05)	NS	0.05	0.14	NS	0.38	1.84	NS	NS	NS

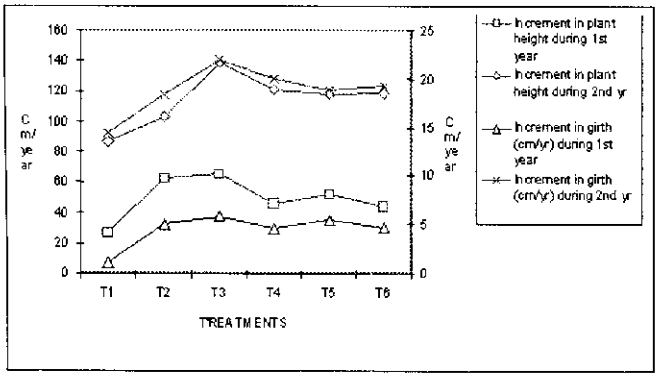

Fig.1. Increment in plant height (cm/yr)and girth at base as influenced by different treatments

Evaluation of soil and water conservation measures under bearing arecanut garden

Yield of arecanut

Yield of arecanut palms as influenced by different soil and water conservation measures is presented in Table 3. The number of nuts and chali yield was significantly higher in the treatment of catch pit and planting of pineapple in the down stream (T3), and was on par with the treatment, trench with one layer of coconut husk (T2). Other soil and water conservation measures also recorded significantly higher chali yield compared to control. Dhanapal *et al.* (2005) also have

Table 3. Yield of arecanut palms as influenced by different *in situ* soil and water conservation measures

Treatments	Ripe nuts per palm per year (No.)		Mean	Chali (kg per palm per year)		Mean
	2004	2005		2004	2005	
T1	144	150	147.0	1.20	1.27	1.24
T2	244	252	248.0	2.03	2.10	2.07
T3	254	249	251.5	2.12	2.08	2.10
T4	236	228	232.0	1.97	1.90	1.94
T5	222	233	227.5	1.90	1.94	1.92
T6	231	232	231.5	1.93	1.94	1.94
C D (P=0.05)	17.50	29.99	-	0.16	0.25	-

reported that contour trench filled with coconut husk with two lines of pineapple in interspaces of coconut proved to be the best treatment for soil and moisture conservation in laterite soils having a slope of 14-16%. There was increase in the yield of coconut by three times after the implementation of soil and water conservation measures. In cashew, Ghosh (1999) has reported increase in nut yield and higher income with elliptical trench or circular trench methods of soil and water conservation.

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