Research Article

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Feasibility studies on growing hybrid Bajra Napier fodder grass as intercrop in coconut under coastal littoral sandy soil

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Abstract

Coconut is grown in coastal littoral sandy soil, which occurs all along the coastal sandy tract of the West and East coasts of the Peninsular India lying mostly in Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa and Maharastra. Coastal littoral sandy soils are mainly skeletal soils, consisting of 99.1 per cent sand particle characterized by poor water holding capacity, high infiltration rate, easy leachability and low inherent fertility status. Even though coconut is a widely spaced crop, the interspace cannot be utilized for growing of intercrops in sandy soils under normal conditions. However, by adopting proper soil and moisture conservation measures intercropping can be practiced in the coconut garden under coastal sandy soil. Keeping this in mind, a field experiment was conducted to study the feasibility of growing bajra Napier fodder grass (Co 3) as intercrop in the coconut garden by adopting various soil and moisture conservation methods under coastal sandy soil at Central Plantation Crops Research Institute, Kasaragod, Kerala during June 2004. The treatments included soil moisture conservation measures *viz.*, one layer dried coconut husk burial in the trenches and planting of grass, coir pith application in the trenches and planting of grass and control (planting of grass with out any soil and water conservation measures). Among the treatments, one layer of dried coconut husk burial in the trenches and planting of grass, resulted in higher green fodder yield (96.83 tonnes/ha). The experimental results revealed that bajra Napier fodder grass (Co 3) can be successfully grown as intercrop in the coconut garden in coastal sandy soil by adopting suitable soil moisture conservation measures.

Key words: Coastal littoral sandy soil, coconut husk, coir pith, intercrop, fodder

Introduction

Coconut, the Tree of Heaven is highly amenable for cultivating grass in the interspaces because of its wider spacing. Coconut based integrated farming system is a proven system which is ecologically sustainable that will enable the farmer to realize more income (Maheshwarappa *et al.*, 1998). It is a well-established fact that grass can be successfully grown as intercrop in most of the coconut growing soils. However, growing of grass in between the coconut palms in coastal littoral sandy soil is not feasible under normal management practices. This is mainly because of poor inherent physico chemical properties of the coastal sandy soil. As coastal sandy soils are mainly skeletal soils consisting of 99.1 per cent sand particles, growing any annual/ biennial/perennial in the interspaces of coconut palm is possible only by improving physico chemical properties of soil. Research in this line is limited. Keeping this in view, a field experiment was conducted with the objective to study the feasibility of growing grass as intercrop in the coconut garden under coastal littoral sandy soil.

Materials and Methods

The investigation was carried out during the period from June 2004 to August 2005 at Central Plantation Crops Research Institute, Kasaragod (12°30' N latitude and 75°00' E longitude, with an elevation of 10.7 m above mean sea level). The weather data prevailed during the period under study is given in Table 1.

The experiment was laid out in a 40 years old WCT coconut garden. The soil of the experimental field was sandy (Quartzip samments) having 99.1 percent sand, 0.2 per cent silt and 0.7 per cent clay. The pre experimental physico-chemical properties of the soil of the experimental field are given in Tables 2, 2 a and 2 b.

The experiment was laid out in Randomized block design with seven replications and three treatments. The

Table 1. Weather parameters during the experimental period (2004-2005)

Parameters Month	Temperature (°C)		Relative humidity(%)		Evaporation (mm/day)	Sunshine (hr/day)	Rainfall (mm)
June '04	29.7	22.5	91	83	2.4	4.1	862.2
July	28.6	21.8	95	86	2.3	3.2	528.6
August	28.7	21.6	96	80	2.6	5.4	589.6
September	30.0	21.0	95	77	1.9	3.0	115.0
October	31.4	21.6	94	71	3.5	6.8	169.4
November	32.8	20.8	87	59	3.6	7.2	129.6
December	33.3	18.9	80	45	3.9	9.6	0
Jan-'05	31.5	20.2	89	56	3.5	8.3	0
Feb	32.0	20.4	89	58	4.7	9.9	0
March	32.3	22.2	89	64	4.8	9.5	0
April	33.3	23.8	86	64	5.3	8.2	52.2
May	33.8	24.4	86	64	5.7	8.4	45.1
June	30.3	22.3	90	83	3.2	3.1	1057.5
July	28.6	21.8	93	89	2.6	2.0	708.8

Table 2. Physical constants of the experimental field soil

1	Field capacity (%)	4.2
2	Permanent wilting point (%)	0.44
3	*In situ* bulk density g.cm^{-3}	1.66

Table 2a. Textural composition of the experimental field soil (% on moisture free basis)

1	Clay	0.7
2	Silt	0.2
3	Fine sand	3.3
4	Coarse sand	95.8
5	Textural class	Sandy soil

Table 2 b. Chemical composition of the experimental field soil

1	Available nitrogen (kg ha^{-1})	34.8
2	Available phosphorus (kg ha^{-1})	23.05
3	Available potassium (kg ha^{-1})	12.5
4	Organic carbon (%)	0.139

treatments are, T_1: Coconut husk burial in the planting zone of the grass, T_2: 5 cm thickness of coir pith application in the planting zone and T_3: control. For the husk burial, a trench was opened measuring 30 cm width and 30 cm depth, and one layer of husk was applied in a convex manner. (Husks from 10 coconuts were used to cover 1-meter long trench). In the case of T_2 treatment, trench was opened measuring 30 cm width and 30 cm depth and coir pith was applied to a height of 5 cm. In the control plot only trenches were opened. Farmyard manure @ 5 t and vermicompost @ 5 t /ha were applied uniformly to all the treatments. Then the trenches were filled with soil and the planting was taken up during June 2004 with hybrid bajra Napier Co 3 fodder grass. Two budded stem cuttings were used for planting at a spacing of 50 x 50 cm. As a basal dose, 50 kg N, 40 kg K and 40 kg P was applied at the time of planting. Thereafter only nitrogen @ 75 kg was applied after each cutting was made. Sprinkler system of irrigation was practiced with 20 mm of water at IW/CPE ratio of 1.00. First cutting was done 80 days after planting and subsequent cuttings were done at 50 days intervals. The experimental plot size was 7 x 3.5 m.

Soil samples were collected fourth day after irrigation at 0-30 cm depth using tube augur and soil moisture was estimated by gravimetric method. Fresh fodder samples (1000 g) from each treatment were dried at 70° C for calculating the dry matter yield. Observations on growth characters were taken from ten tagged plants/treatment at the time of harvest. Crude protein yield was calculated as per the procedure suggested by Piper (1996). The data were subjected to Fishers method for analysis of variance and interpreted following the procedure given by Gomez and Gomez (1984).

Results and Discussion

Soil moisture content

The results revealed that, soil drawn from husk and coir pith treatments retained higher soil moisture content during the rainless period (Nov- May) compared with that in control plots (Fig. 1). Further, higher moisture content (2.9 to 3.3 per cent on fourth day after irrigation) was noticed in the treatments T_1 and T_2, whereas lower moisture content was noticed in the control treatment T_3 (1.3 to 1.5 per cent on fourth day after irrigation) at 0-30 cm. Higher soil moisture content in the coir pith/husk

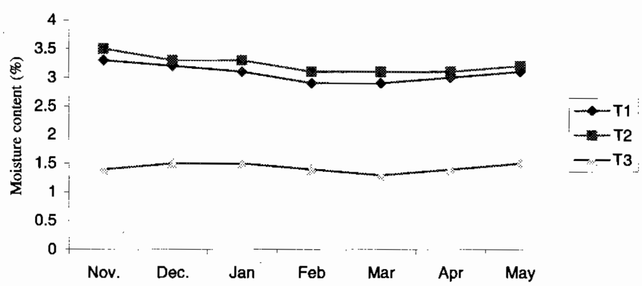

Fig. 1. Effect of different treatments on soil moisture content

burial treatments is due to the absorption and retention of more moisture in the soil by coir pith/husk materials. Child (1964) also reported that coir dust improved the retention of moisture in the soil.

Growth attributes

The husk and coir pith application had significantly influenced the plant height of Co 3 grass during different periods of cutting (Fig. 2). Higher plant height (ranging from 172 to 237 cm during different cutting periods with a mean of 237 cm) was recorded in the treatment where husk was applied in the planting zone (T_1) and it was comparable with coir pith application (T_2) and both the treatments significantly differed from the control (143

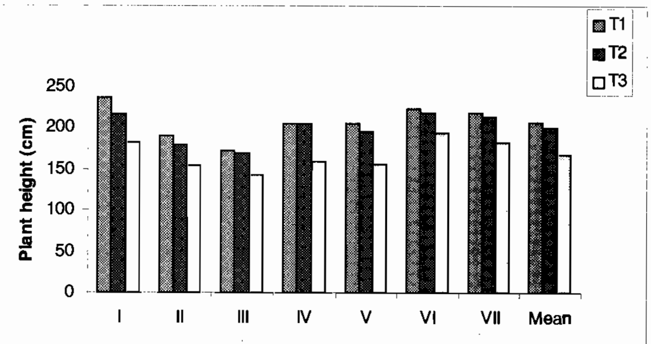

Fig. 2. Plant height as influenced by different treatments

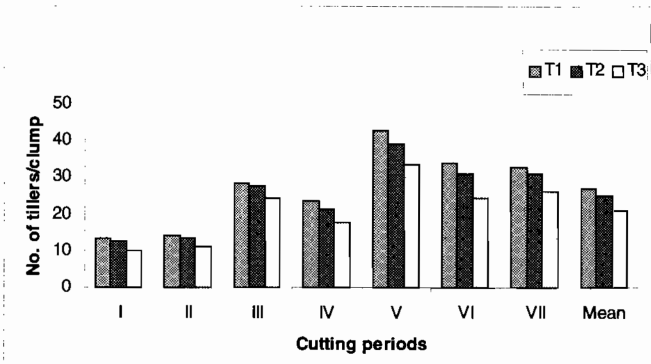

Fig. 3. No. of tillers/clump as influenced by different treatments

clearly evident from the data that when the soil was incorporated with husk or coir pith, the yield of grass was increased significantly compared to that of control. Higher green fodder yield was obtained under husk application during each cutting (green fodder yield ranged from 10.57 to 16.59 t/cutting with a total yield of 96.83 t/ha/year) and it was on par with coir pith application and significantly differed from the control treatment (green fodder yield ranging 8.00 to 11.20 t/ cutting with a total fodder yield of 62.8 t/ha/year). Similar trend was obtained in dry fodder yield also (Table 4). Higher green fodder yield under husk and coir pith application is mainly due to the beneficial effect of husk

Table 3. Effect of different treatments on green fodder yield (t/ha/year)

Treatment	I	II	III	IV	V	VI	VII	Total
T_1	13.27	13.45	10.57	12.05	16.59	16.20	14.70	96.83
T_2	12.14	12.96	10.10	11.30	14.80	15.10	13.80	90.20
T_3	8.62	9.53	8.00	8.10	8.20	11.20	9.20	62.85
CD (P =0.05)	1.23	0.94	0.60	0.92	1.93	1.16	1.08	6.68

Table 4. Effect of different treatments on dry fodder yield (t/ha/year)

Treatment	I	II	III	IV	V	VI	VII	Total
T_1	2.56	2.66	2.04	2.36	3.27	3.26	3.07	19.22
T_2	2.39	2.59	1.98	2.24	3.08	3.19	2.86	18.32
T_3	1.66	1.98	1.59	1.70	1.72	2.32	1.92	12.90
CD (P =0.05)	0.21	0.27	0.18	0.32	0.29	0.40	0.38	2.10

to 183 cm.with mean of 168 cm). Similar type of response was obtained in number of tillers /clump also (Fig.3). The highest number of tillers/clump was obtained in the treatment where husk was applied in the planting zone (13.3 to 42 tillers/clump) and it was on a par with the treatment T_2 where coir pith was applied in the planting zone and it was significantly different from the control treatment. Higher plant height and more number of tillers/clump in the husk/coir pith treatment is mainly due to congenial conditions prevailing in the rooting zone.

Green and dry fodder yield

The fodder grass bajra Napier hybrid Co 3 responded well to husk and coir pith application (Table 3). It is

and coir pith application in the planting zone *viz*., higher soil moisture availability, increased nutrient availability and enhanced biological activities in the rhizosphere. Coir pith and husk have very high water holding capacity of 5 to 6 times their weight (Abeygunawardena *et al.*, 1995). It has been found that by incorporation of 2 percent weight of coir pith with sandy soil, the water holding capacity of the latter is increased by 40 percent. Liyanage *et al.* (1993) reported that coir dust and husk incorporation was beneficial to coconut production. Sossamma and Ragavan Pillai (2000) reported that application of organic manures had significant influence on guinea grass production when intercropped under coconut.

Crude protein content and yield

Husk application in the planting zone resulted in higher crude protein yield and was on par with that of coir pith application and both the treatments significantly differed from the control (Table 5). This is mainly due to higher dry matter yield recorded in these treatments.

From the results it is clearly revealed that grass can be successfully grown as intercrop in coconut gardens under coastal littoral sandy soils by adopting appropriate soil moisture conservation measures.

Table 5. Effect of different treatments on crude protein content (%) (Mean of seven cuttings) and crude protein yield (t/ha/year)

Treatment	Crude protein	Crude protein yield
T_1	11.83	2.28
T_2	12.13	2.22
T_3	11.47	1.48
CD(P =0.05)	NS	0.3

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