Intercropping of fodder crops in coconut garden

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Introduction

Green fodder availability in adequate quantity and quality is crucial for ensuring good health of milch animals, higher milk yield and reducing cost of milk production. Non availability of land is the major constraint experienced by farmers in the cultivation of fodder crops as pure crop. This problem is getting more severe as the average size of land holding is shrinking over the years. Coconut provides excellent opportunities for raising fodder crops in the interspace. Intercropping of fodder crops in the interspaces of coconut is one of the components of the coconut based integrated mixed farming system.

Fodder grass

While choosing fodder grass it should have the following desirable qualities viz.

- Low competition with coconut for resources such as plant nutrients and soil moisture
- Ability to withstand shade
- Good response to fertilizer application
- Compatibility to grow with leguminous fodder plants
- Relished by cattle.

Different species of fodder grass were tried besides some legumes as intercrops in coconut garden since the commencement of the integrated farming experiments at CPCRI, Kasaragod. The results from these studies have shown that various pasture grasses (*Brachiaria miliiformis, B. brizantha, B. ruziziensis, B. mutica, B. dicotyoneura, and Digitaria decumbens*), fodder grass varieties (Guinea grass (*Panicum maximum*), Hybrid Napier: NB 21 and BH-18, Hybrid Bajra Napier (Co 3), Guatemala grass (*Tripsacum laxum*), Blue panic (*Panicum antidotale*), Rhodes (*Chloris gayana*), Sudan grass (*Sorghum sudanense*), leguminous fodder species viz., Brazilian lucerne (*Stylosanthes gracilis*), Cowpea (*Vigna unguiculata*), Centro (*Centrosema pubescens*) and Pueraria (*Pueraria javanica*) and grass + legume mixture species (Hybrid Napier + *Stylosanthes gracilis*), Hybrid Napier + *Pueraria javanica* and Hybrid Napier + *Centrosema pubescens* could be successfully cultivated in coconut garden.

The details of management and performance of selected fodder crops are presented as follows.

i. Hybrid Bajra Napier Co 3 fodder grass

The Bajra Napier hybrid, Co 3 is a good fodder crop. This grass is highly leafy with long and broad leaves having very little stem portion (leaf to stem ratio is 0.7) and hence palatability is high. Under the climatic conditions of Kerala, the best season of planting is with the onset of southwest monsoon during May-June. As an irrigated crop, planting can be done at any time of the year. The grass is planted by rooted slips or by stem cuttings. Cuttings of moderately mature stems (3 months old) and preferably from the lower two thirds of the stem length sprout better than the older stems. The cuttings are planted in a slanting position with the spacing of 60 cm x 60 cm. The cuttings with three nodes are stuck into the soil with the basal end down to such a depth that two nodes remain within the soil and one node above the soil surface. The underground nodes develop roots and shoots while the upper ones develop shoots only. Planting during heavy rainfall period should be avoided. The field should be provided with good drainage during the rainy season, as the crop cannot withstand water stagnation. Sprinkler system of irrigation was practiced with 20 mm of water at IW/CPE ratio of 1.00 and around 200000 liters water is required for one irrigation and the interval will be once in four days. Frequency of irrigation depends upon the rainfall and weather conditions. Intercultivation once or twice is necessary to avoid weed growth in the initial period for better establishment and vigorous growth. Subsequently, intercultivation should be given as and when necessary. The first cutting of the grass should be done at 80 days after planting Thereafter cutting should be at the intyerval of 45 days. Cutting should be done close to the ground level leaving stubbles of 5- 10 cm height. It has got quick regeneration capacity also. The grass can be maintained for a period of three years. Replanting should be done after three years. Leguminous green manure crops can be raised in the interspace and can be incorporated before replanting of grass.

Effect of nutrient management practice on green fodder yield and crude protein content

Nutrient management practice	Green fodder yield (t/ha)			Mean yield (t/ha)*	Crude protein content (%)
	1st year	2nd year	3rd year		
50 per cent organics + 50 per cent chemical fertilizers	137	110	105	117	12.19
100 per cent organics	110	100	103	106	12.69
100 per cent chemical	120	83	85	96	11.94

* Yield obtained from fodder grass planted in the interspace in coconut garden ie 65% of the total area

Performance of Bajra Napier hybrid, Co 3 under different nutrient management practices was studied in red sandy loam soil at CPCRI, Kasaragod. Growth parameters viz., plant height, number of tillers and yield of grass were measured at every harvest stage and results revealed that fodder grass yield was higher under the treatment in which combined use of inorganic fertilizer and organic manures was practiced (117 t/ha/year) followed by the treatment in which nutrient requirement was met through 100 per cent organics (106 tonne/ha/year) and treatment having chemical fertilizers alone (96 t/ha/year) . The Crude protein content ranges from 11.94 to 12.69. It was interesting to note that crude protein content was higher when the fodder grass was grown as intercrop when compared to monocrop. This is mainly due to the nitrogen content of grass was higher under shaded conditions. This quantity of fodder is sufficient to maintain 10-12 milching animals.

In the field situation, staggered planting of fodder grass is practiced depending on the number of cattle to be fed to avoid wastage of fodder grass. Based on the experimental results at CPCRI, Kasaragod the recommended pattern of staggered planting of fodder grass to meet the requirement of cattle as part of CBIFS is furnished below.

Recommended pattern of staggered planting of fodder grass

No. of milch animal	Area in cents	Area of staggered planting in cents					Day of planting in the second month
		Days of planting in the first month					
		1st	7th	14th	21st	28th	5th
1	24-25	4.2	4.2	4.2	4.2	4.2	4.2
2	48-50	8.3	8.3	8.3	8.3	8.3	8.3
3	72-75	12.5	12.5	12.5	12.5	12.5	12.5
4	96-100	16.6	16.6	16.6	16.6	16.6	16.6
5	120-125	20.8	20.8	20.8	20.8	20.8	20.8
6	144-150	25	25	25	25	25	25
7	168-175	29.2	29.2	29.2	29.2	29.2	29.2
8	192-200	33.3	33.3	33.3	33.3	33.3	33.3
9	216-225	37.5	37.5	37.5	37.5	37.5	37.5
10	240-250	41.6	41.6	41.6	41.6	41.6	41.6

Hybrid bajra napier co 3 as intercrop

ii. Guinea grass

Guinea grass is an important perennial bunch fodder grass species of the tropics. It is an excellent fodder, much valued for its high productivity, palatability and good persistence. This grass tolerates shade and grows under trees and bushes and is best suitable as an intercrop in coconut gardens. It can perform well under rainfed conditions also. The grass is adapted to a wide range of soil conditions. It usually grows on well-drained light textured soil, preferably sandy loam

Guinea grass variety CO (GG) -3 as intercrop in coconut

or loam and is better suited to medium to highly fertile loam. The field should be ploughed two to three times to obtain a good tilth. The best season of planting is at the onset of southwest monsoon during May-June. Under irrigated conditions, planting can be done at any time of the year. Since seed germination is poor, vegetative propagation is preferred. To obtain slips for planting, old clumps are uprooted and slips with roots are separated. The spacing of 50 x 50 cm is followed and the crop is planted in the trenches of 30 cm width and depth. A basal dose of 10 to 20 tonnes of FYM, 50 kg P_2O_5 and 50 kg K_2O per ha (applied in trenches) is recommended. 25 kg of nitrogen/ha should be applied after each cut. Under rainfed conditions fertilizer application should be applied only when there is sufficient moisture. Sprinkler system of irrigation is ideal with 20 mm of water at IW/CPE ratio of 0.75. Cowshed washing from the dairy unit and water from fish pond can also be used for irrigation especially during the initial stage for better performance of the grass. Cutting at 10 cm above the ground level is advised. The first cut is usually ready in 9-10 weeks after planting and subsequent cuts are taken at 45 to 60 days intervals. About six to seven harvests can be made in a year. Guinea grass variety Co2 recorded a yield of 60 tonnes of green fodder when grown as intercrop. Similarly the performance of Guinea grass variety CO (GG) 3 is also being evaluated and the yield of 85 t/ha / year obtained. Guinea grass has to be replanted after 3-4 years.

Fodder legume

i. Cowpea

Legumes are palatable and protienaceous fodder crops, which have pivotal role in animal production systems. Legume fodders may be mixed with straw or other grasses to prevent the occurrence of bloat and indigestion. For higher productivity of milk the animal should be fed with balanced amount of grass with leguminous fodder in the ratio of 3:1. In the CBIFS cowpea were tried. The seeds of Co 5 and C 152 were sown with spacing of 30 cm x15 cm. Weeding was done as and when necessary. Fertilizer dose of 16kg N, 24 kg P_2O_5 and 12 kg K_2O of coconut garden was applied. Harvesting was done 50-60 days after sowing and after attaining 50 % flowering. From one ha of coconut garden Co 5 and C 152 recorded 15.75 and 13.2

Fodder cowpea as intercrop

tonnes green fodder yield, respectively. Sowing should be avoided during heavy rainfall. Fodder cowpea can be cultivated as intercrop in the coconut garden or combination of grass + cowpea either 3: 1 ratio or interspaces fodder and in the intra spaces cowpea can be grown as shown in the figure below. Cowpea for fodder purpose can be grown in any month under irrigated conditions.

ii. Stylosanthes

Stylosanthes is a fodder cum leguminous cover crop, which is suited for intercropping in coconut gardens, either alone or in combination with other fodder grasses. The plant thrives well in light soils due to its deep rooting system. The crop is suited for growing in warm, humid tropical climate. It is fairly drought resistant and shade tolerant. Sowing is to be done at the onset of southwest monsoon during May-June. Irrigation is required if there is no proper soil moisture at the time of sowing. Different species suitable for cultivation include perennial types viz., Brazilian lucerne *(Stylosanthes guianensis)*, Shrubby Stylo *(Stylosanthes scabra)*, short-lived perennial legume Caribbean stylo *(Stylosanthes hamata* cv. Verano) and annual type Townsville stylo *(Stylosanthes humilis)*. The seed rate is 2 to 3.5 kg/ha when grown as an intercrop in coconut garden. Seeds broadcasted and covered with a thin layer of soil. The depth of sowing should be 5-10 mm. Seeds germinate within a week. Recommended dose of N, P_2O_5 and K_2O for both annual and perennial stylosanthes are 20, 80 and 30 kg per ha, respectively. For perennial crops, phosphorus @ 80 kg/ha and potash @ 30 kg/ha may be applied in subsequent years. Application of lime @ 375 kg/ha is also recommended in acid soils. Gap filling may be done 15 days after sowing. First weeding is given 45 days after sowing. A second weeding and hoeing may also be done after the first harvest. Gentle raking of the interspace after the application of fertilizers in the subsequent years may be done. First harvest is taken 3-4 months after sowing and subsequent harvest at 45 days intervals or according to the growth of the crop. A maximum of 4-5 harvests can be taken in a year for a perennial crop, which will remain in the field for 3 years(Fig. 7). All these different species of stylosanthes were tried as intercrop in coconut garden. The green fodder yield obtained per year from different stylosanthes species viz., *Stylosanthes guianensis, Stylosanthes hamata and Stylosanthes scabra* when grown in the interspaces of coconut are 23.2 t/ha, 26.3 t/ha and 27.9 t/ha, respectively.

Stylosanthus as intercrop

Fodder cereals

i. Fodder maize *(Zea mays)*

Maize is mainly grown for grain purpose. However, it could be cultivated for fodder purpose also because of its good quality green fodder and high yield. Maize is the most ideal crop for silage making too. In irrigated areas, one crop of maize for fodder purpose may be taken preferably along with cowpea before monsoon, i.e. from March to June to get green fodder during summer. The optimum season for sowing as rainfed crop is the last week of June to second week of July and September to October. For fodder, African Tall and local varieties are recommended. 50-60 kg of seed should be sown per hectare at the spacing of 30 x15 cm. For early crop, seeding should be done during mid March to mid April. Irrigation should be given immediately after sowing and life irrigation should be given on the third day and thereafter once in 10

days. Hoeing and weeding are done as and when necessary. Monsoon crop should be seeded at the beginning of monsoon. 80 kg N and 60 kg P_2O_5 per hectare are recommended to obtain good yield. 50 % N and full P and K should be applied at sowing time and the remaining 50 % N at 30 days after sowing as top dressing. Maize fodder which is upto three weeks old should not be fed to cattle. The crop should be harvested when the cob is in the milky stage. The green fodder yield obtained from fodder maize (variety African tall) under Kasaragod conditions was 26.2 t/ha.

Fodder Maize as intercrop

ii. Fodder sorghum

Fodder sorghum is quite soft, palatable and fast growing annual fodder crop adapted to areas up to 1500 m altitude. Under irrigated conditions two crops of sorghum may be taken in one year, one during March to June and the second during monsoon season, i.e. June to October. It should be harvested for fodder purpose after flowering. If harvested at early stage there is risk of hydrocyanine(HCN) poisoning. The recommended spacing is 30 x 10 cm. Irrigation should be given immediately after sowing. Light irrigation should be given on the third day and thereafter once in 10 days. First hand weeding should be done on the 20th day of sowing and if necessary a second hand weeding between 35 – 40 days after sowing. Apply N, P_2O_5 and K_2O fertilizers at the rate of 60, 40 and 20 kg per ha, respectively for Co 27 variety of fodder sorghum. The recommended dose of fertilizer for variety CoFS 29 is 45 : 40 : 40 kg N,P, K/ha as basal and 45 kg N as top dressing after 30 days after sowing followed by the application of 45 kg N/ha after every cut. After 4th cut, apply 40 kg P and 40 kg K along with 45 kg N to sustain the fodder yield and quality. Harvesting should be taken up at 50% flowering for fodder. The fodder varieties tried under coconut as intercrops are viz. CO 27 and CO FS 29 (multicut variety). Co 27 recorded green fodder yield of 22 t/ha and CO FS 29 variety recorded a green fodder yield of 36 t/ha/year.

Fodder sorghum -CO 27 as intercrop

Conclusion

Integration of subsidiary enterprises such as dairy is suggested for higher income from coconut farming and for ensuring ecological sustainability. Research at CPCRI has identified suitable fodder crops and their management practices for growing as intercrops in coconut garden. Scientific crop management practices are to be followed for ensuring higher yield of fodder crops without affecting productivity of coconut.