Identification of Suitable Grass and Legume Fodder for the Development of Pastures Under Coconut Garden

ABSTRACT

Aim: The study was conducted for the evaluation of suitable grass and legume fodder for the development of pastures under coconut garden.
Study design: Randomized Block Design
Place and Duration of Study: The field experiment was carried out in Farmer's coconut field, Pollachi, Coimbatore, Tamil Nadu during 2021-2022.
Methodology: Ten different fodder crops were selected which includes six grasses and four leguminous fodders. Stem cuttings of grass fodders and seeds of legume fodders are raised in three replications. 90 Days after planting (DAP) the observations were taken for the growth parameters of plant height, establishment percentage, green fodder yield. The crop was cut at 90 DAP followed by subsequent cuts at 120 DAP (i.e. 30 Days interval between two cuts). The fodder growth and development were observed in field as well as nutrition dynamics along with other quality parameters which includes crude fibre, ash content were analyzed in laboratory.
Results: Guinea grass recorded higher values of plant height (205 cm), establishment percentage of 100 % and yield of 183 t ha^{-1} year^{-1}. Other grasses includes para grass, signal and congo signal grass had good establishment and yield. Among legumes *Desmodium* was found to be performed well under shade with plant height of 181 cm and yield of 125 t ha^{-1} year^{-1} followed by siratro with 148 cm height and fodder yield of 98 t ha^{-1} year^{-1}. Marvel grass had poor establishment under shaded environment. Ash content was high in siratro with 21.9 %. Crude fibre was observed high in marvel grass with 41.15 %
Conclusion: Among grasses guinea grass and *Brachiaria sp.* as well as *Desmodium sp.* and siratro among legumes were found to perform well under shade in coconut garden.

Keywords: Fodders, shade tolerant fodder crops, pastures under coconut garden, Crude fibre, Ash content

1. INTRODUCTION

Livestock contributes to a remarkable existence of rural livelihood and also act as major resource for small and marginal farmers. National economy and socio-economic growth of India is backed by livestock sector [1]. India is blessed with variegated livestock resources. According to the 20th livestock census, the total livestock population is about 535.78 million which has a 4.6 % increase over 2012 census. India shares about 20 % of livestock population in world of which cattle (192.49 billion) and buffalo (109.85 million) population ranks first. Goat (148.88 million) and sheep (74.26 million) population ranks second and third in the world, respectively (Press Information Bureau, 2019). With this population of livestock, about 25.6 % of total agricultural and 4.11 % of national GDP is brought by this sector in India.

There are good enough livestock resources but also have more constraints that affects the livestock productivity. There are many steps taken to increase the productivity through breeding technologies but care should be taken to boost up the production of feed and fodder resources which are now at sub-optimal level [2]. Livestock production system is characterized by low input and output. Fodder scarcity is major issue that ends up with uneconomical income generation for farmers. There should be an equal increase in production of feed and fodder to meet out the current livestock population which ultimately enhances the livestock productivity.

Dairying could be made economical by production of good quality fodder as these fodder crops are cheapest source of feed for livestock. The present demand for green fodder is 851.3 million tonnes but the supply is only 590.4 million tonnes thus having a net deficit of 30.65 %. There would be a net deficit of 186.6 million tonnes (18.43 %) in green fodder around 2050 (IGFRI Vision: 2050).Growing population, nutritional requirements and increased economic growth ended up with modifications in cropping pattern with high food grains and cash crops production thus results in the non-availability of fodder for livestock resources. Thus improvised technologies should be adopted to step up fodder production [3]. The land which is not being put to use for cultivation which includes fallows, waste lands, and pastures can be well organized to bring out fodder production. To solve the fodder crisis pastures can be developed to meet out the livestock fodder requirement.

Livestock along with plantation crops shows more advantageous in case of contributing income, diverse land usage, and maintaining soil health [4]. Coconut furnishes food security to the huge population in the world. India with abundant diverseness in coconut is the largest producer and has a share of about 33.02 %. The area, production and productivity of coconut have an abrupt increase over the last 19 years. About 15 million people of India are reliant on producing, processing and marketing of coconut [5]. Coconut contributes about 15,000 crore rupees to India's GDP and 72 % of total production of coconut is from India [6].

Another advantage of integrating fodder in coconut garden is greater reduction in the cost involved for weed management as the coconut crop is planted very spaciously. There occurs competition for moisture and nutrients thus affecting growth and yield. Nearly 20 % involved in cost of cultivation is utilized for weed management. Hence to reduce the cost incurred for controlling of weeds can be reduced by maintaining effective ground cover which acts a good livestock feed and prevent loss of moisture and nutrients by weeds [7].

2. MATERIAL AND METHODS

The field experiment was conducted under old stand of coconut in Kedimedu village, Pollachi, Coimbatore, Tamil Nadu during the period from December 2021 to July 2022. Treatments consisted of 6 grasses and 4 legumes *viz.,* T_1 – *Cenchrus setigeris* (Buffel grass), T_2 – *Panicum maximum* (Guinea grass), T_3 – *Brachiaria decumbens* (Signal grass), T_4 – *Brachiaria ruziziensis* (Congo signal), T_5 – *Brachiaria mutica* (Para grass), T_6 – *Dicanthium annulatum* (Marvel grass), T_7 – *Stylosanthes hamata*, T_8 – *Desmanthus virgatus*, T_9 – *Macroptilium atropurpureum* (Siratro) and T_{10} – *Desmodium gangeticum.* The experiment was laid out in randomized block design (RBD) with 10 treatments and each treatment was replicated thrice. Grasses are propagated using stem cuttings and planted at 45 cm x 45 cm spacing. Legumes are propagated using seeds which are treated with hot water to break dormancy and sown at a spacing of 30 cm x 10 cm.

The fodder crops were allowed for harvest at 90 DAP. Then subsequent cut was done at 30 days interval. The growth parameters *viz.,* plant height, establishment percentage and green fodder yield were recorded. During second cut which was done at 120 DAP, the same observations were repeated and recorded. The crops grown under coconut field shaded environment were collected, shade dried and stored for further analysis.

Ash content was determined by using muffle furnace method, by keeping the samples in muffle furnace at 600 ^{o}C for 3 hours according to Chemists and Cunniff [8] and it is expressed in percentage. The mineral nutrients in the crop are analyzed in Inductively Coupled Plasma Mass Spectrophotometry (ICPMS) suggested by Masson *et al.* [9] to determine the nutritional composition of plant samples and expressed in percentage. Crude fibre content was determined as suggested by Goering *et al.* [10]. The estimation was done gravimetrically by successive digestion and washing of a weighed portion of the plant sample with dilute acid and alkali and the material left undigested was taken as crude fibre and expressed in percentage.

3. RESULTS AND DISCUSSION

The nutritional and quality parameters of different grasses and leguminous fodder crops were determined from this experiment. Since the crops were raised under shade of coconut crop, the influence of shade on growth parameters and quality parameters were analyzed. Guinea grass (T_2) was found to be taller (205 cm) among grasses followed by para grass (T_5) with 159 cm under shade which was found to be similar with findings of Malaviya *et al.* [11]. Among legumes *Desmodium* (T_{10}) 181 cm was found to be the taller than other legumes fodder crops. Wong *et al.* [12] found that at highest light level (50-80 %) under mature coconut field improved the growth of tropical grasses and legumes which include guinea grass, para grass and *Desmodium sp* potentially increased the forage supply. Lowest plant height was recorded in marvel grass (T_6) 104 cm among grasses and in legumes *Stylosanthes* (T_7) with 56 cm. Establishment percentage was found to be highest in guinea grass (T_2) 100 % which was on par with congo signal, para grass and *Desmanthus sp.*. Green fodder yield showed significant variation among the treatments under shaded environment (Table 1). Higher yield under shade was recorded in guinea grass (T_2) 183 t ha^{-1}year^{-1} followed by para grass (T_5) 140 t ha^{-1}year^{-1} and lowest yield was found in marvel grass (T_6) 32 t ha^{-1}year^{-1} among grasses. In legumes the higher yield under shade was recorded in *Desmodium* (T_{10}) 125 t ha^{-1}year^{-1}. Similar findings were reported by Stur [13].

Table 1: Effect of shade on growth parameters plant height, establishment percentage (%) in fodder crops

Treatments	Plant height (cm)	Establishment percentage (%)	Green fodder yield (t ha^{-1}year^{-1})
T_1- Buffel grass	118	46	70
T_2 – Guinea grass	205	100	183
T_3 – Signal grass	136	80	75
T_4- Congo signal grass	138	100	155
T_5 – Para grass	159	100	140
T_6 – Marvel grass	104	27	32
T_7 – *Stylosanthes*	56	55	52
T_8 – *Desmanthus*	126	100	70
T_9 – Siratro	148	94	98
T_{10} – *Desmodium*	181	83	125
SEd	7.42	4.06	10.15
CD(P=0.05)	15.59	8.53	21.32

Higher ash content (21.9 %) was recorded in siratro (T_9) followed by para grass (T_5) with 17.1 %. Similar result in siratro was recorded by Mupangwa *et al.* [14]. Lowest ash percentage was recorded in *Desmanthus* (T_8) 9.4 %. Cell wall is the major function available for digestion and it's important to determine whether shade affects their composition. The difference between values obtained from normal open condition and shade treatments were small, inconsistent and non-significant (Table 2). Highest crude fibre content was found in marvel grass (T_6) 41.15 % and lowest content was found in *Desmodium* (T_{10}) 25.80 %.
The nutritional composition of fodder crops were analyzed and given in (Table 3). Na content was high in para grass (T_5) 15.20 g kg^{-1}. Mg content was recorded highest in siratro (T_9) 19.13 g kg^{-1} followed by *Desmodium* (T_{10})17.42 g kg^{-1}. P content was recorded highest in siratro (T_9) 9.25 g kg^{-1} which is on par with *Desmodium* (T_{10}) 9.13 g kg^{-1}. Fe and Ca content were high in *Desmodium* (T_{10}) 5.42 g kg^{-1} and 67.48 g kg^{-1}. Congo signal grass (T_4) with 162.48 g kg^{-1} and para grass (T_5) 160.05 g kg^{-1} recorded highest in K content. N content in shaded grasses were found to be increased than normal grown which is similar to the results obtained by Norton *et al.* [15].

Table 2: Effect of shade on quality parameters ash content, crude fibre in fodder crops

Treatments	Ash Content %	Crude fibre %
T_1- Buffel grass	15.6	30.40
T_2 – Guinea grass	15.2	36.18
T_3 – Signal grass	14.8	25.93
T_4- Congo signal grass	15.6	28.50
T_5 – Para grass	17.1	29.35
T_6 – Marvel grass	12.1	41.15
T_7 – *Stylosanthes*	13.2	37.13
T_8 – *Desmanthus*	9.4	29.07
T_9 – Siratro	21.9	26.07
T_{10} – *Desmodium*	13.5	25.80
SEd	1.07	1.59
CD(P=0.05)	2.24	3.33

Table 3: Effect of shade on nutritional composition sodium, calcium, magnesium, phosphorous, potassium and iron in fodder crops

Treatments	Sodium (g kg^{-1})	Calcium (g kg^{-1})	Magnesium (g kg^{-1})	Phosphorus (g kg^{-1})	Potassium (g kg^{-1})	Iron (g kg^{-1})
T_1- Buffel grass	1.42	10.90	4.97	3.69	123.34	0.80
T_2 – Guinea grass	0.69	10.65	8.51	5.61	135.16	0.63
T_3 – Signal grass	0.58	10.59	7.74	7.15	134.89	1.73
T_4- Congo signal grass	0.30	14.31	11.32	5.44	160.05	1.85
T_5 – Para grass	15.20	11.51	6.59	7.42	162.48	1.21
T_6 – Marvel grass	1.01	15.15	5.53	5.59	73.07	3.30
T_7 -	0.29	9.43	1.13	2.76	26.00	0.74

Stylosanthes						
T_8 - *Desmanthus*	0.55	29.95	12.60	7.33	76.57	4.25
T_9 – Siratro	1.65	47.09	19.13	9.13	100.91	3.18
T_{10} - *Desmodium*	1.62	67.48	17.42	9.25	103.35	5.42
SEd	115.05	1667.62	670.93	318.71	6374.23	123.49
CD (P=0.05)	241.72	3503.54	1409.63	669.56	13391.94	259.43

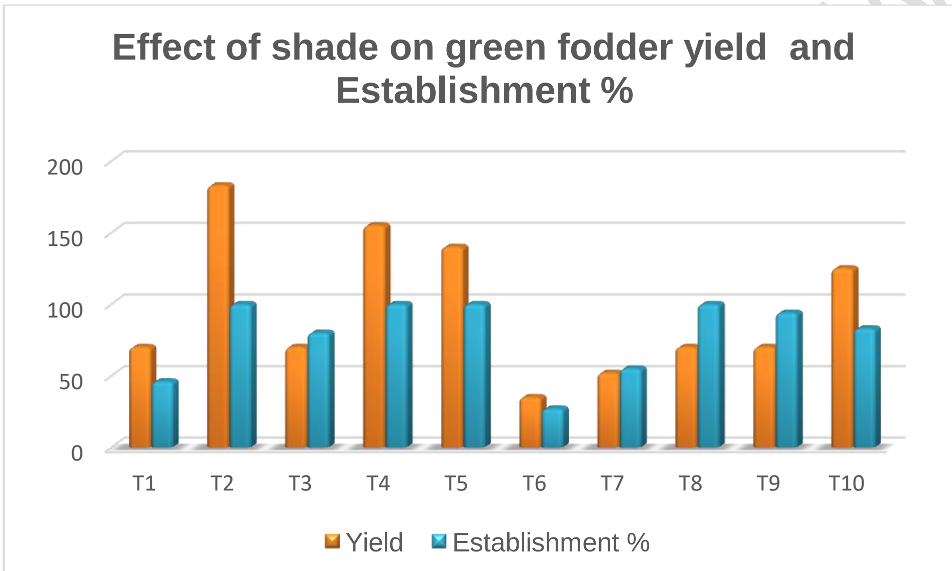
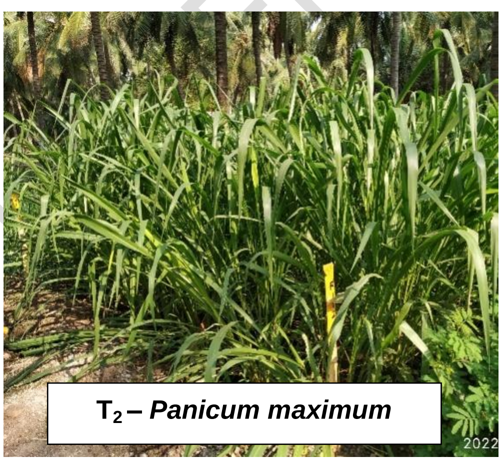
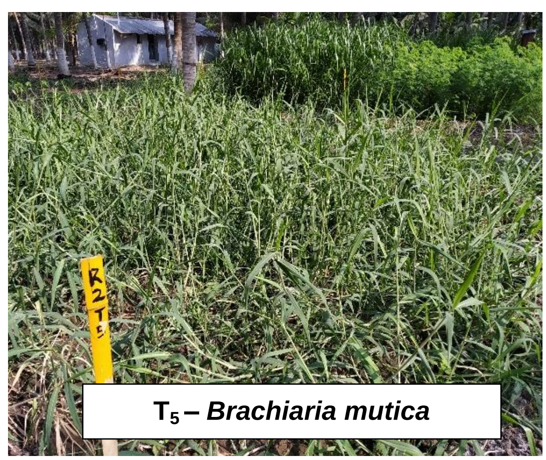


Fig 1 Effect of shade on fodder growth and yield



T_2 – *Panicum maximum*

Fig 2



T_5 – *Brachiaria mutica*

Fig 3

T$_9$ - ***Macroptilium atropurpureum***

Fig 4

T$_{10}$ -Desmodium gangeticum

Fig 5

4. CONCLUSION

The results revealed that the study was highly helpful to identify the suitable fodder crops to be grown under old mature coconut garden. This evaluation clearly showed that there are number of fodder legumes and grasses which appear promising under shaded environment. These species are found to be shade tolerant and performed well with low light intensity. Among fodder grasses guniea grass and *Brachiaria sp* (para grass, signal, congo signal) are found to be efficient and marvel grass has poor adaptation under shade. In legumes *Desmodium* and siratro are highly recommended.

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