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PERFORMANCE OF FODDER CROPS DURING POST RAINY SEASON IN ANDAMAN AND NICOBAR ISLANDS

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SUMMARY

Andaman & Nicobar Islands dairy farming progress was severely constrained by shortage of green fodders especially during post rainy season and fodder cultivation was unknown for the stakeholders. In this context, field experimentation was carried out under rain fed situations during for post-rainy seasons (December 2015 – January 2016) at Port Blair in a low fertile neutral pH soil to assess the productivity, quality and economics of 3 fodder crops *i.e*., maize (*Zea mays* L.), sweet sorghum [*Sorghum bicolor* (L.) Moench] and pillipesara (*Phaseolus trilobatus* (L.) Schreb) in Randomized Block Design (RBD) with four replications. The results revealed that sweet sorghum has significantly higher dry fodder production (t/ha) and net returns (*Rs.* /ha) *i.e*. 12.73 and 23,074 than maize (10.91 and 16,995) and pillipesara (3.78 and 4,030). Pillipesara fodder was more nutrient dense (N, P), but overall nutrient contained in biomass was highest in maize and sweet sorghum (N & P) and maize (K). Based on productivity, quality and economics sweet sorghum cultivation was recommended for augmenting fodder supplies in the islands during post-rainy season.

Keywords : Fodder, Maize, Sweet sorghum, Pillipesara, Crude Protein, Leaf: Stem ratio, Income

Union Territory Andaman and Nicobar Islands (ANI), India is spread on 0.825 million ha geographical area was inhabited by 3, 79,944 people (2011 Census) and practices homestead plantation based farming predominantly on sloppy terrains that transforms into rice based farming in coastal lowlands on ~45,000 ha area. Both land owning and landless farmers keep dairy animals (29,161 cows and 3,823 buffaloes; Livestock Census, 2012) and both of them faces fodder constraints owing to lack of cultivated fodders (only 10 ha reported area under cultivated fodders) in the islands. Further, the grass lands that forms the major source of feed to livestock spread on 14,840 ha (Sudhakar Reddy *et al.*, 2016) are disproportionately distributed among the districts. This was evident from the fact that Nicobar district has 81.3% of grasslands area but have only 5.8 & 0.4% of the total cattle & buffaloes of islands 45625 & 7863 while North & Middle Andaman (54.9 & 87.1% cattle & buffalo) and South Andaman district (39.3 & 12.5% cattle & buffalo) having majority of population but have only 19.7% of grazing lands produces 95.9% of milk (13,426 tonnes; DOES, 2016-17). The livestock feeding on grassland soils having mineral deficiencies / toxicities experiences several mineral disorders as evaluated from the blood sample sera in South Andaman district (Jaisundar *et al.*, 2007) finally results to their poor productivity. This was reflected in the per capita milk consumption i.e.113. 62 g/person/day (DOES, 2016-17) that was only 29.7% of the national level milk availability of 337 g/person/day in 2015-16 (Economic Survey, 2016-17). The non-existent use of concentrates and mineral mixtures to dairy animals further compounds the mineral associated problems. The renovation of milk procurement, processing and marketing in islands by Andaman & Nicobar Islands Development Corporation (ANIDCO) in 2017 offering attractive price (Rs. 45/ litre milk) to farmer has renewed interest in dairy farming. Hence, an attempt was made to produce fodders during post rainy season.

MATERIAL AND METHODS

Field experimentation was made during *rabi* season (1^{st} December 2015-28^{th} January, 2016) at Garacharma Research Farm of ICAR-Central Island Agricultural Research Institute (CIARI), Port Blair, Andaman & Nicobar Islands situated at 11^0 38’ 06” N latitude and 92^0 39’ 15’’ E longitude at an altitude of 62 m–above mean sea level. The experimental clay loam soil in the top 20 cm depth has 6.7 pH (neutral in reaction) rated as non saline (550µs/m electrical conductivity) was rated as medium in organic carbon (0.7%), low in available nitrogen (178/ha) and potassium (112 kg/ha) and medium for available phosphorous (11.6 kg/ha) at the start of experiment in December 2015. A rainfall of 207.6 mm was received in 10 days (136.6 mm in 8 days and 71 mm in 2 days during December, 2015 and January 2016) during fodder crops life cycle. A mean maximum and minimum temperature (^{o}C) of 30.9 and 25.3 during December-2015 and 32.0 and 24.8 during January-2016 were recorded. The relative humidity was above 80% all through the crop growth period.

Three fodder crops as treatments i.e. sweet sorghum (*Sorghum bicolor* L. Moench), maize (*Zea mays* L), and pillipesara (*Phaseolus trilobatus* (L.) Schreb) were tested in randomized block design (RBD) with four replications. The experimental field was prepared by running tractor drawn cultivator twice. A gross plot size of 18 m^2 was used for the study during both the years. African tall, SSV-74 and local (collection from Andhra Pradesh) varieties of maize, sweet sorghum and pillipesara crops were sown by using manually drawn seed drill by *pora* method on 1 December 2015 using recommended seed rates of 45, 30 and 10 kg/ha for maize, sweet sorghum and pillipesara. Maize & sweet sorghum and pillipesara crops were sown in solid rows 45 and 30 cm apart. On 10^{th} day of sowing, thinning / gap filling was done to maintain a plant to plant spacing of 10 cm (sweet sorghum and maize) and 5 cm (pillipesara). A fertilizer dose of 60-30-30 and 20-30-30 kg N-P-K/ha were given for cereal (sweet sorghum and maize) and legume crop of pillipesara as basal dose in the last ploughing. Prilled urea, single super phosphate and muriate of potash were used as sources of nitrogen (N), phosphorus (P) and potassium (K). For emerging weeds management, pendimethalin 38.7% CS @ 0.75 kg a.i/ha was applied immediately after seeding. All crops were harvested 28^{th} January, 2016. Fodder crops were grown under rain fed situation. No plant protection measures were undertaken to the fodder crops.

The fodder crops were harvested at 2 cm above the ground level. Plant height (cm) was recorded for 5 selected plants at harvest stage. The harvested biomass from each plot was weighed and reported as green fodder yield (kg/plot). The green fodder of five observation hills was dried at 60^{0}C for 48 hours in a ventilated oven and weight was recorded as dry weight. The ratio of dry to green fodder weight so obtained from the samples was used to convert the green fodder yield of plot into dry fodder yield (kg/plot). The fodder yields (t/ha) was estimated from the green and dry fodder yields/plot. From selected 5 plants, leaf was separated carefully and the leaf and canes (stem) were weighed and their ratio was worked out.

The nitrogen (N) concentration of fodder on dry weight basis was estimated by Micro-Kjeldhal method (Jackson, 1973) and crude protein concentration was calculated by multiplying N concentration of the plant with 6.25. Crude protein yield was arrived as product of crude protein concentration (%) and dry fodder yield (t/ha) /100. Per day productivity (kg/ha/day) was worked as ratio of fodder yield (t/ha) to crop duration (days). In the calculation of economics, a price of **?**. 3, 500 and 6, 000/ tonne of dry matter of cereal and legume fodder were used. All input prices were taken as per the prevailing prices of market. Benefit Cost Ratio was worked out as ratio of gross income (net income + cost of cultivation) to the cost of cultivation. The analysis of variance was done for all the information generated in RBD. The significance of treatment differences was compared by critical difference at 5% level of significance (P=0.05) and statistical interpretation of treatments was done as per Gomez and Gomez (1988).

RESULTS AND DISCUSSION

Growth and fodder production

Plant height (cm) at harvest (an indicator of growth), green and dry fodder production (t/ha) of crops were given in Table 1. The data reveals that sweet sorghum and maize (190.5 and 181.3 cm) being at par with each other have recorded significantly taller plant heights than pillipesara (145.0 cm). There was no tillers production in all crops. On account of similar plant height and no tiller production, sweet sorghum and maize crops have statistically similar green fodder production, but differed significantly for dry fodder production. The dry fodder production of sweet sorghum was 1.82 t/ha than maize that was ascribed to 9.2 cm taller plants and higher dry matter content (31.9%) of the sweet sorghum, Maize has less dry matter content than sweet sorghum (29.9%). Pillipesara has the lowest fodder production among all the fodder crops with a mean green (dry) fodder yield of 13.50 (3.78) t/ha. The higher yields of sweet

TABLE 1
Growth and fodder production of crops in sole and intercropping system in Andaman and Nicobar islands

Crop	Plant height (cm)	Fodder yield (t/ha)		Dry matter (%)	Crude protein		Productivity (kg/ha-day)		Leaf stem ratio
		Green	Dry		Concentration	Yield	Fodder	Crude	
Maize	181.3	36.54	10.91	29.9	8.65	943.7	188.1	16.27	0.63
Sweet sorghum	190.5	39.90	12.73	31.9	7.55	961.1	219.5	16.57	0.61
Pillipesara	145.0	13.50	3.78	28.0	16.58	626.7	65.2	10.81	0.41
S. Em±	3.55	2.17	0.49		0.245	33.45	6.8	0.199	0.017
C. D. (P=0.05)	12.3	7.52	1.70		0.85	115.6	25.3	0.69	0.06

sorghum and maize in comparison to legume of the current study are inconformity with the findings of Gangaiah (2004). Sorghum performance of the current study was similar to that reported by Singh *et al.* (2014) in Andaman's. Per day productivity of fodder of sweet sorghum was the significantly higher (31.4 kg/ha-day) than maize (188.1). The per day productivity of pillipesara was (65.2 kg/ha; mean) significantly lower than cereal crops and was 29.7 and 34.7 per cent of sweet sorghum and maize crops fodder production.

Fodder quality and crude protein yield

Fodder quality as assessed by crude protein content, leaf stem ratio and crude protein yield (Table 1) varied significantly among the crops. Crude protein content was highest in legume crop of pillipesara (16.58%) that was 2.20 and 1.92 times that sweet sorghum and maize crops. However, the leaf: stem (L/S) ratio of cereal crops being almost similar (0.62 mean of sweet sorghum and maize) was significantly higher than pillipesara (0.41). It is pertinent to mention here that stem portion of cereals was very hard while pillipesara was soft like leaves.

Crude protein yield (t/ha) of sweet sorghum and maize was statistically similar with a mean value of 0.951 t/ha was significantly higher than pillipesara (0.627 t/ha). Cereal fodders have produced 51.7% higher crude protein yield than legume on account of 2.88 (maize) to 3.37 (sweet sorghum) times dry matter yields that has more than offset their lower crude protein contents as mentioned above.

Nutrient concentration and uptake

Nutrient concentration and uptake (Table 2) of fodder crops varied significantly. As far as nutrient concentration (N, P and K) is concerned, sweet sorghum fares poorly that is evident from the significantly lowest values among all 3 fodder crops. Pillipesara was recorded the significantly higher concentration of nitrogen and phosphorus and has statistically similar potassium concentration s that of maize. However, nutrient uptake of sweet sorghum (N & P) was at par with that of maize crop and was significantly higher than pillipesara. Potassium uptake of maize was significantly higher than sweet sorghum and pillipesara. The higher biomass yield of cereals fodders despite of lower concentration of nutrients has resulted in greater uptake nutrients than legume crop of pillipesara.

ECONOMICS

Economics (Table 3) of fodder crops cultivation shows sweet sorghum as the most

TABLE 2
Nutrient content and uptake of fodders

Crops	Nutrient concentration (%)			Nutrient uptake (kg/ha)		
	Nitrogen	Phosphorus	Potassium	Nitrogen	Phosphorus	Potassium
Maize	1.38	0.151	1.58	150.6	16.47	172.4
Sweet sorghum	1.21	0.121	1.19	154.0	15.40	151.5
Pillipesara	2.65	0.210	1.55	100.2	7.94	58.6
S. Em±		0.0548	0.0318	2.97	0.722	3.67
C. D. (P=0.05)	0.15	0.019	0.11	10.3	2.50	12.7

TABLE 3
Economics of fodder cultivation in Andaman & Nicobar Islands

Crops	Gross income (Rs./ha)	Cost of cultivation (Rs./ha)	Net income (Rs./ha)	Benefit : Cost (B : C) ratio
Maize	38185	21190	16995	1.80
Sweet sorghum	44555	21481	23074	2.07
Pillipesara	22680	18650	4030	1.22
S. Em±	734.5	333.9	242.1	0.052
C. D. (P=0.05)	2545	1157	839	0.18

promising choice based on significantly higher net income and B:C ratio. Maize stands next with a net income of 73.7% as that of sweet sorghum and also and has 0.27 units lower B: C ratio than sweet sorghum (2.07). Pillipesara has the least net income and B: C ratio (***?*** 4,030 and 1.22) among the three fodder crops.

Conclusion and future work

The study identifies sweet sorghum followed by maize as the potential cereal fodder crops for post rainy season in the island ecosystem.

Further, there was need to integrate pillipesara as an intercrop with sweet sorghum and maize. There is also need to develop silage production technology for continued supply of green fodder that could augment fodder shortages of Islands even during post rainy seasons (January-April).

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