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AN ASSESMENT OF NUTRIENT CONTENT OF UNDERUTILIZED GRASS SPECIES OF SOUTH INDIA

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ABSTRACT

In the past and now most of the developments in conventional agriculture have concentrate on major grasses with little attention to the minor, underutilized grasses and as yet undeveloped grasses of livestock. Many underutilized grass species are being lost each day and more of which have unknown potential will be lost. The present study is undertaken to carry out the nutrient content of twenty grass species of family Poaceae, commonly found in waste lands of South India to screen some nutritive values. The Moisture content of the grass species varied between 42% to 71%, Protein content 1.66% to 5.43%, Sugar 1 % to 3.54%, Starch from 7% to 17.74% and Cellulose ranged from 1.79% to 7.60% of dry weight. Among the twenty grass species *Eragrostis amabilis* showed high nutritive value, followed by *Cynodon dactylon, Pycreus flavidus, Digitaria sanguinalis* and *Brachiaria racemosa*. Hence these grass species of high nutritive value can be choosen for feeding the live stock.

KEY WORDS: Grasses, Nutrients, Proteins, Carbohydrates, Cellulose, Starch and Relative water content.

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INTRODUCTION

Grasses are the dominant plant species in most forage based enterprises throughout the world and herbaceous to wild life and livestock. Grazing is important to encourage growth of other more palatable and valuable forage grasses such as *Cynodon dactylon, Panicum and Setaria* (Herlocker, 1999). Grassland provides a multitude of benefits to society including forage, production of milk, wild life habitat, nutrients and CO_2 sequestration. Additionally, they can have very high biodiversity when properly managed. Recently there has been interest in establishing native grasslands plantings to conserve biodiversity while simultaneously entrancing ecosystem services such as biomass for cellulose based biofuels (Tilman *et al*., 1994; Parrish and Fike, 2005; and Jordanet *et al.,* 2007). Pastures and forage are the cheapest form of animal feed. Livestock provides drought power, rural transport, manure fuel, milk and meat. India supports nearly 20% of the world livestock; leader in Cattle (16%) and Buffalo (55%) population and has world's second largest in goat (20%) and fourth largest in sheep (5%) population. The seventeenth livestock census has placed the total livestock population is 485 millions and expected to grown 1.235 in the coming years. The nutritive value of feed and fodder has a significant bearing on the productivity of livestock; more than 50% of the fodder for the livestock comes from grasslands. At present the country faces a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% feeds.

The Poaceae or Gramineae is the fourth largest flowering plant family in the world and contains about 11,000 species in 800 genera worldwide (Watson and Dallwitz, 1992 and 1999). Feed requirements are based on the need for specific amounts of various classes of nutrients. Hence the present study was undertaken to identify the underutilized grass species which is having high nutritive values. Each nutrient fulfills specific role in growth, production or metabolism. RWC known as relative turgidity in the amount of water present in the tissue and do to addition of other preservatives may be due to their effects on preventing microbial growth and cleaning the path of water due to xylem blockage (Singh *et al.,* 2011). Crude protein is forms the building blocks of muscle and its components are used in every system of the body; protein is positively related to the digestibility of grass and in general, as crude protein increases so does livestock performance (e.g. weight gain and milk production). Feeding value of forage quality is dependent on crude protein per cent and total digestible nutrients. Crude protein is very useful in the diet of ruments to keep up their milk, meat and maintaining livestock property (Afzal and Ullah, 2007). Carbohydrates are the major source of energy in feed to dairy cattle and usually comprise 62% to 70% of the diet. Grasses with larger seeds containing more starch and germinate at faster rate and establish. High sugar content in grass allow more efficient utilization of nitrogen in the rumen and preventing excess from being excreted and contaminating the environment While the ruminant livestock enterprises benefit from higher levels of carbohydrates in grasses (Miller *et al*.,2001 and Lovett *et al.,* 2004).. Various forms of carbohydrates are begin recognized in horses responsible to obesity, laminitis and insulin resistance (Treiber *et al.,* 2006) and developmental orthopedic diseases (Hoffman *et al*., 1999). Cellulose is the most abundant biopolymer on earth, comprising 25% to 50% of plant biomass with an estimated 100 billion tonns are synthesized annually as a result of photosynthesis (Haigler *et al*., 2001 and Sticklen, 2006). Long chain cellulose polymers are organized to in micro fibrils that make up the strength, structure, and development of plants (Sticklen, 2006). Good quality forage is high in protein and digestible nutrients, low in fibre and lignin. Though there is an availability of high nutrient quality grass species in India, much attention is not been given to improve or cultivate. Hence an attempt has been made to screen the underutilized grass species for forage. Thus there is an urgent need to improve the present supply position in quantitative and qualitative terms through supplying of high yielding varieties of various forage crops and enhanced palatability, other quality traits and adaptability to different agro-ecological zones.

MATERIALS AND METHODS

Grass species of Poaceae *Alloteropsis cimicina, Aristida hystrix, Aristida setacea, Brachiaria racemosa, Chloris barbata, Cymbopogon coloratus, Cynodon dactylon, Dactyloctenium aegyptium, Digitaria sanguinalis, Echinochola colonum, Eleusine indica, Eragrostis amabilis, Eragrostiella bifaria, Heteropogon contortus, Panicum repens, Perotis indica, Pycreus flavidus, Setaria pumila, Sporobolus coromandelianus* and *Sporobolus wallichii* were collected from different meadows during March to September and all the grass species were uprooted by digging the soil and preserved in plastic bags. The samples of each grass species were immediately pressed in paper bags for herbaria specimen and the species were identified with the help of Gamble (1915-36) and compared and authenticated with the specimens of BSI (Coimbatore, Tamil Nadu). Total moisture content and dry weight of the samples were determined by following the standard procedures. 10g of fresh samples were dried in oven at 65^{o} C till constant weight was obtained. The RWC was determined by using formula

$$\mathrm{RWC} = \frac{\text{Fresh weight} - \text{Dry weight}}{\text{Turgid weight} - \text{Dry weight}}$$

The difference between the initial and final weights of the samples were recorded as dry matter accumulation. Protein content was estimated following the method of Lowry *et al.* (1951). About 5g of each of the fresh grass samples were taken and homogenized in an electric homogenizer with about 3 ml of phosphate buffer of pH 7.4 and Folin phenol reagent. Bovine serum albumin used as the standard. Total Soluble Sugar and starch contents were estimated as per the methods of Dubois *et al*. (1951) and Cready *et al.* *(*1950). The cellulose was estimated colorimetrically as per the procedure outlined by Updegroff (1969). The results were expressed in percentage of dry weight. Each data point was obtained by taking at least 3 independent measurements, as mean ± SD (standard deviation).

RESULTS AND DISCUSSION

Based on the experimental results the Relative water content of the selected grass species can be divided in to three categories like higher RWC grasses, intermediate RWC grasses and lower RWC grasses. Maximum Relative water content has been obtained ranging from (71.81 ± 0.05 to 63.39±0.02% Dry weight) in *Cynodon dactylon* to *Brachiaria racemosa* respectively. Medium Relative water content was recorded ranging from (61.81 ± 0.02 to 52.45 ± 0.04% DW), in *Eleusine indica* and *Sporobolus coromandelianus* respectively. Whereas minimum range is (50.96 ± 0.02 to 42.22 ± 0.01% DW), in *Panicum repens* and *Eragrostiella bifaria*. Little bit lesser content of RWC was reported by Patra *et al*. (2011), in *Cynodon dactylon* and *Eleusine indica*. The variation in RWC among grasses may be due to the collection of time and also the moisture content and age of the plants. RWC generally high in young stages of plants and in cool weather conditions. RWC decreased substantially with increasing duration of membrane injury (Blum and Ebercon, 1981 and Krishnamurthy *et al*. (2003). Moreover tensile strength of variety of grasses has been showed to increase with the loss of water content (Balsamo *et al*., 2005).

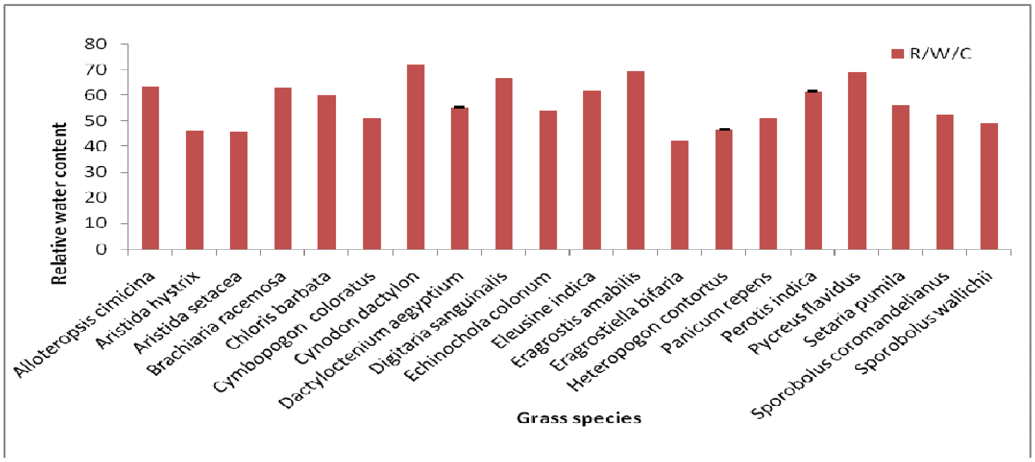
Heteropogon contortus (5.43 ± 0.02% DW) has been identified as Protenaceous grass, followed *by Aristida hystrix* (4.24 ± 0.01% DW), *Sporobolus coromandelianus* (4.22 ± 0.07% DW*), Aristida setacea* (4.19 ± 0.05% DW), *Eleusine indica* (4.18 ± 0.01% DW) and *Brachiaria racemosa* (3.98 ± 0.02% DW) among the selected species. Whereas lowest protein content was obtained from *Chloris barbata* (1.98 ± 0.02% DW). The results of the present study is closely related with the studies made by Fatur *et al*. (2007) in *Aristida* and *Eragrostis.* However lower content of protein has been recorded by Patra *et al.* (2011), and Sultan *et al*. (2010) in *Cynodon dactylon, Eleusine indica, Setaria pumila* and *Digitaria sanguinalis*. However higher levels of protein content was observed by Oladunni *et al*. (2011). This may be attributed that the age, maturity of the plants, availability of nutrients and water. The significant decline of Crude protein in winter and spring due to flush of growth, accumulation of the protein content and age of leaves. *Dactylotenium aegyptium* (3.54 ± 0.02% DW), is found to be rich source of Sugar followed by *Setaria pumila* (2.87 ± 0.03% DW), *Aristida setacea* (2.55 ± 0.08% DW), *Heteropogon contortus* (2.69 ± 0.04% DW) and *Brachiaria racemosa* (2.04 ± 0.01% DW). Lowest Sugar content has been observed in *Eragrostiella bifaria* (0.91 ± 0.02% DW). The observations of Patra *et al*. (2011), closely related with *Cynodon dactylon* and *Eleusine indica*. Highest Starch content was found in *Aristida setacea* (17.74±0.04% DW), followed by *Cymbopogon coloratus* (17.64±0.01% DW), *Sporobolus coromandelianus* (17.60 ± 0.06% DW), *Eragrostis amabilis* (17.55 ± 0.03% DW) and *Panicum repens* (16.11 ± 0.06% DW). Whereas lowest starch content has observed in *Echinochola colonum* (7.05±0.01% DW) only. According to Patra *et al*. (2011) higher amount of starch content was found in *Eleusine indica* but similar in the case of *Cynodon dactylon*. The Cellulose content of *Cynodon dactylon*, *Setaria pumila* and *Digitaria sanguinalis* was found to be lower levels when compare with the findings of Sultan *et al.* (2010). The results of the present study revealed that the grass species *Eragrostis amabilis*, *Cynodon dactylon, Pycreus flavidus, Digitaria sanguinalis* and *Brachiaria racemosa* are found to be rich source of water, protein and cellulose. Hence these species may be recommended for domestication (cultivation) for animal feed.

Table-1
Physiological studies of selected Poaceae grass species

Grass species	R/W/C	Protein	Sugar	Starch	Cellulose
Alloteropsis cimicina	63.39±0.02	3.70±0.01	1.31±0.04	13.17±0.03	1.98±0.01
Aristida hystrix	45.97±0.02	4.24±0.01	1.14±0.01	13.46±0.01	1.99±0.01
Aristida setacea	45.69±0.01	4.19±0.05	2.55±0.08	17.74±0.04	1.79±0.06
Brachiaria racemosa	63.16±0.02	3.98±0.02	2.04±0.01	10.14±0.02	5.20±0.01
Chloris barbata	59.84±0.01	1.98±0.02	0.98±0.02	12.92±0.08	5.54±0.03
Cymbopogon coloratus	50.83±0.04	3.11±0.08	0.92±0.05	17.64±0.01	2.95±0.01
Cynodon dactylon	71.81±0.05	3.81±0.01	1.33±0.03	10.48±0.04	2.15±0.02
Dactyloctenium aegyptium	55.22±0.08	2.03±0.02	3.54±0.02	9.03±0.05	7.60±0.02
Digitaria sanguinalis	66.73±0.03	3.71±0.04	1.29±0.05	11.13±0.02	1.99±0.05
Echinochola colonum	54.13±0.05	2.87±0.03	1.39±0.03	7.05±0.01	6.01±0.01
Eleusine indica	61.81±0.02	4.18±0.01	1.24±0.05	13.34±0.02	2.63±0.02
Eragrostis amabilis	69.34±0.04	2.19±0.08	1.12±0.05	17.55±0.03	5.64±0.01
Eragrostiella bifaria	42.22±0.01	3.19±0.02	0.91±0.02	13.950±0.02	7.14±0.04
Heteropogon contortus	46.57±0.04	5.43±0.02	2.69.±0.04	12.07±0.05	2.07±0.01
Panicum repens	50.96±0.02	3.96±0.01	1.27±0.03	16.11±0.06	4.41±0.05
Perotis indica	61.66±0.06	2.06±0.01	1.43±0.02	8.84±0.02	2.11±0.01
Pycreus flavidus	68.98±0.01	3.58±0.02	1.10±0.08	13.04±0.04	2.28±0.05
Setaria pumila	56.41±0.07	2.78±0.02	2.87±0.03	12.00±0.01	5.42±0.04
Sporobolus coromandelianus	52.45±0.04	4.22±0.07	1.86±0.04	17.6±0.06	3.36±0.03
Sporobolus wallichii	49.08±0.06	2.16±0.01	1.17±0.03	13.34±0.06	2.05±0.03

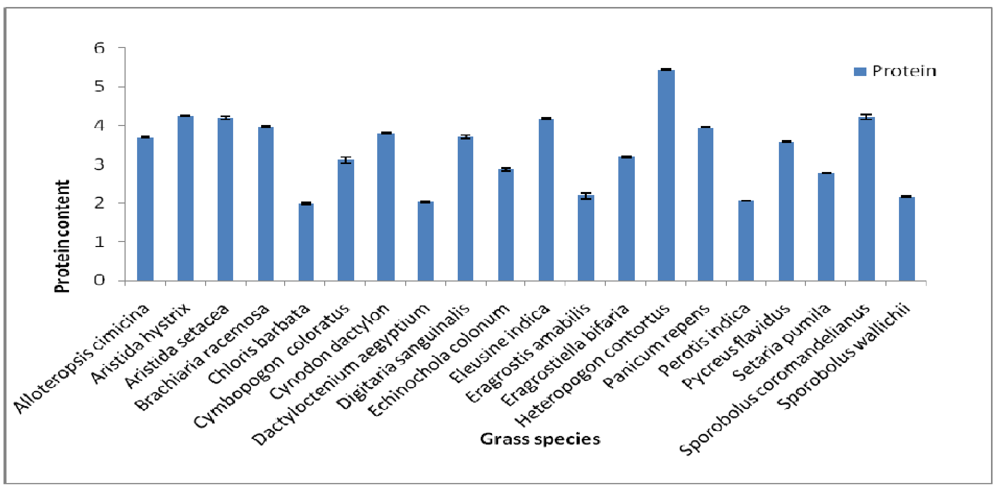
Graph-1

Relative Water content of selected Poaceae grass species



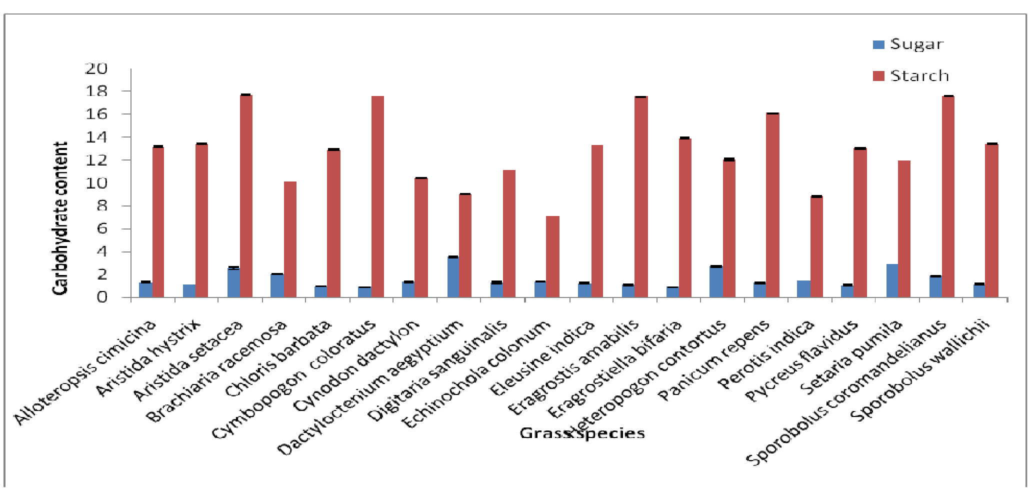
Graph-2

Protein content of selected Poaceae grass species

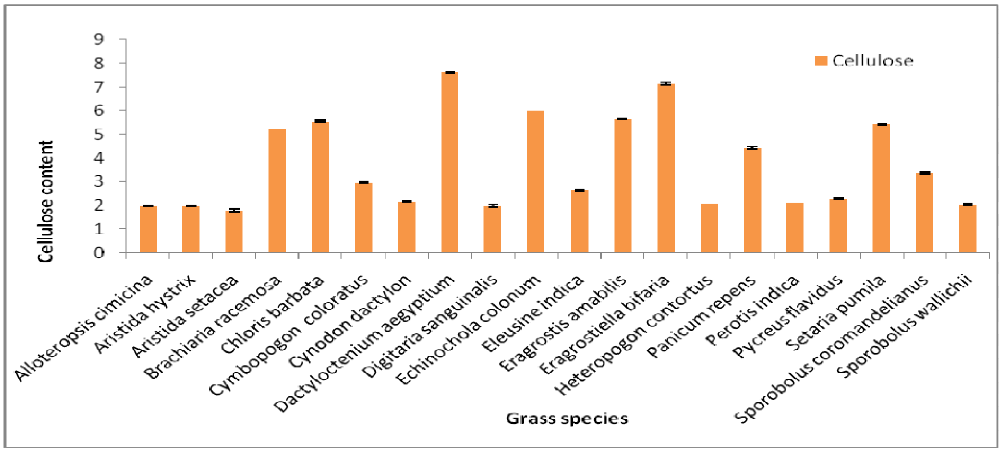


Graph-3

Carbohydrate content of selected Poaceae grass species



Graph-4
Cellulose content of selected Poaceae grass species



CONCLUSION

The study revealed that the variation in nutrient composition of grasses of poaceae. On the basis of the nutrient contents *Eragrostis amabilis* and *Heteropogon contortus* were found to be best among the selected twenty grass species. These crops can be grown along with the legume crops grown fodder to feed the feed stock. The nutrient composition of grasses are linked to seasons, age and vegetative stage of the plants. These data make it possible to predict the variation of nutrient composition of grasses selected by ruminants during the grazing down process. *Eragrostis* and *Cynodon dactylon* can preferably grown on wastelands for fulfilling the requirements of balanced diet of the livestock. Development of underutilized grasses can make an important contribution to the alleviation of poverty.

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