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Stover Quality: New Priority Trait in Fodder Sorghum

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INTRODUCTION

Grasses played a significant role in providing the energy source in form of grains to humans and as feed to livestock across the world. With increasing livestock population, diminishing arable land and freshwater, and emerging demand of feed supply grasses are poised to yet another key role in sustaining livestock life on earth. Sorghum (*Sorghum bicolor* (L). Moench; 2n=20) is a major grass that employs C4 photosynthesis thus, exhibits higher carbon fixation, water use efficiency, and have excellent potential to supply green fodder, dry matter and stover yield, especially in hotter and drier climates.

A unique property that makes sorghum an ideal fodder to meet the challenge, supply of feed and fodder to the increasing livestock population is its potential to accumulate more amount of carbohydrates stored in vegetative parts or stover. The carbohydrates stored in stover exist in both components, structural and non-structural. The structural component is composed of insoluble polysaccharides (cellulose and hemicelluloses) which are incorporated in the plant cell wall whereas, nonstructural components composed of soluble sugars or sugar polymers are majorly stored in parenchyma cells. Traditionally, stover is served, a leftover after harvesting grain, as a key feed for animals and widely used as roughage especially when there is non-availability of green fodder. However, with increased demand for stover, development of dual-purpose sorghum is now a prime objective which in addition to grain, also provides a high-quality stover. For the farmers, both grain and stover are of equal

importance and consider harvested stover as almost equal in market value to harvested grain. It has been reported that on an average stover contributes 40% to the total value of sorghum crops.

In the northern region of India, sorghum is mainly grown as *kharif* crop whereas, in Southern part of the country it is cultivated in both the season. Sorghum can withstand harsh climatic conditions as compared to other cereal crops like maize, rice and wheat which make it a climate-resilient crop. During 2018-19, in India, forage sorghum was cultivated in an area of 5.9Mha with a total production of 5.1 MT and productivity of 900 Kg/ha. Due to its high biomass production potential in a limited water regime and better quality forage sorghum is considered the main source of green forage and roughages for the livestock in tropical areas. Forage sorghum has 8-12% crude protein (CP), 60-75% neutral detergent fiber (NDF), 34-40% acid detergent fiber (ADF) on a dry matter basis and exhibits high digestibility and palatability. With its impressive available genetic variability, forage sorghum can be tailored to various climatic conditions and biomass processing systems like sweet sorghum for high extractable sucrose and high total lignocellulosic biomass yield.

However, realizing on sorghum stover the major problem is low level of digestible energy, protein and certain minerals. In livestock nutrition, minimum nitrogen content 1.2% is required in a feed for proper degradation of feed by rumen microbes.

Previously, workers have found the genetic variability for digestibility of sorghum stover at flowering and harvest time. The effect on stover quality through genotype and environment interaction would determine the possible opportunity to improve the stover quality. Before initiating sorghum stover breeding programme, breeder needs to examine the diverse genotypes under specific environmental factors. It has also been observed that nutritive value of stover is generally poor and this is because of limited adoption of improved varieties. There are several findings which supports that soil type and cultivar x soil type interaction contribute towards variation in stover nitrogen content and in vitro digestibility and this interaction is very useful for genetic enhancement of stover yield and quality.

LABORATORY MEASUREMENT OF STOVER QUALITY

The measurement of gas production through Gas48hr method and comprised with other nutritional quality parameter (IVDMD, ADF, NDF, ash, lignin) should be used to examine the stover quality. In the Gas48hr method (Osuji 1993) sample leaves and stem parts of sample plant are incubated with ruminal fluid taken from cattle before feeding in the morning and cattle should adopted to sorghum residue for minimum three weeks. 200 mg of each sample and blanks should be incubated with ruminal fluid (30 ml) including a buffer solution of sodium hydrogen carbonate in replications. The anaerobic digestion of cellulose in rumen by microbes produces various volatile fatty acids (VFA), gases like CO_2, CH_4 and trace of H_2. These VFA reacts with bicarbonates to

release CO_2 because of that gas production occurs simultaneously. Cumulative fermented gas should measured at various time intervals (3,6,12,24,36,48,72 and 96) after incubation. Measurement of gas production (Gas48hr) *in vitro,* can provide knowledge about rate and amount of cellulose digestion.

More precisely stover quality estimation can be achieved by using near-infrared (NIR) spectroscopy with FOSS Forage Analyzer 5000 with WinISI II software package. For this, collected sample (leaves and stem parts) should be dried upto a constant weight and 10gm finely chopped subsample should take for measurement against NIR spectroscopy and reaming sample can be used for wet chemistry analysis for other quality parameters. Other fodder quality traits (NDF, ADF, *in-vitro* digestibility) are identified as crucial traits to predict pertinent cattle response like digestible organic matter intake with a very high precision.

CONCLUSION

It has reported that nitrogen content and in-vitro digestibility of stover in improved varieties is higher than in local cultivar and this difference is unlikely to be of nutritional significance. For the better stover quality breeding one sustainable mean is to incorporate the brown mid rib trait which is known to improve quality of stover, as genotypes with this trait exhibits very low level of the lignin which is desirable trait for better stover quality.

Although, value of sorghum stover as fodder is widely recognized and easy to access, but still there is less understanding of quality of stover. This area for sorghum breeder to research and build breeding programme to enhance genetically sorghum stover quality. Assessing sorghum genotypes for stover quality will allow sorghum breeders to select for stover quality trait more quickly, efficiently and cost effectively to develop new dual purpose sorghum varieties without sacrificing the grain yield