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Sweet Sorghum- dynamics of sugar yield in relation to different phenological stages

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Abstract: Sweet sorghum (*Sorghum bicolor* (L.) Moench) is one of the promising feedstock for bioethanol production worldwide. It is a food-feed-fuel-industrial crop, which requires low water and fertilizer input, has moderate grain yield and high yield of biomass for bio-refining and industrial utilization. Sweet sorghum is grown in many countries of Asia, Africa and Americas primarily for syrup making and as fodder. Sweet sorghum requires one-fourth the amount of water that sugarcane needs and has fermentable sugars in the juice extracted from the stalks. Sweet sorghum is similar to grain sorghum but grows rapidly and produces higher biomass. Sweet sorghums are distinct due to higher sugar content in the stalks (Brix % 10.0 to 20.0) from flowering to maturity than that of grain sorghum (Brix % 9.0-11.0) during the same period. Thus, sweet sorghum being a multi-purpose crop offers a solution to the food-versus-fuel issue particularly with reference to the energy requirements of developing nations particularly in Asia and Africa. The knowledge on sugar components at different phenological stages of crop growth and identification of appropriate stage of harvesting is critical for sweet sorghum commercialization and value chain sustenance. In this regard, sweet sorghum stalk yield, juice yield, Brix%, pH, sugars (sucrose, fructose and glucose) and their content were analyzed at three different phenological stages i.e. the dough stage, physiological maturity and post- physiological maturity. Variations in sugar content at different growth stages revealed that the sugar yield was high at physiological maturity, but highest at post- physiological maturity. Sucrose accounts for major fermentable sugar (about 70%) and it sharply increased by 146% from dough stage to post-physiological maturity. The variation in the monosaccharide's content (glucose and fructose) is not statistically significant. The earlier studies points to high genotype × environmental interaction for sugar yield. Therefore, it is suggested to observe the fluctuations of component sugars of juice in relation with locations and seasons *vis-a-vis* location of the commercial distillery to arrive at reliable period of industrial utilization of sweet stalks. Based on the results of the present study, genotypes such as SP 4495, SPV 422, SP 4487-3 and SP 4511-2 t ha^{-1} are recommended for harvesting at physiological maturity as they recorded sugar yield near or above 2 tha^{-1} and SP 4495, SPV 422, SS 2016, SP 4511-3 and ICSA 38 × ICSV 700 for harvesting at post physiological maturity. The entries SP 4495, SP 4511-3 and SPV 422 are

suitable for harvesting in a wider window of time as the sugar levels are sustained at same level from physiological maturity to post- physiological maturity. Further studies on enzymes involved in metabolism of glucose, fructose and sucrose such as amylase, invertase, sucrose phosphate synthase will help in better understanding of the dynamics of sugars *vis a vis* phenological stages under controlled conditions (temperature and photoperiod), that will aid in strategizing higher sugar productivity besides orienting breeding programs to develop photo-thermo insensitive cultivars.

Ref: CG Kumar, A Fatima, P SrinivasaRao, BVS Reddy, A Rathore, RN Rao, S Khalid, AA Kumar and A Kamal. 2011. Characterization of improved sweet sorghum genotypes for biochemical parameters, sugar yield and its attributes at different phenological stages. J of Sug Tech. (accepted)