



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCES

**EVALUATION OF SWEET SORGHUM CULTIVARS FOR WATER
PRODUCTIVITY, FODDER QUALITY AND FARMER PREFERENCES
FOR FOOD AND FODDER IN SEMI-ARID TROPICS OF ZIMBABWE**

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ABSTRACT

Crop-livestock production systems are common forms of land use in the semi-arid tropics of sub-Saharan Africa. Farmers practising these systems are faced with numerous constraints that include poor soil fertility, land and water shortages, livestock feed quantity and quality deficits. Field experiments, participatory rural appraisals and participatory variety selections were conducted to assess the potential contribution of sweet sorghum [*Sorghum bicolor* (L.) Moench] cultivars to alleviate food and feed scarcity. In articulating system efficiency, an integrated approach was further incorporated to assess sweet sorghum cultivars' response to nitrogen fertilization, understand semi-arid tropical cropping systems and farmers' preferred sorghum traits. The first field experiment was conducted during the 2007/08 season at Matopos Research Station, Zimbabwe. Three assessments were applied namely: grain and stover water productivity, stover feed quality traits and farmers preferences of cultivars. Twenty sweet sorghum cultivars were evaluated and comprised of 17 improved cultivars; experimental grain (CSV 15, E36-1, ICSR93034, ICSV25263, JJ1041, NTJ-2, S35, Seredo, SPV1022), forage (B24, GD65174-2, GD65195), dual purpose (PVK801 and SPV1411), India released varieties (ICSV700, ICSV93046 and SPV422) and landraces (IS19674, IS21100 and Matebele sweet stalk) from Southern Africa. Significant ($p < 0.05$) differences among cultivars types were observed with regard to days to maturity, harvest index, grain water productivity, nitrogen uptake, grain yield, stover yield, sugar concentration (Brix %), dry stover metabolisable energy concentration and dry stover digestibility percentage. The grain and dual types had the highest grain yield of 3.5t/ha and 3.2t/ha respectively. The landraces, forage and India released variety types had superior stover metabolisable energy concentration and digestibility than the grain type. Farmers selections shows that both grain and stover yield are important consideration under semi-arid crop-livestock systems. The dual purpose cultivar SPV1411 performed well in terms of all three selection criteria used in the screening study. The second field experiment was conducted to determine the response of improved sorghum cultivars to nitrogen application rate in sandy and clay soil types. Two sweet sorghum cultivars, E36-1 and PVK801, and Macia, were evaluated at 0 (farmers practice), 9 (micro-dosing) and 69 (recommended) kg N/ha. They were evaluated for grain and stover yield, water productivity, stover nutritional quality traits and economic benefits. In clay soil, stover yield and water productivity varied significantly ($P < 0.05$) across cultivars and nitrogen application rates. The cultivars' stover yield and water productivity were in the order E36-1=PVK801>Macia. On sandy soil, cultivars varied significantly ($P < 0.05$) for grain yield and water productivity and response to nitrogen application rates. In clay soil, stover metabolisable energy (ME) concentration and in-vitro organic matter digestibility % (IOMD %) were in the order E36-1=PVK 801>Macia. The gross margin analysis revealed that higher returns were obtained with sweet sorghum cultivars at micro dosing. In the 2009/10 season participatory rural appraisals (PRA) and participatory variety selection (PVS) methods were used to understand cropping systems, important sorghum traits and farmer preferred sweet sorghum cultivars in Nkayi District of Zimbabwe. The major five field crops grown in these crop-livestock farming systems were in the order maize>sorghum> cowpeas> pearl millet and groundnuts. The important sorghum traits considered by farmers in selecting cultivars were drought tolerance, pest and diseases tolerance and maturity period. Farmers showed preferences for Seredo, which had high grain and stover yields and bird damage tolerant. Among the released varieties in Zimbabwe only two, SV-1 and DC-75 are known and grown by farmers in Nkayi. This shows the need for participatory research in future plant breeding programmes. This study showed that sweet sorghum cultivars evaluated had high water productivity. Variation exists among cultivars for grain and stover yield, water productivity and fodder quality traits. This means that selection for these traits is possible. The sweet sorghum cultivars have higher response to nitrogen application than Macia for grain and stover yield and stover nutritional value traits. This is beneficial to farmers as they invest in soil fertility management options.