



Growth response of three sweet potato varieties to different quantities of cow dung manure

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Abstract: Organic manures as a source of plant nutrients for cultivation of field crops have received worldwide attention due to the rising costs, rapid nutrient loss and adverse environmental impacts from inorganic fertilizers. A field trial was conducted during the raining season at Njala University experimental site in a randomized complete block design (RCBD) with three replications to determine growth response of three varieties of sweet potato (82/188, Pa Kabbia and Kapurila) to different quantities 0kg (control), 30kg, 40kg, and 50kg) of cow dung manure. Application of different quantities of cow dung manure positively influenced ($P < 0.05$) number of branches, leaf length, leaf breath and vine length compared to control. The result showed that high quantities of cow dung manure (30kg, 40kg and 50kg) improved the vegetative growth of the three varieties of sweet potato compared to control while 50kg of cow dung manure gave the best growth performance of three varieties of sweet potato compared to control, 30kg, and 40kg. Among the three varieties used in this study, variety 82/188 had better response to cow dung manure with the better vegetative growth followed by Pa Kabbia and Kapurila. Thus, from the findings of the present research work, it can be concluded that Cow dung manure contains essential nutrients for plant growth. This can be due to the high amount of nutrients that prompts the physiological process of sweet potatoes that leads to increase in vegetative growth.

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Introduction

Sweet potato (*Ipomoea batatas*) is one of the most important staple carbohydrate rich food in sub-Saharan Africa countries. A number of factors that are responsible for the low yield of crop have been ascribed to several constraints. Among them, low organic matter content, poor fertility status, imbalanced use of high analysis chemical fertilizers accompanied by restricted use of organic manures that made the soils not only deficient in secondary and micronutrients, but also deteriorated the soil health (Akbari et al., 2011). Indigenously available organic sources of nutrients have enhanced the efficiency and reduced the requirements of chemical fertilizers (Bhat *et al.*, 2007). Organic manures improved the soil physical, chemical and biological properties and also increase the efficiency of the applied nutrients especially in light soils (Pandey *et al.*, 2007). Mineral fertilizers have the merit of being readily soluble in soil solution, less bulky and easy to manipulate but their constitution in most cases does not include the much-needed essential minor elements as compared to cattle manures which meet this requirement (Bekunda *et al.*, 2010). Cow dung has long been recognized as perhaps the most

desirable animal manures because of its high nutrient and organic matter content. Addition of cow dung increases the organic carbon content of degraded soil which may lead to the increasing activity of beneficial soil microorganisms as well as the fertility status of soil by increasing the availability of nutrients for the plants from soil (Zaman et al., 2017). Cattle manure seems to act directly in increasing crop growth and yields either by accelerating respiratory process with increasing cell permeability and hormonal growth action or by the combination of all of these processes which supplies N, P and S in available form to the plants via biological decomposition and improves physical properties of soil such as aggregation, permeability and water holding capacity (Purakayastha and Bhatnagar, 1997). Cattle manure, contains large amount of nutrients and influences plant growth and production via improving chemical, physical and biological fertility (Benedek, 2010). This study therefore sought to evaluate the response of three varieties of sweet potato to different quantities of cow dung on the following growth parameters, leaves breath, leaf length, number of branches and vine length.

Materials and Method

Location and Climate of the Study Area.

The research was done on farm field at the school of agriculture, Njala University, Njala campus, Kori chiefdom, Moyamba district, Southern Sierra Leone. Sierra Leone have two different seasons, the raining season which started from May and end in October while the dry season started from November and end in April.

Experimental Procedures

The experiment was laid out as a Randomized complete Block Design (RCBD) in a factorial arrangement and replicated three times. The treatments were, 0kg (control), 30kg, 40kg and 50kg cow dung manure respectively. The three varieties used in this study were Pa Kabbia, kapurila and 82\144. After site selection, the field was ploughed manually followed by lay outing and constructing of ridges. Each plot was measured 3m x 2m. Area of each replication was measured 11m x 4m. The vine cuttings were used for this experiment and they were planted on the ridges and each ridge had 10 planting holes with a distance of 30cm. In the use of vine cuttings, apical cuttings are preferred to those from the middle and basal portion of the stem (Shanmugavelu et al., 1972). The cow dung was applied as basal manure four (4) days before planting the vine.

Data Collection

In each plot, ten plant were tagged for the collection of data on the following growth parameters, breath of leaves, leaf length, number of branches and vine length.

Statistical Analysis

The SAS statistical software (9.4 versions) was used to analyze the data including analysis of variance (ANOVA). Treatments means were compared using least significance difference (LSD) at $P < 0.05$.

Result and Discussion

Leaf Length

The interaction between varieties and different quantities of cow dung manure was significantly different ($p < 0.05$) for leaf length for the three varieties of sweet potato. Results indicated that leaf length increased with increase in quantities of cow dung manure at 50kg for all three varieties compared to control (Fig:1). The result further showed that, variety (82/188) recorded the longest leaf length with 14.05cm followed by variety Pa Kabbia and Kapurila with 10.63cm and 9.78cm respectively. The shortest leaf length for all three varieties were recorded at control while the longest leaf length for all three varieties were recorded at 50kg. Sweet potato varieties had better leaf length when different quantities of cow dung were used as manure compare to control. The application of cow dung manure to the soil at different levels may have improved soil fertility and soil structure, increased soil organic matter and enhanced microbial activity (Khalil et al., 2010) and the nutrients released from manure thus support and enhanced rapid root development (Abou El-Magd et al., 2005), which might have enhanced leaf growth (Eleduma et al., 2020). Increased in vegetative growth in soil amended with organic fertilizer could probably be attributed to N availability which promoted vegetative development and also helped to maintain functional leaf length during the growth period (Cox et al., 1993).

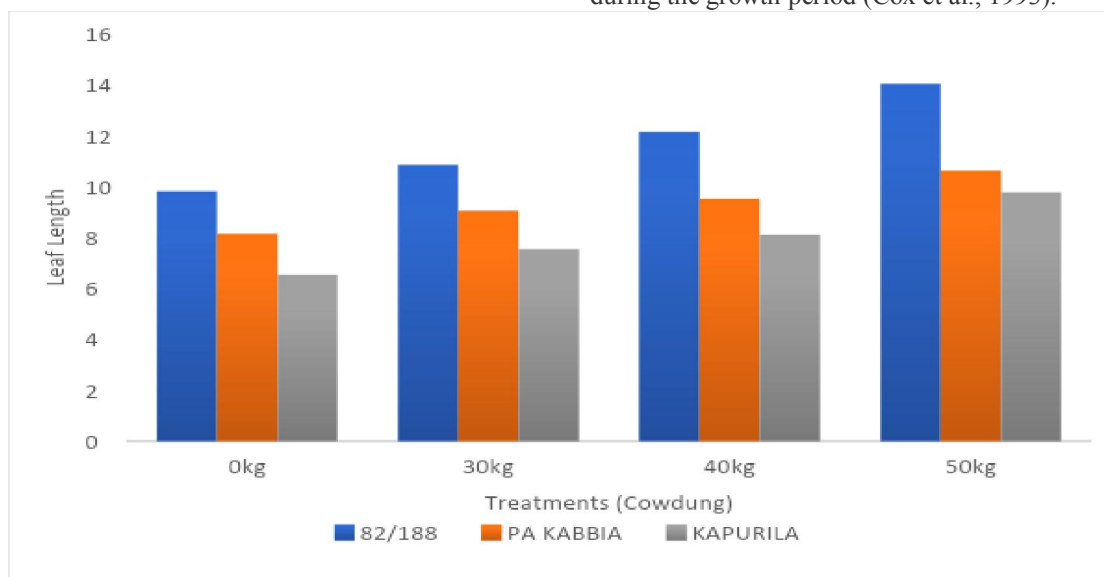


Fig 1. Effect of different quantities of cow dung on leaf length on three varieties of sweet potatoes

Number of Branches

The effect of different quantities of cow dung on number of branches for three varieties sweet potato was significantly different ($p < 0.05$). Increased in different quantities of cow dung manure saw an increase in all three varieties of sweet potatoes as compared to control (Fig: 2). The application of cow dung influenced number of branches and it was increased with the advanced doses of cow dung. The lowest branches were counted for control. Result further showed that at 50kg of cow dung manure, variety (82/188) recorded the highest of number of branches of 28.03 followed by Kapurila with 26.17 and

Pa Kabbia with 22.25. The steady increase in vegetative growth in sweet potatoes with increase in different rate of cattle manure suggests that quantity of manure applied affects nutrients availability for uptake by plants which promoted vigorous plant growth through efficient photosynthesis (Ayoub et al., 1994; Islam, 2002; Iqtidar et al., 2006). Srinivasarao et al., (2011b) observed that cow dung enhances crop vegetative growth in several rainfed crops. It is well established that the addition of organic fertilizers increased the organic matter contents of the soil and availability of plant nutrients (Brar et al., 2004).

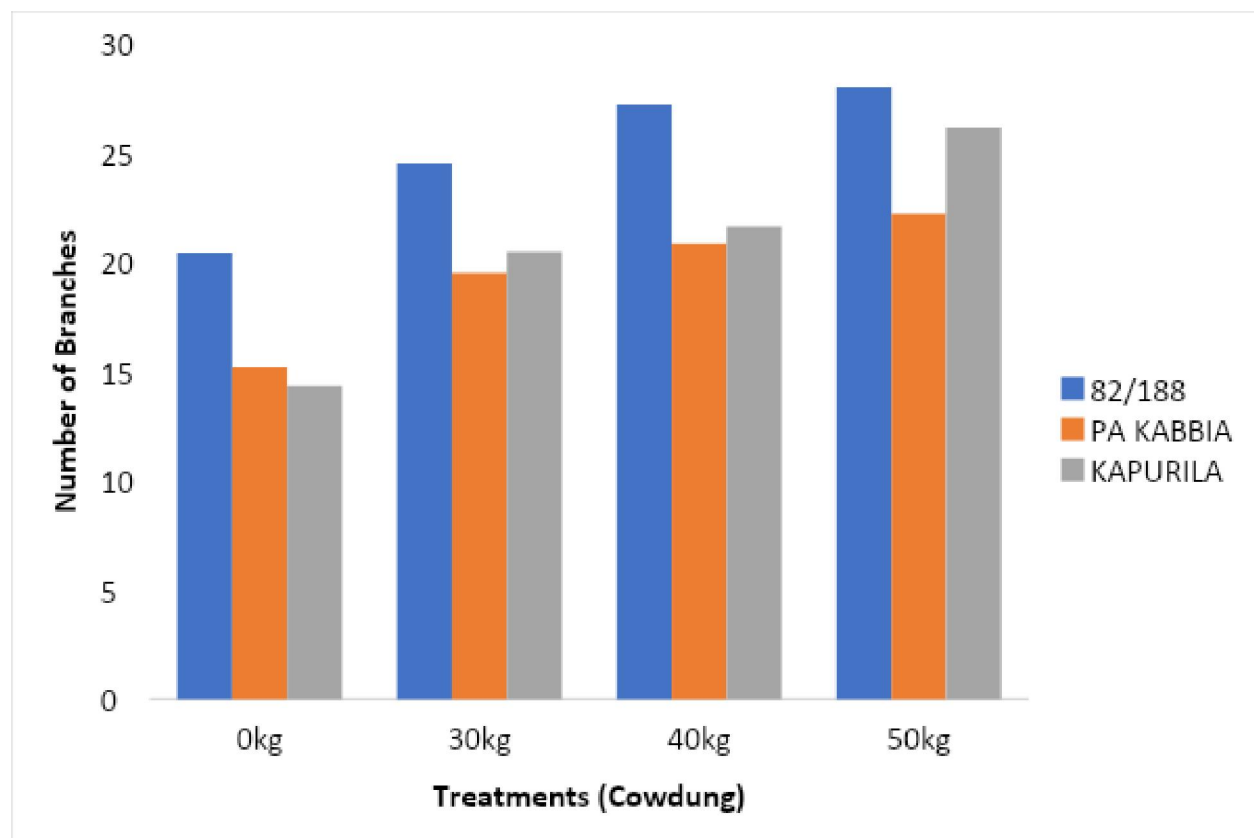


Fig 2. Effect of different quantities of cow dung on number of branches on three varieties of sweet potatoes

Leaf Breath

Data pertaining to leaf breath with different quantities of cow dung on sweet potato was significantly different ($p < 0.05$). The result revealed that leaf breath progressively increased with increasing levels of cow dung manure up to 50kg while leaf breath declined at control (Fig: 3). The widest leaf breath was recorded at 50kg for all three varieties and the lowest leaf breath was measured at control for all varieties.

Furthermore, Variety 82/188 recorded the broadest leaf breath with 12.37cm followed by variety Pa Kabbia and Kapurila recorded 9.78cm and 9.54cm respectively. These improvements in growth parameters with increase in rates of cattle manure applied agree with the findings of Fawuzi (1977); Uzo (1971) and Aminifard, et al. (2010). Eleduma et al., (2020) noted that the higher the amount of manure applied the greater the mean value of the vegetative growth parameters.

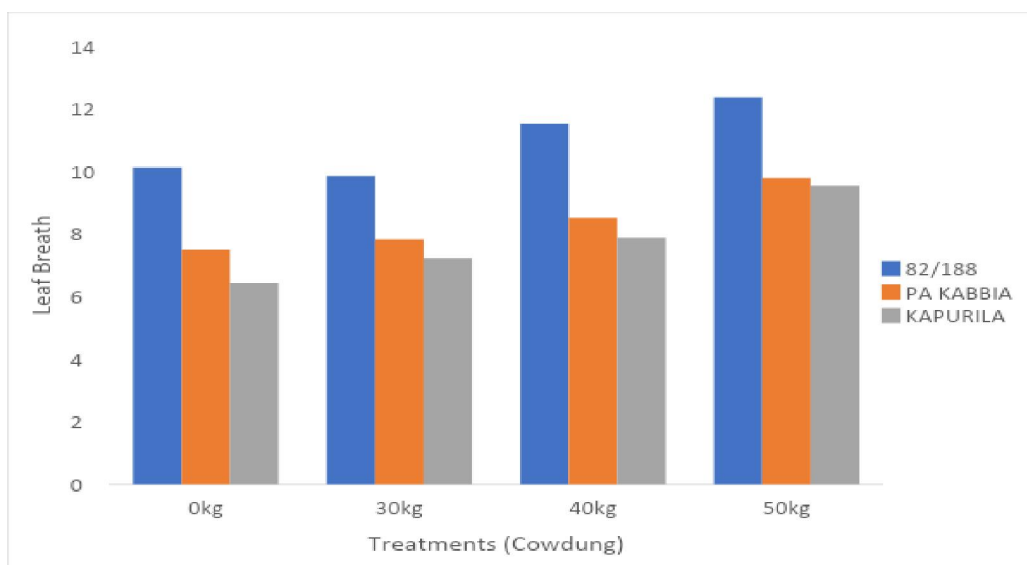


Fig 3. Effect of different quantities of cow dung on leaf breath on three varieties of sweet potatoes.

Vine Length

The interaction between varieties and different quantities of cow dung manure was significantly different ($p < 0.05$) for vine length for sweet potato. Results indicated that vine length of sweet potato increased with increase in different quantities of cow dung manure. The lowest values for vine length were recorded at control and higher values for vine length was recorded at 50kg of manure applied (Fig: 4). Furthermore, variety (82/188) recorded the longest vine length with 58.05cm followed by variety Pa Kabbia and Kapurila with 46.27cm and 39.85cm respectively. Organic manures have been said to improve soil

fertility by activating soil microbial biomass, which in turn leads to development in crops (Ayuso et al., 1996) and this may have been responsible for the observed increase in vine length resulting from nutrient application. This result showed that nutrient availability, especially NPK, determines plant vegetative growth and development (Adebayo et al., 2009). The consistent poor performance of control plots (non-fertilized) and those with low level of manure revealed that when nutrients are available in adequate amounts, plant tends to grow at their optimum potential (Eleduma et al., 2020).

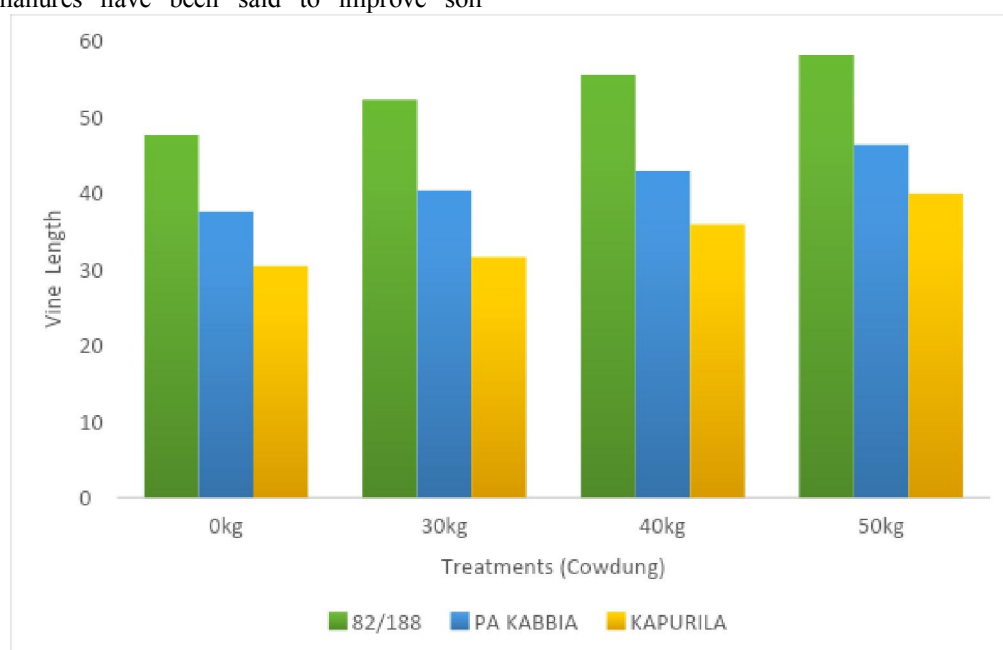


Fig 4. Effect of different quantities of cow dung on vine length on three varieties of sweet potatoes.

Conclusion

The present study revealed that the application of cow dung manure at different levels positively influenced all the parameters studied. The study clearly indicated that cow dung manure significantly improved the performances of the three varieties of sweet potato with the increased in the rates at 50kg giving the best performances. The parameters were increased with the advancement of growth and increased rate of cow dung manure up to 50kg. Thus, it can be advised that cow dung manure at 50kg might be applied to get maximum vegetative growth of sweet potatoes. Cow dung manure contains essential nutrients for plant growth and development. This can be due to the high amount of nutrients that prompts the physiological process of sweet potatoes that leads to increase in vegetative growth. Among the three varieties used in this study, variety 82/188 had better response to cow dung manure with the best vegetative growth parameters followed by Pa Kabbia and Kapurila. Therefore, the study indicated that cow dung manure at different levels have affirmative effect on the three varieties of sweet potato used for this study.

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