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# Sorghum x Sudangrass Root Morphological Changes Affected by Additional N Application while Ratooning

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**[Introduction]**

Plant root functions as nutrient and water uptake, physical supports. There is a direct relationship between the performance of roots and overall crop yield and quality. According to recent study, the N uptake is related to specific traits of their root system. Sorghum x sudangrass hybrid (forage sorghum) is a candidate for summer forage and cellulosic biofuel. It has great regrowth potential and excellent biomass yield. The focus of the current research was the root morphological changes affected by summer harvest and following additional N application to the ratooning plant.

**[Materials and Method]**

The field research was conducted at Gyeongsang National University research farm located in Jinju City, Gyeongnam. The soil was sandy, so it is ideal for large scale field root sampling efforts. The plant received 100-81-81 kg/ha fertilizer before planting. Summer harvest was conducted August $10^{th}$ 2018. The experimental design was a randomized complete block design with a split-plot arrangement. Forage sorghum cultivars; HoneychewBMR (early flowering) and Greenstar (late flowering) was main-plot, and, after summer harvest, additional N level (0, 50, 100, 150 kgN/ha; N0, N50, N100, and N150) was sub-plot. 10 crown roots were collected twice at the harvests (Oct. $17^{th}$ and Nov. $21^{st}$; Date1 and Date2, respectively). Outliers roots were discarded then five representative crown roots from each plot were washed thoroughly then placed on the array scanner for WinRHIZO PRO system (Regent instruments, Canada.) Traits calculated by WinRhizo included total root length, surface area, volume, avg. diameter and each measured of the following diameter classes (<0.5mm, 0.5-1mm, 1mm more). Data were statistically analyzed using SAS 9.4.

**[Result and discussion]**

For late flowering cultivar Greenstar, N0 had the lowest surface area, and volume compared to the other N treatments in Date1. In the case of root volume, N50 had avg. of 4.9cm$^3$ which was 4.7-folds greater than N0. Unlike HoneychewBMR(early flowering) cultivar, N0 had lowest avg. length, surface area and volume comparing to the other N treatments in Date 2. This is an indication that each cultivar requires a different level of N application for root regrowth. For early flowering cultivar HoneychewBMR, N100, and N150 showed greater root length, surface area, and volume comparing to N0 and N50 in Date1. In the case of root length, N100 had avg. of 1343.87cm which was 2.2-folds greater than N0. However, N0 had the lowest length and surface area compared to the other N treatments in Date1 this different was disappeared in Date2. For each cultivar showed most of the root length in the top section fell within the finest/first diameter class(<0.5mm) from each date.

The Current research showed different belowground characteristics (surface area, volume and length) by increasing N level in two cultivars. The relationships showed that between nutrient uptake and root morphological characteristics. Thus, this field based research suggest that nutrient level affect root development.

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