

Prasit Khunsanit 2011: Biomass and Macronutrient Contents of Sugarcane cv. K95-84.
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Thesis Advisor: Professor Suntaree Yingjajaval, Ph.D. 85 pages.

The total content of macronutrients in sugarcane cv. K95-84 was determined as the sum of the products of the dry mass and the nutrient concentration of each part of the plant. The plant was sampled on monthly interval until maturation at the end of one year. The cane or stalk contributed the highest proportion of the whole plant dry mass. The highest leaf area index at 7 months was $4.8 \text{ m}^2 \text{ m}^{-2}$, and the highest root density occurred in the 10-20 cm soil layer. The whole plant average of dry to fresh mass was 19.4%. The relationship between the dry mass (Md) and the plant age (t) was a logistic function: $Md = Md_o Md_m / [Md_o + (Md_m - Md_o) \exp(-\alpha t)]$, where Md_m is the highest, Md_o the minimal mass and α the absolute growth rate. The parameters were evaluated in two parts: the whole plant (Md_w) and the cane yield (Md_{CY}). For the whole plant: $Md_m = 18.88$, $Md_o = 0.68 \text{ ton rai}^{-1}$ and $\alpha = 0.013 \text{ day}^{-1}$. For the cane yield: $Md_m = 5.99$, $Md_o = 0.12 \text{ ton rai}^{-1}$ and $\alpha = 0.014 \text{ day}^{-1}$. The rate of dry mass increase was determined as the derivative of the logistic function. The whole plant had the highest increase in dry mass at the age of 252 days after planting (8.4 months), whereas the highest increase in cane yield was at 272 days (9 months). The highest concentrations of nitrogen and phosphorus were found in the leaf, while the leaf sheath had the highest concentration of potassium. The whole plant nutrient concentration average was derived as the slope of the linear relationship between the total dry mass and the total nutrient content. For the whole plant, the concentrations (dry mass basis) were $N = 0.667\%$, $P = 0.113\%$, $Ca = 0.148\%$, $Mg = 0.118\%$ and $K = 1.5\%$ when $Md_w \leq 8 \text{ ton rai}^{-1}$, beyond which the K content was capped at 120 kg rai^{-1} . As for the cane yield dry mass: $N = 0.636\%$, $P = 0.106\%$, $Ca = 0.081\%$, $Mg = 0.115\%$ and $K = 1.322\%$ for $Md_{CY} \leq 2.6 \text{ ton rai}^{-1}$, before the K content being capped at 35 kg rai^{-1} . Potassium was the exception in that its content increased initially with the plant dry mass before it reached a plateau. The result substantiated the fact that K is not used as part of tissue construct. Potassium accounted for 51% of the total amount of all macronutrients. The macronutrient contents in the cane were about 24%, with Ca content only 13% of those present in the whole cane. So the cane residues after harvest contribute significant amount of nutrient for next crop. The study estimated that a fresh cane yield of 20 ton rai^{-1} would deprive the soil of $N = 24.7$, $P = 4.1$, $K = 35.0$, $Ca = 3.2$ and $Mg = 4.4 \text{ kg rai}^{-1}$. The N:P:K ratio for sugarcane was 6:1:10. The period when the largest amount of nutrient was required was at the highest rate of dry mass increase at 8 months after planting. The replenishing of macronutrients in accordance to the amount removed, and at the right timing would sustain the soil productivity for sugarcane production.

Student's signature

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