

PRODUCTIVITY OF UDULTS UNDER SUGARCANE AS INFLUENCED BY THE PROPERTIES OF THEIR TEXTURAL B HORIZON

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Abstract

STUDIES to qualify the production environment have been undertaken to explore the productive potential of the soil, and consequently find the most favourable environment for sugarcane production. The surface and sub-surface characteristics of the soil, correlated with climate, allow the exploration of the genetic potential of sugarcane varieties. In the state of São Paulo (Brazil), there are extensive areas of Udult with sugarcane plantations. However, these Udults possess different water availabilities due to differences in clay content between the A and B horizons and the position where the textural B horizon (Bt) begins in the soil profile, thus influencing sugar cane productivity. Udults with Bt horizon beginning at 40, 60, or 80 cm were analysed. Soil samples were obtained in 0–20 cm, 20–40 cm and in the Bt horizon for determination of physical properties, such as clay content and available water capacity. The correlation of the productivity data with morphological characteristics such as the textural gradient of the Udults led to the conclusion that Udults with Bt horizon beginning at around 40 cm depth showed better conditions for water and nutrient absorption by the roots and consequently better sugarcane productivity.

Introduction

The production environment can be qualified by associating soil classification with climate information. Pedological characteristics can be used to obtain productivity increases of sugarcane through proper and rational soil exploration.

Prado (2007) defines the production environment as an association of surface and subsurface soil characteristics correlated with regional climate. The state of São Paulo accounts for a large amount of sugarcane production in Brazil and large areas are used.

Regarding soils with high occurrence, extensive areas of Udults (EMBRAPA, 2006) are used for sugarcane production. The Udults have morphological characteristics, namely an elevated textural gradient between the surface A horizon and the subsurface textural B horizon (Bt), and pedological characteristics, namely the position where the Bt horizon begins in the soil profile, that affect the water flux and storage in the soil.

This creates a wide variety of production environments in the same region. This work shows that the Udult heterogeneity, such as the textural differences between A and Bt horizons and the initial position of the Bt soil horizon, causes differences in the production environments of sugarcane.

Material and methods

The productivity data were acquired from sugarcane industries in the regions of Catanduva, Quatá, Porto Ferreira and Itapira, all located in the state of São Paulo. The soils studied were

Udults, with Bt horizon beginning at 40, 60 or 80 cm. Samples were obtained for granulometric analysis and determination of available water capacity (AWC) at 0–20 cm, 20–40 cm depth and in Bt horizon, which occurs at variable depth in the soil profile.

Results and discussion

Table 1 shows the productivity of the Udults in the four regions under study. Sugarcane productivity was observed to be lower where the Bt horizon starts at a greater depth, as described by Prado *et al.* (2008).

This indicates that Udults with Bt horizon beginning at about 40 cm showed better conditions for water and nutrient absorption by roots and consequently better productivity for sugarcane.

In the four regions studied, Udults with Bt horizon beginning around 40 cm showed the highest productivities, independent of the subsurface chemical condition.

Table 1—Sugarcane productivities (average of 5 analyses) in Udults with Bt horizon starting at different depths.

Region	Porto Ferreira	Quatá	Itapira	Catanduva
Depth of the B horizon starting (cm)	Sugarcane productivity (t/ha)			
40	96.0	79.18	88.26	111.5
60	82.0	70.30	79.5	90.0
80	76.0	66.51	73.8	74.7

In Table 2, results of the granulometric analysis show that soil water storage is better where the difference in clay percentage between A and Bt horizons is larger. The high textural gradient in the Udults was thus one of the responsible factors for the highest sugarcane productivities.

Table 2—Available water capacity of Ultisols (40 cm of A horizon and 60 cm of the Bt horizon) from 4 regions studied, considering the content of clay.

Region	A Horizon % Clay	AWC – A Horizon (L of water/cm of soil)	Bt Horizon % Clay	AWC – Bt Horizon (L of water/cm of soil)
Catanduva	16	0.12	42	0.60
Itapira	18	0.14	35	0.52
Quatá	17	0.13	30	0.45
Porto Ferreira	19	0.15	37	0.55

With respect to AWC values obtained in all Udults (Table 3), those with Bt horizon beginning at around 40 cm had the highest AWC value, assuming a rooting depth of 1 metre.

Table 3—Analysis of AWC in the Bt horizons of the Udults.

		CC* (% volume)	PWP* (% volume)	H* (cm)	AWC (L of water/cm of soil)
Bt horizon start (cm)	40	15	5	60	0.60
	60	14.4	4.6	40	0.39
	80	13.8	4.8	20	0.18

*CC = field capacity

*PWP = permanent wilting point

*H = depth of Bt horizon

*AWC = L of water/cm of Bt horizon considering the depth of 100 cm

Conclusions

The Udults with Bt horizon beginning at around 40 cm and with a high percentage of clay in the beginning of this horizon had higher productivity, due to the elevated water retention and availability in the soil profile.

Through correlation of productivity data with morphological and pedological characteristics of the Udults, it was possible to conclude that soils with Bt horizon beginning at 40 cm had an environment that was more suitable for production as they allowed better water and nutrient absorption by the roots and, consequently had the highest sugarcane productivity.

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PRODUCTIVITE DES UDULTS SOUS CANNE A SUCRE SELON LES PROPRIETES DE LEUR HORIZON TEXTURAL B

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**MOTS-CLES: Canne à Sucre, Udults, Sol,
Horizon Textural B.**

Résumé

DES ETUDES de caractérisation de la production environnementale ont été entreprises afin d’inventorier le potentiel productif du sol, et donc de trouver l’environnement le plus favorable pour la production de canne à sucre. Les caractéristiques surfaciques et pédologiques du sol, corrélées au climat, permettent d’explorer le potentiel génétique des variétés de canne à sucre. Dans l’état de São Paulo (Brésil), il existe des surfaces importantes d’Udults cultivées en canne à sucre. Cependant, ces Udults possèdent des disponibilités différentes en eau liées aux différents teneurs en argile entre les horizons A et B et à la position où l’horizon textural B (Bt) commence dans le profil de sol, influençant ainsi la productivité de la canne à sucre. Des Udults avec des horizons Bt commençant à 40, 60 et 80 cm ont été analysés. Des échantillons de sol ont été prélevés entre 0–20, 20–40 cm et dans l’horizon Bt afin de déterminer les propriétés physiques, telles que la teneur en argile et la réserve en eau disponible. La corrélation entre la productivité et les caractéristiques morphologiques des Udults telles que leur gradient textural montre que les Udults avec un horizon Bt à environ 40cm de profondeur présentent les meilleures conditions d’absorption en eau et éléments minéraux pour les racines et par conséquent la meilleure productivité en canne à sucre.

PRODUCTIVIDAD DE UDULTS BAJO EL CULTIVO DE CAÑA DE AZÚCAR, INFLUENCIADOS POR LAS PROPIEDADES DE SU HORIZONTE B TEXTURAL

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PALABRAS CLAVE: caña de azúcar, Udults, suelo, horizonte B textural

Resumen

SE HAN realizado estudios para calificar el ambiente de producción con el fin de explorar el potencial productivo del suelo y, consecuentemente, encontrar el ambiente más favorable para la producción de la caña de azúcar. Las características de la superficie y sub-superficie del suelo correlacionadas con el clima permiten la exploración del potencial genético de las variedades de caña de azúcar. En el estado de São Paulo (Brasil) hay áreas extensivas de Udults con plantaciones de caña de azúcar. Sin embargo, estos Udults poseen diferentes disponibilidades de agua, debido a diferencias en el contenido de arcillas entre los horizontes A y B, y la posición en que comienza el horizonte B textural (Bt) en el perfil, lo cual influencia la productividad de la caña de azúcar. Se analizaron Udults con horizonte Bt a los 40, 60 y 80 cm. Se obtuvo muestras de suelo de 0–20 cm, 20–40 cm y del horizonte Bt para determinar propiedades físicas tales como contenido de arcilla y capacidad de disponibilidad de agua. La correlación de los datos de productividad con características morfológicas como el gradiente textural de los Udults, condujo a concluir que los Udults con un horizonte Bt que comienza alrededor de los 40 cm de profundidad, muestran mejores condiciones para la absorción de agua y nutrientes por las raíces y, consecuentemente, una mejor productividad de caña de azúcar.