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Granulometric analyses of some sandy soils form northern Minas Gerais

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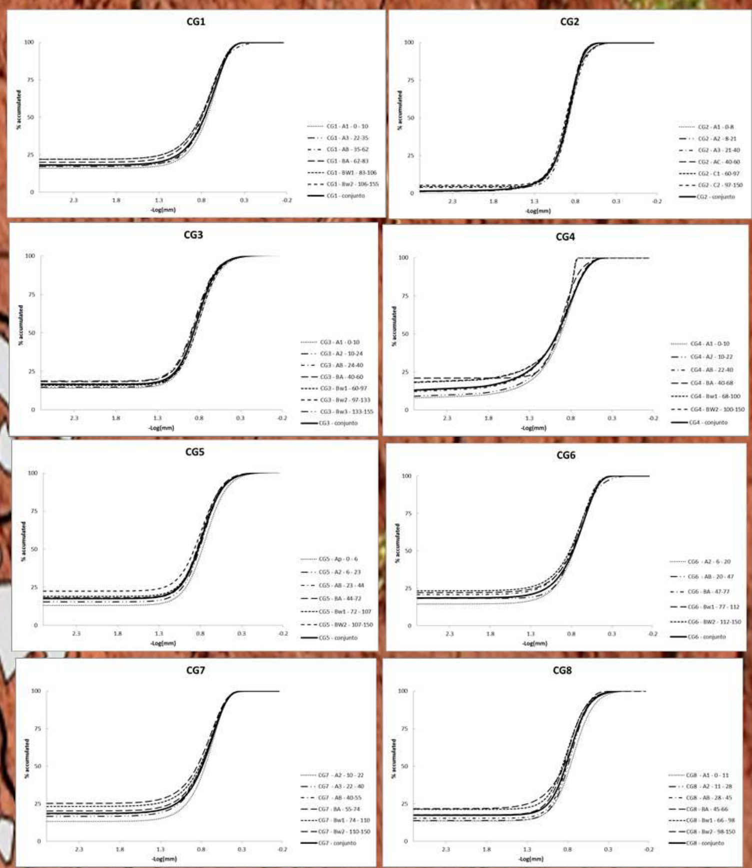
The granulometric distribution curve is one of the most basic and important characteristics of the soils, and it is directly related to many soil functions, e.g. gas and water permeability and retention. As the granulometric analysis is one of the standard routine analyses for soils, and it is usually available in the soils data bases, it has been used as a proxy for other parameters that are less available, more difficult or more expensive to achieve, through the pedotransfer functions (PTFs), such as the retention curve. The goal of this work is to model and to evaluate the distribution curves of some representative sandy soils of northern Minas Gerais, developed over the Urucuia Sandstone Formation, which have been used for rain fed agriculture, and to establish a general model curve for these soils, to be used in modelling and in comparative analyses. Eight soils (48 horizons in total) were analyzed, ranging from sandy to sandy-clay-loam texture. The granulometric analysis was performed accordingly to Brazilian standards, and the sand fraction was partitioned in five size classes. The cumulative distribution curves were computed and empiric non-linear functions were fitted to them. The curves were fitted for each soil horizon, and also for the whole profiles. The results indicate that the fitting procedures were efficient, but different models were necessary for the profiles. In some cases, even in the same profile different models were applied. The Morgan-Mercer-Flodin (MMF) model was the best for half of the horizons, followed by the Weibull Model (33%) and the Logistic model (13%). Only for two horizons the Richards model was the best. The MMF model was also the most flexible, adapting to soils of broad granulometric distribution, from sandy to sandy-clay-loam. The Weibull model performed best in the sandy-clay-loam soils, and the Logistic model in the sandy soils.



Weibull Model

$$y = a - b \times e^{(-c \times x^{d})}$$

Morgan-Mercer-Flodin model

$$y = \frac{(a \times b + c \times x^{d})}{(b + x^{d})}$$

Logistic Model

$$y = \frac{a}{(1 + b \times e^{(-c \times x)})}$$

Richards Model

$$y = \frac{a}{(1 + e^{(b - c \times x)})^{(1/d)}}$$

	Total	%
Weibull Model	16	33
Richards Model	2	4
MMF Model	24	50
Logistic Model	6	13
	48	100

		Clay %
CG2 - A2 - 8-21	Logistic Model	2.9
CG2 - A3 - 21-40	MMF Model	3.6
CG2 - A1 - 0-8	Logistic Model	3.7
CG2 - AC - 40-60	Logistic Model	3.8
CG2 - C1 - 60-97	MMF Model	3.9
CG2 - C2 - 97-150	MMF Model	4.4
CG5 - A2 - 6 - 23	MMF Model	12.5
CG8 - A1 - 0 - 11	MMF Model	12.7
CG7 - A2 - 10 - 22	Weibull Model	12.9
CG3 - A1 - 0-10	MMF Model	13.3
CG8 - A2 - 11 - 28	MMF Model	13.3
CG4 - A1 - 0-10	Logistic Model	13.4
CG3 - A2 - 10-24	MMF Model	13.8
CG4 - A2 - 10-22	Logistic Model	14.5
CG6 - A2 - 6 - 20	Weibull Model	14.6
CG8 - AB - 28 - 45	MMF Model	14.6
CG5 - AB - 23 - 44	MMF Model	14.8
CG3 - Bw1 - 60-97	MMF Model	15.2
CG3 - Bw2 - 97-133	MMF Model	16.0
CG1 - A1 - 0 - 10	Weibull Model	16.1
CG3 - AB - 24-40	MMF Model	16.3
CG7 - A3 - 22 - 40	Weibull Model	16.4
CG5 - Ap - 0 - 6	MMF Model	16.7
CG8 - BA - 45-66	MMF Model	16.9
CG4 - AB - 22-40	Logistic Model	17.1
CG1 - A3 - 22-35	Weibull Model	17.2
CG5 - BA - 44-72	MMF Model	17.3
CG3 - BA - 40-60	MMF Model	17.6
CG1 - AB - 35-62	MMF Model	17.8
CG3 - Bw3 - 133-155	MMF Model	17.8
CG6 - AB - 20 - 47	MMF Model	17.8
CG7 - AB - 40-55	Weibull Model	18.0
CG5 - Bw1 - 72 - 107	MMF Model	18.4
CG7 - BA - 55-74	Weibull Model	19.8
CG1 - BA - 62-83	Weibull Model	20.1
CG4 - BA - 40-68	MMF Model	20.2
CG1 - Bw2 - 106-155	Weibull Model	20.4
CG8 - Bw1 - 66 - 98	MMF Model	20.5
CG6 - BA - 47-77	Weibull Model	20.9
CG4 - Bw1 - 68-100	Richards Model	21.0
CG4 - BW2 - 100-150	Richards Model	21.0
CG8 - Bw2 - 98-150	Weibull Model	21.7
CG1 - BW1 - 83-106	Weibull Model	21.8
CG5 - BW2 - 107-150	MMF Model	21.9
CG6 - Bw1 - 77 - 112	Weibull Model	22.0
CG7 - Bw1 - 74 - 110	Weibull Model	22.8
CG6 - BW2 - 112-150	Weibull Model	23.0
CG7 - Bw2 - 110-150	Weibull Model	24.6

		Clay %	Average
CG2 - A2 - 8-21	Logistic Model	2.9	
CG2 - A1 - 0-8	Logistic Model	3.7	
CG2 - AC - 40-60	Logistic Model	3.8	
CG4 - A1 - 0-10	Logistic Model	13.4	
CG4 - A2 - 10-22	Logistic Model	14.5	
CG4 - AB - 22-40	Logistic Model	17.1	9.2
CG2 - A3 - 21-40	MMF Model	3.6	
CG2 - C1 - 60-97	MMF Model	3.9	
CG2 - C2 - 97-150	MMF Model	4.4	
CG5 - A2 - 6 - 23	MMF Model	12.5	
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CG6 - Bw1 - 77 - 112	Weibull Model	22.0	
CG7 - Bw1 - 74 - 110	Weibull Model	22.8	
CG6 - BW2 - 112-150	Weibull Model	23.0	
CG7 - Bw2 - 110-150	Weibull Model	24.6	19.5