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Published in:
Data in Brief

DOI:
[10.1016/j.dib.2018.01.048](https://doi.org/10.1016/j.dib.2018.01.048)

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

[Link to publication in ResearchOnline](#)

Citation for published version (Harvard):

Mickovski, SB & van Beek, LPH 2018, 'Test data from pullout experiments on vetiver grass (*Vetiveria zizanioides*) grown in semi-arid climate', *Data in Brief*, vol. 17, pp. 463-468.
<https://doi.org/10.1016/j.dib.2018.01.048>

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Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Test data from pullout experiments on vetiver grass (*Vetiveria zizanioides*) grown in semi-arid climateSlobodan B. Mickovski^{a,*}, L.P.H. van Beek^b^a School of Engineering and Built Environment, Glasgow Caledonian University, United Kingdom^b Geosciences Department, University of Utrecht, The Netherlands

ARTICLE INFO

Article history:

Received 11 November 2017

Received in revised form

9 January 2018

Accepted 16 January 2018

Available online 31 January 2018

ABSTRACT

The data set presented in this article includes the results of pullout tests carried out on vetiver grass (*Vetiveria zizanioides*) growing on an abandoned terrace slopes in Spain. The results comprise tables showing the resistance of each tested vetiver plant to pullout forces applied to it at various angles. The dataset also contains the measurements of the displacement at each pullout force increment. The dataset also includes the plots of the pullout resistance of each vetiver plant against the measured displacement.

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Specifications Table

Subject area	Biology, Engineering
More specific sub- ject area	Ecological engineering
Type of data	Tables and graphs
How data was acquired	<i>in situ</i> measurement of the force and displacement during pullout. The force was measured using a hand-held portable force gauge (Alluris FMI-100)
Data format	Raw data presented in tables and analyzed on graphs

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Experimental factors	Before each pullout test the soil surface in a radius 30 cm around the plant was carefully cleared from the litter, exposing the stem base
Experimental features	A strong PVC rope (3 mm diameter) padded with soft tissue in order not to destroy the plant material was then tied around the stem base of the plant. The other end of the rope was connected to a hand-held portable force gauge for accurate measurement of uprooting force. In order to mimic the forces applied to the plant during runoff and sediment impoundment, the pullout force was applied parallel to the slope in downslope direction. The force was applied manually with a rate of 10 mm per minute, recording the change in resistance along the way. The test was terminated once the resisting force dropped sharply and the plant was uprooted.
Data source location	Almudaina, Spain (X= 729275 Y= 4293850 and Z= 480 m on UTM 30 s)
Data accessibility	The data is with this article.

Value of the data

- This data set provides an insight into the behavior of vetiver grass grown in semi-arid climate during potential erosion or shallow landslide event
- This data set can be used to develop a reinforcement models for vegetated soils
- This data set can be combined with published data on root distribution of vetiver to derive the strength that vetiver root systems can impart on soil
- This data set can be combined with published data on above-ground vetiver plant morphology to derive the sediment retention capacity of vetiver plants
- This dataset can serve as a benchmark for measurement and presentation of parameters required for derivation of root reinforcement models and soil-root interaction

1. Data

The data set of the results of pullout tests carried out on vetiver grass (*Vetiveria zizanioides*) growing on row on an abandoned terrace slopes in Spain is shown on [Tables 1–3](#). The results show the resistance of each tested vetiver plant to pullout forces applied to it. This dataset also contains the measurements of the displacement at each pullout force increment. [Fig. 1](#) shows the plots of the pullout resistance of each vetiver plant against the measured displacement.

2. Experimental design, materials and methods

In order to investigate the pullout resistance of vetiver grass, 24 plants were randomly chosen from a plantation on an abandoned terrace near Almudaina, Spain and were used as a test sample [\[1\]](#). Before each pullout test the soil surface in a radius 30 cm around the plant was carefully cleared from the litter, exposing the plant stem base. A strong PVC rope (3 mm diameter) padded with soft tissue in order not to destroy the plant material was then tied around the stem base of each plant. The other end of the rope was connected to a hand-held portable force gauge (Alluris FMI-100) for accurate measurement of the uprooting force. In order to mimic the forces applied to the plant during runoff and sediment impoundment, as well as shallow landslides, the pullout force was applied at different angles to the slope in downslope direction. The force was applied manually with a rate of 10 mm per minute, recording the change in resistance along the way. The displacement of the plant during the pullout was measured using a tape measure with a 1 mm precision ([Tables 1–3](#)). The test was terminated once the resisting force dropped sharply and the plant was uprooted. The data on pullout

Table 1
Pullout resistance of vetiver plants from Row A.

<i>Sample:</i>	<i>A2</i>	<i>Sample:</i>	<i>A3</i>	<i>Sample:</i>	<i>A4A</i>	<i>Sample:</i>	<i>A12</i>	<i>Sample:</i>	<i>A13</i>
Direction of pull [°]:	45	Direction of pull [°]:	60	Direction of pull [°]:	60	Direction of pull [°]:	60	Direction of pull [°]:	60
Diam. At base [mm]	68		30		35		56		69
Displacement [mm]	Force [N]	Displacement [mm]	Force [N]	Displacement [mm]	Force [N]	Displacement [mm]	Force [N]	Displacement [mm]	Force [N]
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
20	68.0	20	134.0	20	132.0	20	68.0	20	80.0
40	118.0	40	190.0	40	200.0	40	133.0	40	122.0
60	200.0	60	216.0	60	260.0	60	186.0	60	188.0
80	247.0	80	290.0			80	285.0	80	235.0
120	407.0	120	370.0			120	365.0	100	301.0
160	477.0	140	389.0			160	484.0	120	379.0
180	540.0	200	506.0			200	615.0	140	399.0
								160	478.0
								200	562.0

Table 2

Pullout resistance of vetiver plants from Row B.

Sample:	B1	Sample:	B2A	Sample:	B2B	Sample:	B3A	Sample:	B4A	Sample:	B4B	Sample:	B5	Sample:	B6	Sample:	B7A	Sample:	B7B	Sample:	B8
Direction of pull [°]:	18	Direction of pull [°]:	0	Direction of pull [°]:	14	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0
Diam. At base [mm]	61		57		57		80		73		73		59		90		56		56		30
Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]
0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
40	94.0	20	51.0	50	9.0	10	30.0	20	26.0	20	60.0	20	48.0	20	45.0	20	22.0	20	61.0	20	42.0
60	170.0	40	120.0	90	17.0	20	56.0	40	60.0	40	100.0	40	75.0	40	69.0	40	45.0	40	123.0	40	101.0
80	260.0	60	180.0	110	26.0	30	74.0	60	110.0	60	159.0	60	100.0	60	120.0	60	72.0	60	215.0	60	188.0
100	340.0	80	210.0	130	37.0	40	116.0	80	160.0	80	200.0	80	140.0	80	180.0	80	102.0	80	284.0	80	278.0
120	410.0	100	240.0	150	42.0	50	180.0	100	220.0	100	296.0	100	210.0	100	245.0		100		320.0	100	288.0
160	420.0	120	300.0			60	215.0	120	280.0	120	378.0	140	250.0	120	269.0		120		362.0	160	351.0
220	440.0	140	361.0			70	250.0	160	335.0	180	529.0	160	290.0	140	335.0		140		389.0		
320	486.7					80	278.0	180	430.0			180	364.0	160	422.0		160		439.0		
							90	299.0	200	550.0		200	442.0	180	508.0		180		460.0		
							100	352.0					240	480.0							
							110	406.0					300	511.0							
							120	416.0													
							130	474.0													
							140	503.0													
							170	508.0													

Table 3

Pullout resistance of vetiver plants from Row D.

<i>Sample:</i>	<i>D6</i>	<i>Sample:</i>	<i>D5-I</i>	<i>Sample:</i>	<i>D5B</i>	<i>Sample:</i>	<i>D5C</i>	<i>Sample:</i>	<i>D4</i>	<i>Sample:</i>	<i>D3</i>	<i>Sample:</i>	<i>D1A</i>	<i>Sample:</i>	<i>D1B</i>
Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	0	Direction of pull [°]:	50
Diam. at base [mm]	50		91		91		91		92		35		76		76
Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]	Displac. [mm]	Force [N]
0	0.0	0	0.0	0	0	0	0	0	0.0	0	0.0	0	0.0	0	0.0
10	21.7	90	71.0	20	65	60	72	40	100.0	50	45.0	50	104.0	30	490
15	26.0	100	82.0	40	110	100	212	50	190.0	80	27.0	70	160.0	60	560
20	29.0	150	124.0	60	172	170	272	110	340.0			90	170.0		
25	33.0	190	165.0	90	255	210	460	160	420.0			110	150.0		
30	33.0	200	198.0	120	330										
35	38.0	250	215.0	220	415										
40	43.0	280	220.0												
45	48.0	300	240.0												
50	51.0														
55	54.0														
60	56.0														
65	60.0														
70	63.0														
75	65.0														
80	68.0														
85	71.0														
90	76.0														
95	80.0														
100	90.0														
105	97.0														
110	110.0														
120	124.0														
130	141.0														
140	156.0														
150	174.0														
160	187.0														

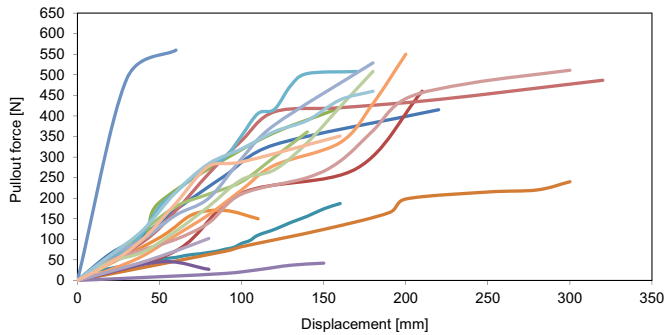


Fig. 1. Pullout resistance of each vetiver plant against the measured displacement.

resistance was then plotted against plant displacement (Fig. 1) to show the plant behavior during the process.

Acknowledgements

The work on this paper was funded under the framework of the Erasmus+ project ECOMED (575796-EPP-1-2016-1-ES-EPPKA2-KA; www.ecomedbio.org).

Transparency document. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.dib.2018.01.048>.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.dib.2018.01.048>.

Reference

- [1] S.B. Mickovski, L.P.H. van Beek, F. Salin, Uprooting of vetiver uprooting resistance of vetiver grass (*Vetiveria zizanioides*, Plant Soil 278 (2005) 33–41.