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Data Article

Test data from pullout experiments on vetiver grass (*Vetiveria zizanioides*) grown in semi-arid climate

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A B S T R A C T

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 subject area | Ecological engineering |
| Type of data               | Tables and graphs    |
| How data was acquired      | in situ 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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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. 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.

**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 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.

| Sample  | A2       | Sample  | A3       | Sample  | A4A      | Sample  | A12      | Sample  | A13      |
|---------|----------|---------|----------|---------|----------|---------|----------|---------|----------|
| 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       | Displacement [mm] | 30       | Displacement [mm] | 35       | Displacement [mm] | 56       | Displacement [mm] | 69       |
| Displacement Force [N] | 0        | Displacement Force [N] | 0        | Displacement Force [N] | 0        | Displacement Force [N] | 0        | Displacement Force [N] | 0        |
| 0       | 68.0     | 40      | 118.0    | 40      | 190.0    | 40      | 200.0    | 40      | 260.0    |
| 20      | 68.0     | 60      | 200.0    | 60      | 216.0    | 60      | 260.0    | 60      | 260.0    |
| 60      | 247.0    | 80      | 290.0    | 80      | 285.0    | 80      | 235.0    | 80      | 235.0    |
| 120     | 407.0    | 120     | 370.0    | 120     | 365.0    | 100     | 301.0    | 100     | 301.0    |
| 160     | 477.0    | 140     | 389.0    | 160     | 484.0    | 120     | 379.0    | 120     | 379.0    |
| 180     | 540.0    | 200     | 506.0    | 200     | 615.0    | 140     | 399.0    | 140     | 399.0    |
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 | 80 | 73 | 73 | 59 | 90 | 56 | 56 | 30 |
| Displac. Force [mm]: | 0 | 40 | 94 | 0.0 | 0.0 | 40 | 110 | 20 | 51 | 90 | 30 | 120 | 90 | 170 | 0.0 | 0.0 | 60 | 260 | 0.0 | 90 | 260 | 0.0 | 80 | 170 | 0.0 | 60 | 300 | 120 | 420 | 0.0 | 200 | 440 | 0.0 | 220 | 486 | 0.0 |
| Displac. Force [N]: | 0 | 94 | 0 | 0.0 | 0.0 | 40 | 110 | 20 | 51 | 90 | 30 | 120 | 90 | 170 | 0.0 | 0.0 | 60 | 260 | 0.0 | 90 | 260 | 0.0 | 80 | 170 | 0.0 | 60 | 300 | 120 | 420 | 0.0 | 200 | 440 | 0.0 | 220 | 486 | 0.0 |
### Table 3
Pullout resistance of vetiver plants from Row D.

| Sample: | D6 | Sample: | D5-I | Sample: | D5B | Sample: | D5C | Sample: | D4 | Sample: | D3 | Sample: | D1A | Sample: | D1B |
|---------|----|---------|------|---------|-----|---------|-----|---------|----|---------|----|---------|-----|---------|-----|
| Diam. at base [mm] | | | | | | | | | | | | | | | |
| 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 |
| 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 | 90 | 170.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 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 |
resistance was then plotted against plant displacement (Fig. 1) to show the plant behavior during the process.

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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.