|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Group* | *L* | *t*  | *Q*  | *h0*  | *Hd*  | *ha*  | *U0*  | *Uc*  | *Flume* | *Fr* | *dus\_a*  | *dus\_m*  | *ds\_a*  | *ds\_m*  |
| *Number* | (h) | (L/s) | (mm) | (mm) | (mm) | (m/s) | (m/s) | slope | (mm) | (mm) | (mm) | (mm) |
| 1 | 0 | 63.9 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 41 | - | 126 |
| 2 | 0 | 23.3 | 34.1 | 147 | 7 | 10 | 0.527 | 0.366 | 0.0007 | 0.44 | 68 | 78 | 80 | 128 |
| 3 | 0 | 28.6 | 43.3 | 154 | 9 | 5 | 0.639 | 0.368 | 0.0017 | 0.52 | 79 | 112 | 73 | 108 |
| 4 | 0 | 22 | 52.5 | 159 | 16 | 7 | 0.75 | 0.37 | 0.0023 | 0.6 | 101 | 160 | 96 | 122 |
| 5 | 0 | 16.7 | 61.7 | 161 | 22 | 11 | 0.871 | 0.37 | 0.0037 | 0.69 | 98 | 130 | 125 | 150 |
| 6 | 0 | 2.3 | 70.9 | 171 | 29 | 8 | 0.942 | 0.374 | 0.0047 | 0.73 | 93 | 148 | 107 | 150 |
| 7 | 0 | 2 | 80.1 | 172 | 32 | 10 | 1.058 | 0.374 | 0.006 | 0.81 | 90 | 128 | 117 | 150 |
| 8 | 0 | 2.1 | 89.3 | 178 | 39 | 11 | 1.14 | 0.376 | 0.0071 | 0.86 | 96 | 143 | 138 | 160 |
| 9 | *D* | 23.1 | 34.1 | 154 | 6 | 2 | 0.503 | 0.368 | 0.0007 | 0.41 | 33 | 44 | 54 | 94 |
| 10 | *D* | 27.9 | 43.3 | 158 | 8 | 0 | 0.623 | 0.369 | 0.0017 | 0.5 | 74 | 128 | 68 | 96 |
| 11 | *D* | 19.1 | 52.5 | 160 | 11 | 1 | 0.746 | 0.37 | 0.0023 | 0.6 | 92 | 149 | 77 | 105 |
| 12 | *D* | 16.7 | 61.7 | 161 | 17 | 6 | 0.871 | 0.37 | 0.0037 | 0.69 | 101 | 149 | 89 | 127 |
| 13 | *D* | 3.1 | 70.9 | 170 | 26 | 6 | 0.948 | 0.373 | 0.0047 | 0.73 | 84 | 147 | 110 | 139 |
| 14 | *D* | 1.9 | 80.1 | 173 | 33 | 10 | 1.052 | 0.374 | 0.006 | 0.81 | 79 | 149 | 123 | 149 |
| 15 | *D* | 2.2 | 89.3 | 178 | 37 | 9 | 1.14 | 0.376 | 0.0071 | 0.86 | 66 | 146 | 143 | 165 |
| 16 | *2D* | 72.2 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 35 | - | 107 |
| 17 | *2D* | 24 | 32.5 | 152 | 6 | 2 | 0.503 | 0.368 | 0.0007 | 0.41 | 3 | 14 | 78 | 103 |
| 18 | *2D* | 24.3 | 43.3 | 154 | 6 | 0 | 0.631 | 0.369 | 0.0017 | 0.51 | 42 | 70 | 73 | 98 |
| 19 | *2D* | 22.5 | 52.5 | 162 | 15 | 1 | 0.728 | 0.371 | 0.0023 | 0.58 | 73 | 129 | 77 | 103 |
| 20 | *2D* | 11.6 | 61.7 | 159 | 17 | 6 | 0.871 | 0.37 | 0.0037 | 0.7 | 73 | 116 | 88 | 114 |
| 21 | *2D* | 3.1 | 70.9 | 169 | 27 | 6 | 0.942 | 0.374 | 0.0047 | 0.73 | 71 | 157 | 101 | 125 |
| 22 | *2D* | 1.9 | 80.1 | 171 | 33 | 10 | 1.052 | 0.374 | 0.006 | 0.81 | 65 | 150 | 117 | 142 |
| 23 | *2D* | 2.8 | 89.3 | 174 | 35 | 9 | 1.153 | 0.375 | 0.0071 | 0.88 | 65 | 123 | 134 | 150 |
| 24 | *4D* | 69.4 | 22 | 151 | 0 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 36 | - | 129 |
| 25 | *4D* | 25 | 34.1 | 149 | 6 | 7 | 0.52 | 0.366 | 0.0007 | 0.43 | 38 | 55 | 55 | 76 |
| 26 | *4D* | 23.5 | 43.3 | 156 | 9 | 3 | 0.631 | 0.369 | 0.0017 | 0.51 | 57 | 89 | 61 | 90 |
| 27 | *4D* | 22.7 | 52.5 | 160 | 14 | 4 | 0.746 | 0.37 | 0.0023 | 0.6 | 72 | 95 | 67 | 93 |
| 28 | *4D* | 16.7 | 61.7 | 169 | 23 | 4 | 0.83 | 0.373 | 0.0037 | 0.64 | 71 | 112 | 73 | 104 |
| 29 | *4D* | 2 | 70.9 | 167 | 27 | 10 | 0.965 | 0.372 | 0.0047 | 0.75 | 64 | 107 | 91 | 117 |
| 30 | *4D* | 1.8 | 80.1 | 172 | 32 | 10 | 1.058 | 0.374 | 0.006 | 0.81 | 59 | 126 | 124 | 147 |
| 31 | *4D* | 2.2 | 89.3 | 179 | 38 | 9 | 1.134 | 0.376 | 0.0071 | 0.86 | 65 | 112 | - | - |
| 32 | *6D* | 72.2 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 39 | - | 117 |
| 33 | *6D* | 25 | 34.1 | 149 | 6 | 7 | 0.52 | 0.366 | 0.0007 | 0.43 | 54 | 67 | 55 | 81 |
| 34 | *6D* | 26.1 | 43.3 | 155 | 7 | 2 | 0.635 | 0.368 | 0.0017 | 0.51 | 71 | 90 | 59 | 82 |
| 35 | *6D* | 22.2 | 52.5 | 156 | 9 | 3 | 0.765 | 0.369 | 0.0023 | 0.62 | 81 | 118 | 67 | 93 |
| 36 | *6D* | 15.5 | 61.7 | 160 | 14 | 4 | 0.876 | 0.37 | 0.0037 | 0.7 | 79 | 99 | 74 | 101 |
| 37 | *6D* | 2.9 | 70.9 | 163 | 19 | 6 | 0.989 | 0.371 | 0.0047 | 0.78 | 81 | 131 | 92 | 125 |
| 38 | *6D* | 2.1 | 80.1 | 170 | 27 | 7 | 1.071 | 0.373 | 0.006 | 0.83 | 82 | 133 | 97 | 123 |
| 39 | *6D* | 2.1 | 89.3 | 176 | 35 | 9 | 1.153 | 0.375 | 0.0071 | 0.88 | 70 | 116 | - | - |
| 40 | *9D* | 26.2 | 34.1 | 149 | 6 | 7 | 0.52 | 0.366 | 0.0007 | 0.43 | 67 | 108 | 65 | 92 |
| 41 | *9D* | 24.7 | 43.3 | 157 | 8 | 1 | 0.627 | 0.369 | 0.0017 | 0.51 | 86 | 115 | 60 | 90 |
| 42 | *9D* | 22.7 | 52.5 | 164 | 14 | 0 | 0.728 | 0.371 | 0.0023 | 0.57 | 94 | 120 | 66 | 96 |
| 43 | *9D* | 10.6 | 61.7 | 164 | 17 | 3 | 0.855 | 0.371 | 0.0037 | 0.67 | 105 | 145 | 80 | 106 |
| 44 | *9D* | 2.7 | 70.9 | 164 | 20 | 6 | 0.983 | 0.371 | 0.0047 | 0.77 | 89 | 115 | 91 | 123 |
| 45 | *9D* | 2.2 | 80.1 | 166 | 24 | 8 | 1.097 | 0.372 | 0.006 | 0.86 | 85 | 134 | 96 | 126 |
| 46 | *9D* | 2.1 | 89.3 | 175 | 35 | 10 | 1.16 | 0.375 | 0.0071 | 0.89 | 84 | 120 | - | - |
| 47 | *12D* | 72.2 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 58 | - | 101 |
| 48 | *18D* | 72.2 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | 39 | - | 93 |
| 49 | *Single weir* | 72.5 | 22 | 151 | 1 | 0 | 0.331 | 0.367 | 0.0007 | 0.27 | - | - | - | 91 |
| 50 | *Single weir* | 35.3 | 34.1 | 151 | 5 | 4 | 0.513 | 0.367 | 0.0009 | 0.43 | 55 | 76 | 62 | 91 |
| 51 | *Single weir* | 27.4 | 43.3 | 156 | 8 | 2 | 0.631 | 0.369 | 0.0021 | 0.51 | 84 | 140 | 58 | 85 |
| 52 | *Single weir* | 17.5 | 52.5 | 156 | 10 | 4 | 0.765 | 0.369 | 0.0031 | 0.62 | 94 | 145 | 66 | 95 |
| 53 | *Single weir* | 11 | 61.7 | 163 | 17 | 4 | 0.860 | 0.371 | 0.0041 | 0.68 | 102 | 177 | 74 | 112 |
| 54 | *Single weir* | 2.4 | 70.9 | 164 | 21 | 7 | 0.983 | 0.371 | 0.0053 | 0.77 | 88 | 123 | 84 | 117 |
| 55 | *Single weir* | 2 | 80.1 | 171 | 28 | 7 | 1.065 | 0.374 | 0.0063 | 0.82 | 84 | 169 | 100 | 127 |
| 56 | *Single weir* | 2 | 89.3 | 180 | 38 | 8 | 1.128 | 0.377 | 0.0074 | 0.83 | 77 | 136 | 121 | 140 |

**Table S1.** Summary of experimental conditions and results