**Table S1**. Composition of Knop solution

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **With Pi** | | **With Phi** | | **Without P** | |
| Composition | Concentration（mg/L） | Composition | Concentration（mg/L） | Composition | Concentration（mg/L） |
| Ca(NO3)2.4H2O | 1150 | Ca(NO3)2.4H2O | 1150 | Ca(NO3)2.4H2O | 1150 |
| KH2PO4 | 200 | KH2PO3 | 200 | / | / |
| KNO3 | 200 | KNO3 | 200 | KNO3 | 200 |
| MgSO4.7H2O | 200 | MgSO4.7H2O | 200 | MgSO4.7H2O | 200 |
| EDTA-Fe | 25 | EDTA-Fe | 25 | EDTA-Fe | 25 |
| H3BO3 | 2.86 | H3BO3 | 2.86 | H3BO3 | 2.86 |
| MnSO4.4H2O | 2.13 | MnSO4.4H2O | 2.13 | MnSO4.4H2O | 2.13 |
| ZnSO4.7H2O | 0.22 | ZnSO4.7H2O | 0.22 | ZnSO4.7H2O | 0.22 |
| (NH4)6Mo7O24.4H2O | 0.08 | (NH4)6Mo7O24.4H2O | 0.08 | (NH4)6Mo7O24.4H2O | 0.08 |
| CuSO4.5H2O | 0.02 | CuSO4.5H2O | 0.02 | CuSO4.5H2O | 0.02 |

**Table S2**. Dry height of plant in sand culture experiments (g/plant)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Plant 1 | Plant 2 | Plant 3 | Plant 4 | Plant 5 | Plant 6 | Plant 7 |
| ptxD-expressing plants | 6.7735 | 8.5675 | 10.5225 | 9.453 | 10.6375 | 9.959 | 6.532 |
| xiangyou18 plants | 1.029 | 0.8295 | 1.4175 | 1.239 | 1.3125 | 1.0395 | 1.638 |

**Table S3**. Total phosphorus content in plants (mmol/g)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | *ptxD*-expressing plants | | | Xiangyou18 plants | | |
|  | Plant 1 | Plant 2 | Plant 3 | Plant 1 | Plant 2 | Plant 3 |
| Knop solution with Phi | 160.48 | 176.93 | 185.56 | 249.95 | 236.17 | 264.98 |
| Knop solution with Pi | 188.56 | 176.93 | 164.49 | 183.96 | 166.12 | 182.99 |
| Knop solution without P | 78.23 | 102.111 | 95.29 | 86.98 | 92.06 | 109.99 |

**Table S4.** N, P, K content of soil (mg/kg of soil)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Available phosphorus | Available potassium | Alkaline hydrolyzable nitrogen |
| Plot 1 | 4.76 | 48.96 | 38.50 |
| 4.43 | 45.73 | 42.97 |
| 9.56 | 43.04 | 34.54 |
| 11.28 | 49.11 | 39.70 |
| 7.89 | 44.55 | 37.29 |
| Plot 2 | 11.78 | 51.85 | 40.01 |
| 6.46 | 42.17 | 37.58 |
| 7.34 | 57.86 | 45.44 |
| 8.74 | 46.74 | 39.76 |
| 9.38 | 42.29 | 34.84 |
| Plot 3 | 3.54 | 44.29 | 37.80 |
| 8.45 | 56.27 | 44.60 |
| 6.78 | 49.16 | 40.69 |
| 7.98 | 52.79 | 37.27 |
| 9.45 | 50.97 | 43.46 |
| 7.85 | 48.39 | 39.63 |

**Table S5**. Dry weight of weed in pot culture experiments (g/pot)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Phi concentration  (mg/kg of soil) | | Malachium aquaticum  (g/pot) | *Alopecurus aequalis Sobol.*  (g/pot) | Rumex acetosa  (g/pot) |
| 0 | Pot 1 | 5.44 | 7.35 | 6.23 |
| Pot 2 | 7.18 | 9.26 | 8.04 |
| Pot 3 | 7.89 | 10.29 | 8.10 |
| 12.5 | Pot 1 | 5.33 | 7.20 | 6.11 |
| Pot 2 | 7.33 | 9.45 | 8.20 |
| Pot 3 | 8.68 | 11.32 | 8.91 |
| 25 | Pot 1 | 5.12 | 6.84 | 5.74 |
| Pot 2 | 7.27 | 9.37 | 8.14 |
| Pot 3 | 6.71 | 12.87 | 7.29 |
| 50 | Pot 1 | 2.83 | 7.06 | 5.36 |
| Pot 2 | 4.45 | 9.45 | 6.59 |
| Pot 3 | 4.81 | 9.37 | 7.46 |
| 100 | Pot 1 | 1.31 | 6.18 | 2.74 |
| Pot 2 | 2.30 | 7.04 | 2.57 |
| Pot 3 | 2.29 | 7.93 | 2.35 |
| 200 | Pot 1 | 0.71 | 3.60 | 1.46 |
| Pot 2 | 0.50 | 2.50 | 0.80 |
| Pot 3 | 0.63 | 3.29 | 0.73 |

**Table S6**. Number of plant in different Phi applications (number/m2)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Plot 1 | Plot 2 | Plot 3 |
| WT+No | 25 | 30 | 29 |
| WT+Pi | 25 | 26 | 25 |
| *ptxD*+Pi | 25 | 28 | 22 |
| WT+Phi | 21 | 19 | 25 |
| *ptxD*+Phi | 32 | 29 | 36 |

**Table S7**. Number of green leaf per plant in different Phi applications

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Plant 1 | Plant 2 | Plant 3 | Plant 4 | Plant 5 | Plant 6 | Plant 7 | Plant 8 | Plant 9 | Plant 10 |
| WT+No | 4 | 5 | 6 | 6 | 6 | 6 | 6 | 7 | 5 | 4 |
| WT+Pi | 5 | 4 | 6 | 5 | 6 | 6 | 6 | 5 | 5 | 5 |
| *ptxD*+Pi | 3 | 7 | 6 | 6 | 7 | 5 | 5 | 6 | 5 | 6 |
| WT+Phi | 4 | 7 | 6 | 5 | 7 | 6 | 6 | 7 | 6 | 6 |
| *ptxD*+Phi | 6 | 7 | 7 | 5 | 7 | 8 | 8 | 6 | 6 | 7 |

**Table S8**. Dry height of plant in fields with different Phi applications (g/plant)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Plant 1 | Plant 2 | Plant 3 | Plant 4 | Plant 5 | Plant 6 | Plant 7 | Plant 8 | Plant 9 | Plant 10 |
| WT+No | 0.78 | 0.63 | 0.83 | 0.54 | 0.98 | 1.20 | 1.50 | 0.78 | 0.38 | 0.75 |
| WT+Pi | 2.01 | 3.25 | 1.89 | 3.15 | 1.38 | 0.98 | 2.56 | 1.05 | 0.98 | 2.12 |
| *ptxD*+Pi | 1.01 | 1.08 | 2.35 | 2.11 | 2.22 | 3.78 | 3.12 | 2.01 | 1.08 | 0.98 |
| WT+Phi | 0.99 | 0.98 | 1.25 | 0.79 | 1.18 | 1.35 | 1.56 | 0.75 | 0.44 | 0.35 |
| *ptxD*+Phi | 9.25 | 7.45 | 8.66 | 5.89 | 5.68 | 8.22 | 9.15 | 5.56 | 5.89 | 9.53 |