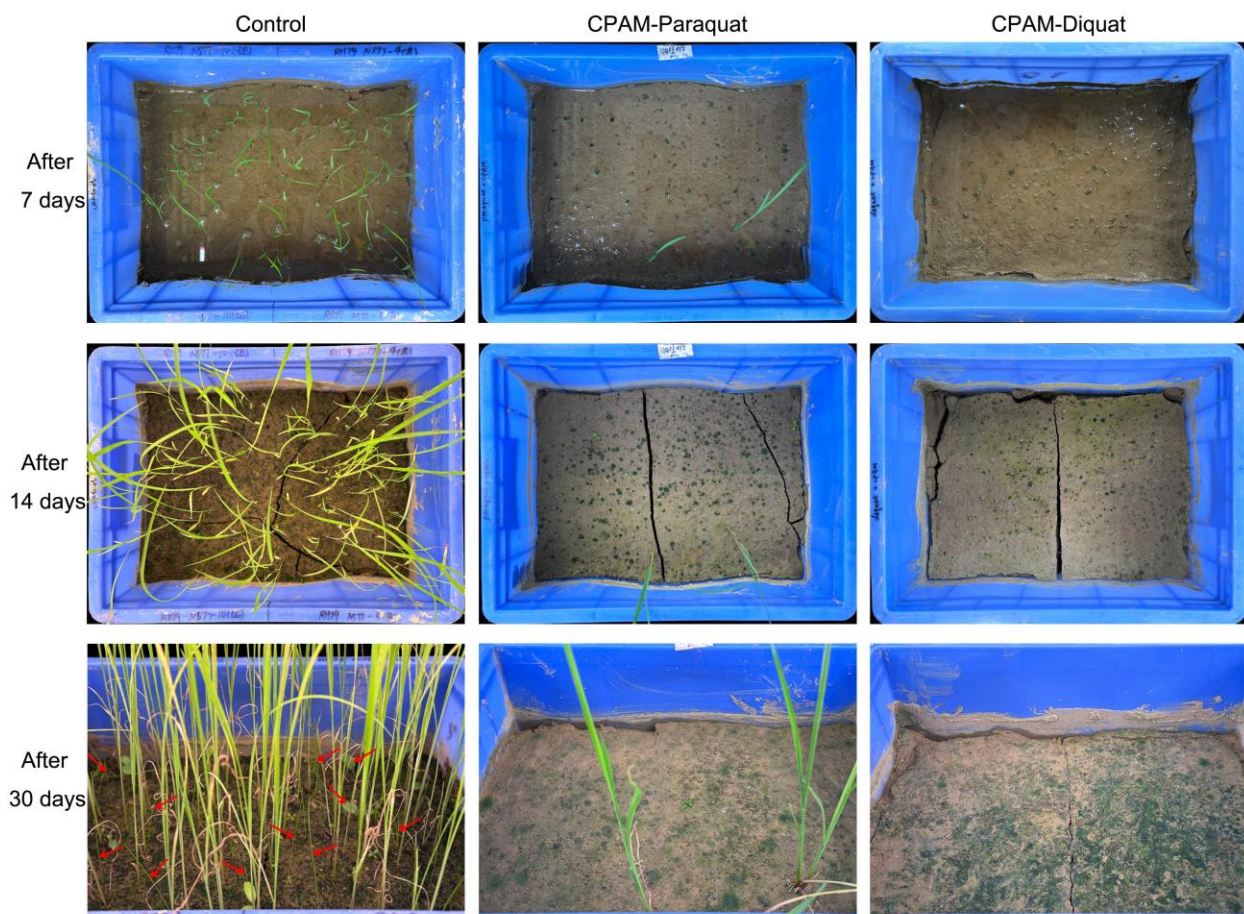
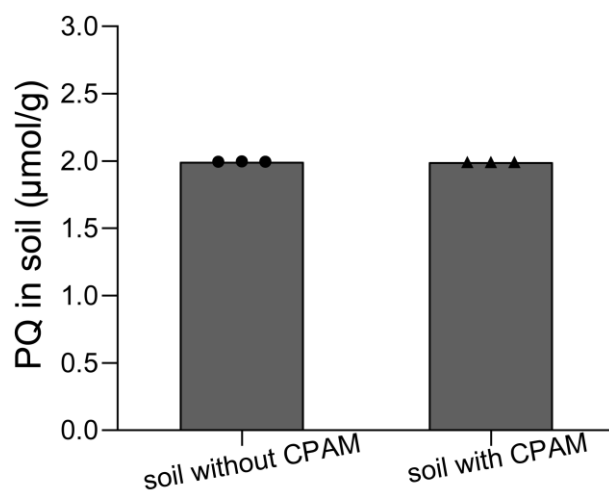


**Fabricating supramolecular pre-emergence herbicide CPAM-BPyHs for  
farming herbicide-resistant rice**

Chen *et al.*

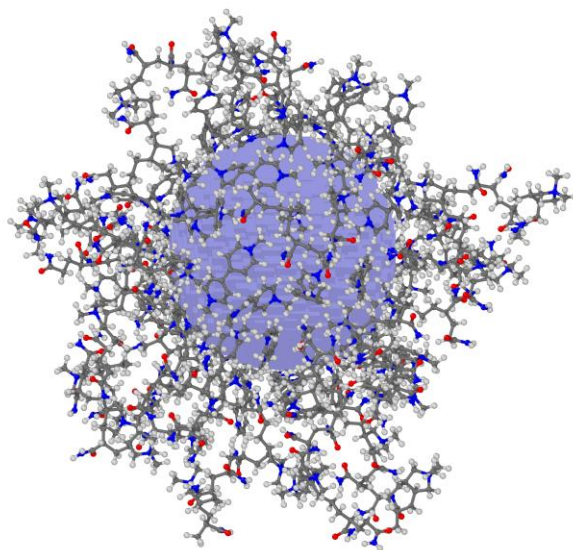


**Supplementary Fig. 1. Weed growth at different times after soil treated with CPAM-BPyHs.** Control refers to the treatment with only water on the 1st day. CPAM-Paraquat refers to the treatment with 1‰ CPAM-5 mM paraquat at the 1st day. CPAM-Diquat refers to the treatment with 1‰ CPAM-5 mM diquat at the 1st day. The red arrow sites are new weeds.

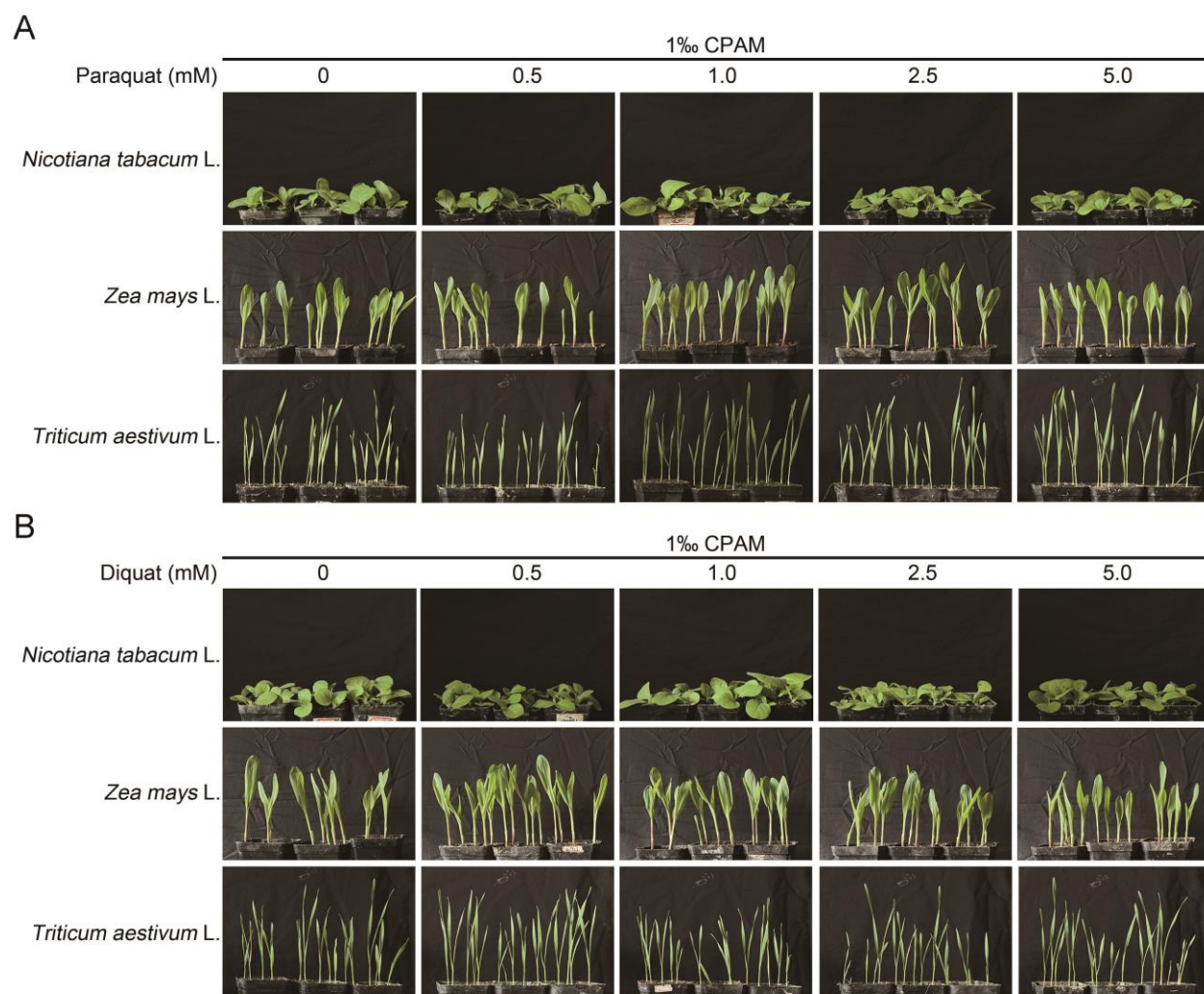


**Supplementary Fig. 2. The content of adsorbed paraquat in soil with or without CPAM.**

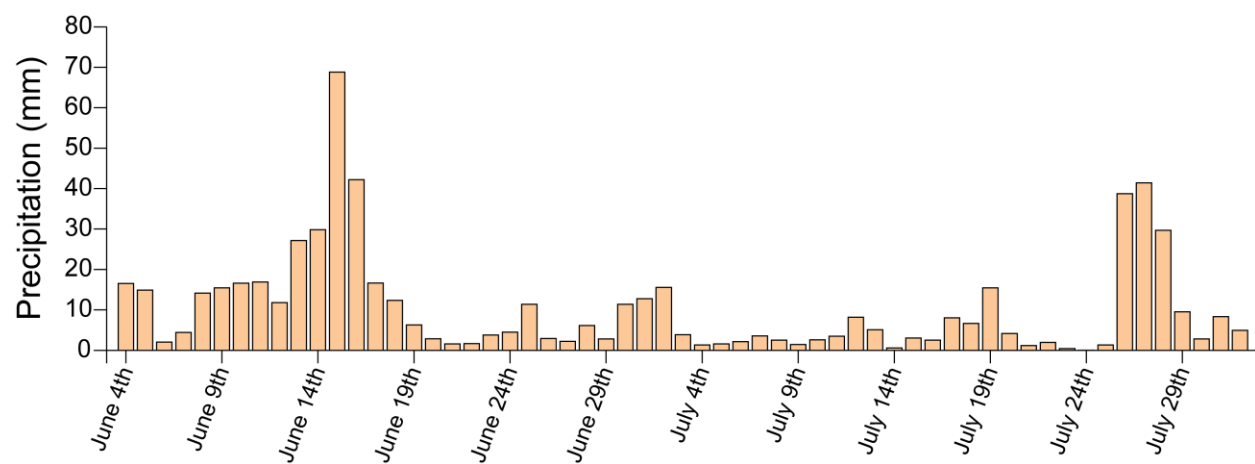
Difference was analyzed using the two-tailed unpaired *t*-test. Data represent mean  $\pm$  SD. *n* = 3 independent experiments. Source data are provided as a Source Data file.



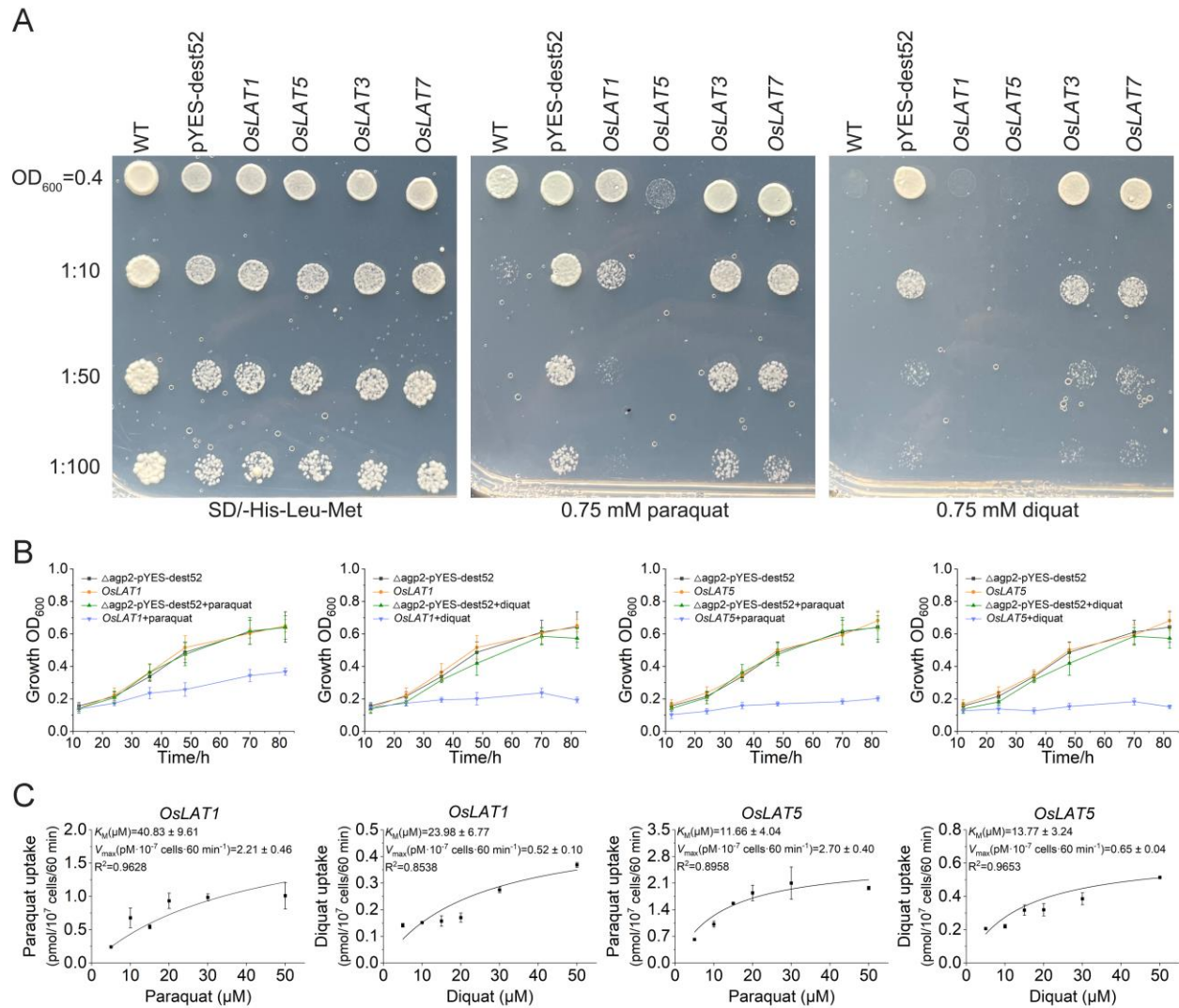
**Supplementary Fig. 3. Snapshot of paraquat and CPAM absorbed on soil particle after  $6 \times 10^6$  timesteps MD simulations in soil-CPAM-paraquat system.**



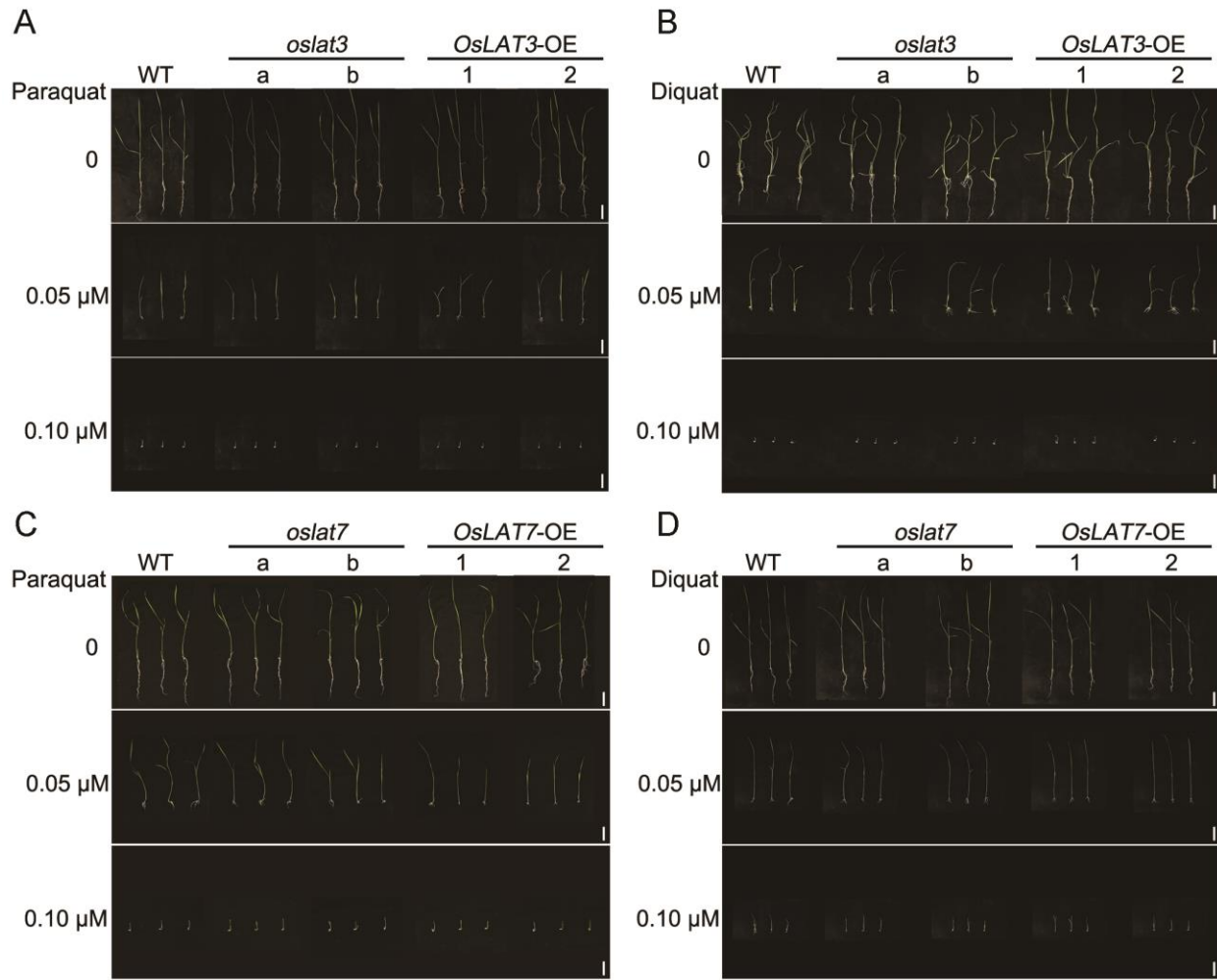
**Supplementary Fig. 4. The effects of (A) CPAM-paraquat or (B) CPAM-diquat on different succeeding crops.** Tobacco (*Nicotiana tabacum* L.), corn (*Zea mays* L.) and wheat (*Triticum aestivum* L.) were sown in the soil, which was treated with CPAM-BPyHs 60 days before sowing the seeds.



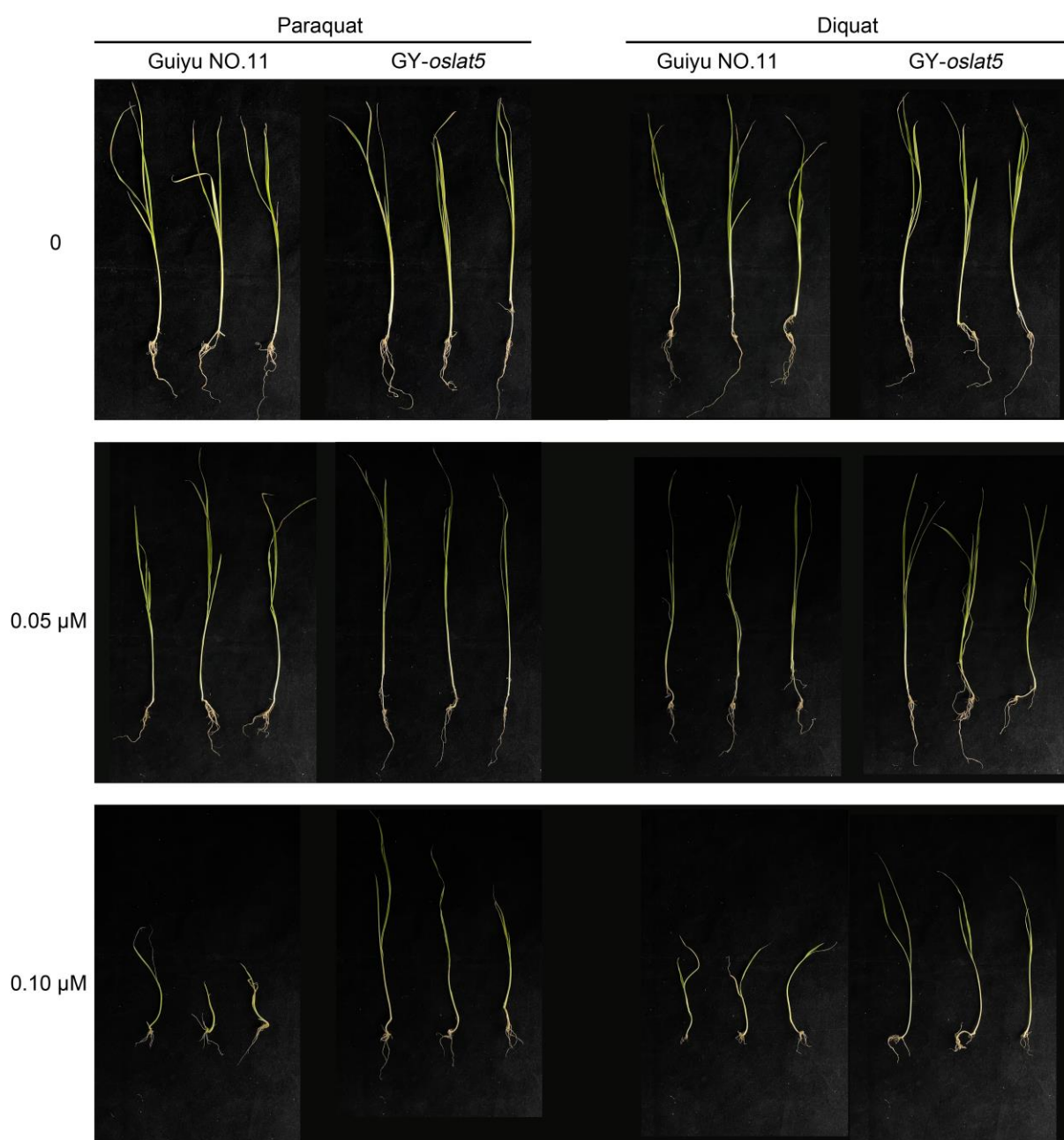
**Supplementary Fig. 5. Rainfall during the experimental period.** The rainfall data were from the Xihe Energy Weather Big Data Platform ([www.xihe-energy.com](http://www.xihe-energy.com), accessed on September 25th, 2024). Source data are provided as a Source Data file.



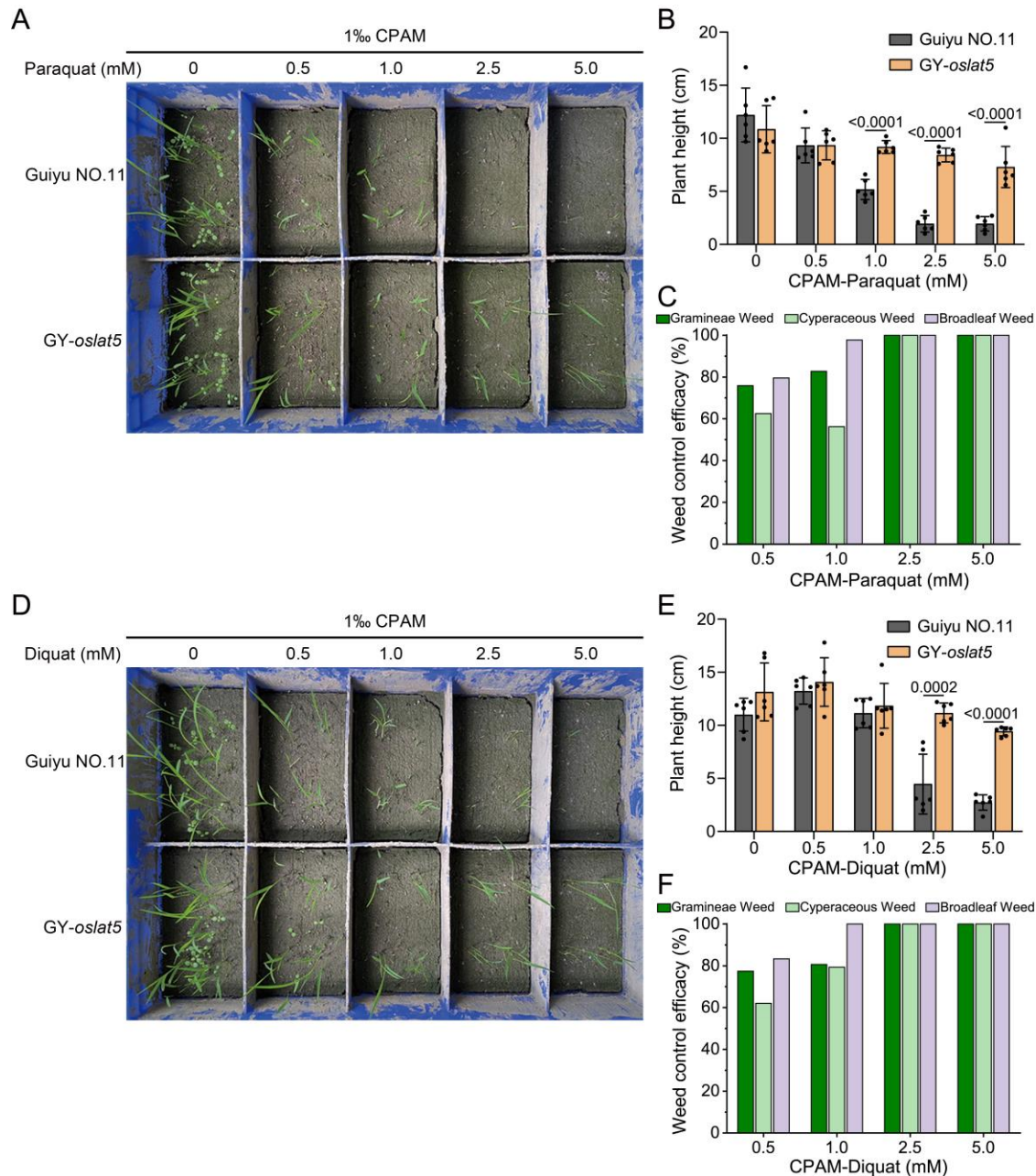
**Supplementary Fig. 6. The function of OsLATs as BPyHs transporter in yeast heterologous system.** (A) Growth of yeast mutant  $\Delta agp2$  transformants carrying four LATs (1, 3, 5 and 7) genes. (B) Growth curves plotted from OD<sub>600</sub> values of liquid cultures. Yeast cells were grown in liquid medium containing 0.75 mM paraquat or diquat. (C) Dose-dependent and kinetic analysis of BPyHs uptake by *OsLAT1* and *OsLAT5*. Michaelis–Menten curves for BPyHs uptake were obtained by subtracting the uptake in vector control expressing cells from that in  $\Delta agp2$ -*OsLAT1* or *OsLAT5* cells. Data represent mean  $\pm$  SD. n = 2 yeast cell samples. Source data are provided as a Source Data file.



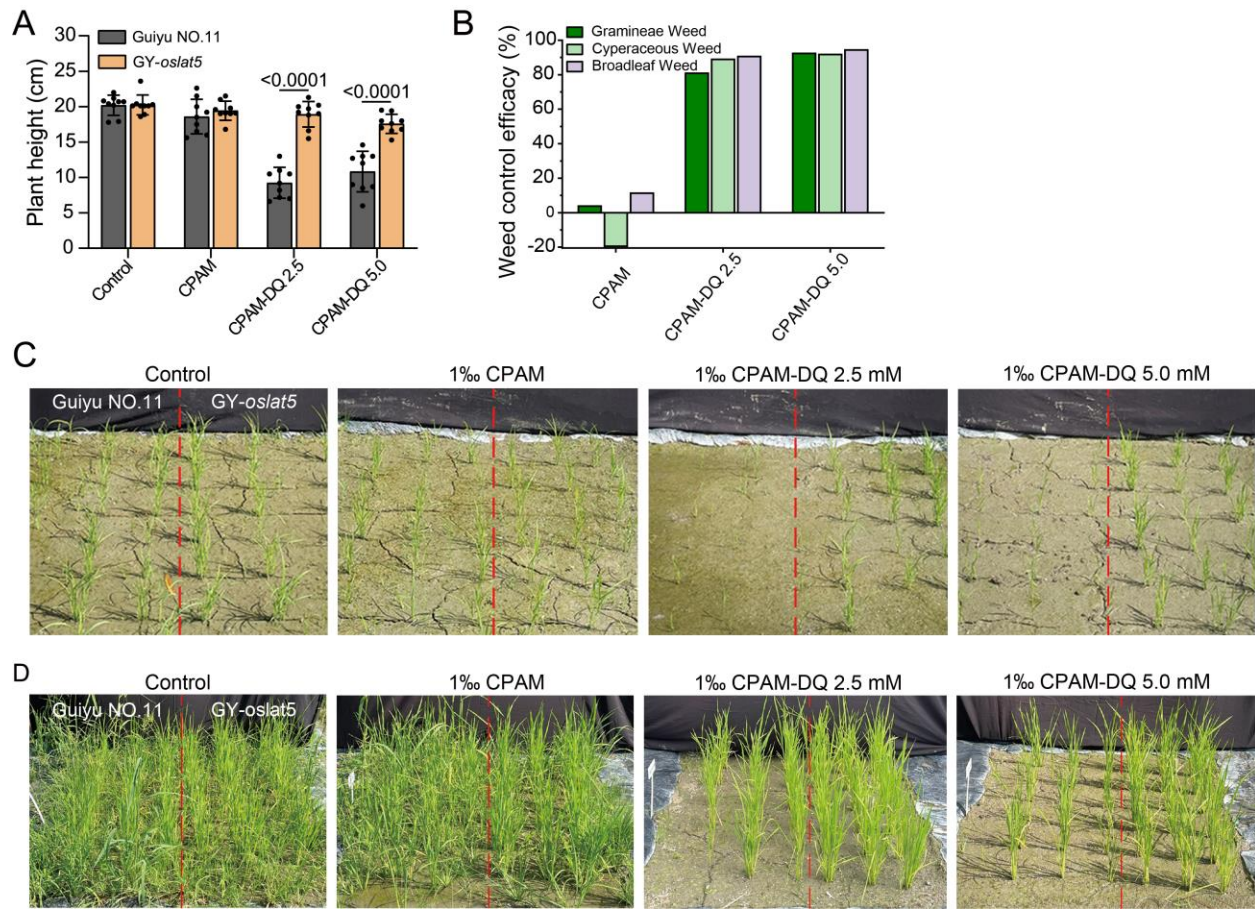
**Supplementary Fig. 7. Rice seed germination and seedling growth in BPyHs by *OsLAT3* and *OsLAT7*.** Growth of germinated rice seedlings mediated by *OsLAT3* with (A) paraquat or (B) diquat on MS medium. Bar = 4 cm. Growth of germinated rice seedlings mediated by *OsLAT7* with (C) paraquat or (D) diquat on MS medium. Bar = 4 cm.



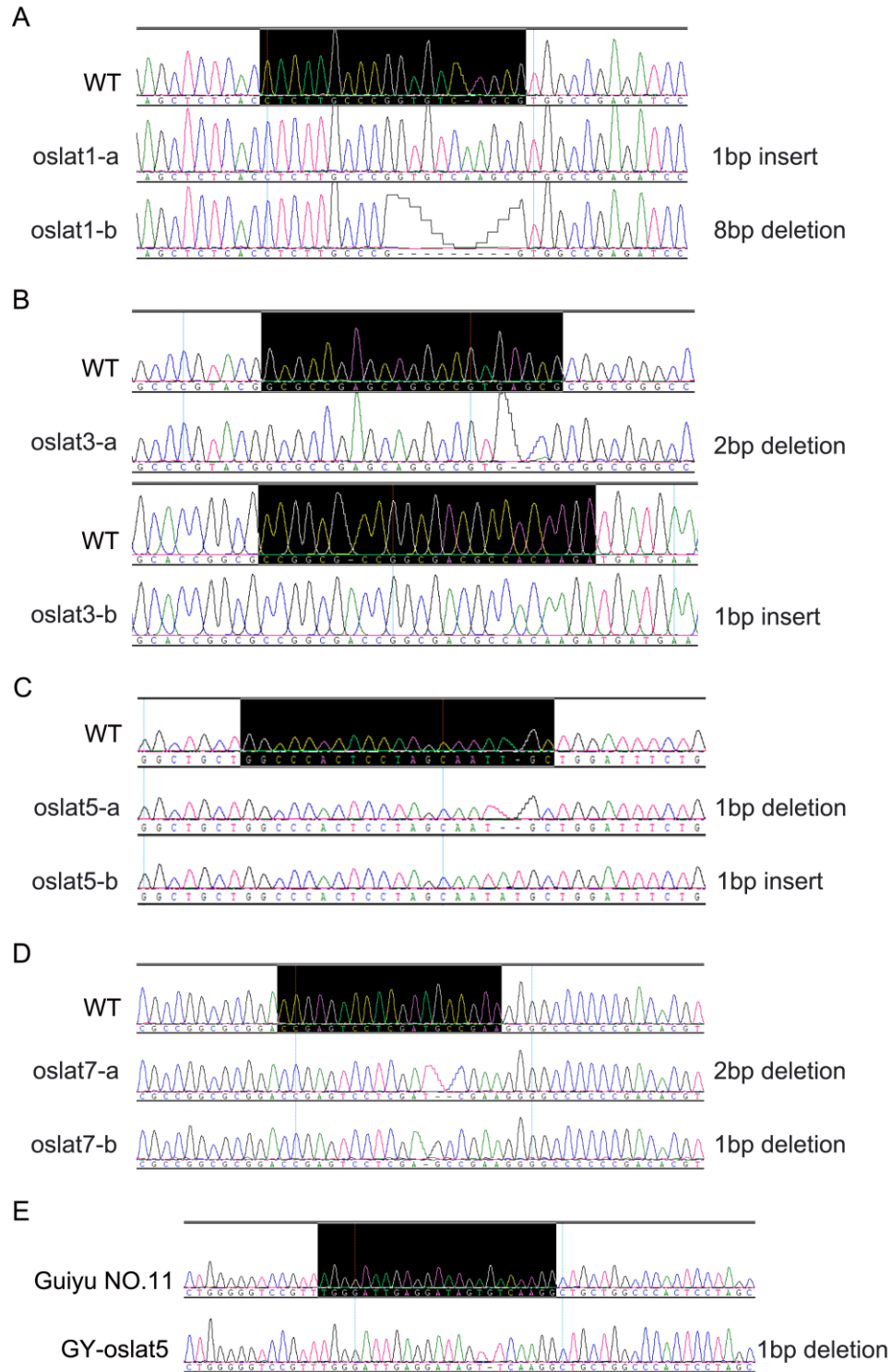
**Supplementary Fig. 8. The GY-*oslat5* mutant (Guiyu NO.11 background) phenotype on paraquat or diquat medium.**



**Supplementary Fig. 9. Indoor crop-weed competition of Guiyu NO.11, GY-*oslat5* and weeds in soil treated with CPAM-paraquat or CPAM-diquat.** Growth of Guiyu NO.11 and GY-*oslat5* in soil treated with (A) CPAM-paraquat or (D) CPAM-diquat. Plant height of Guiyu NO.11 and GY-*oslat5* in soil treated with (B) CPAM-paraquat or (E) CPAM-diquat. Difference was analyzed using the multiple *t*-test. Data represent mean  $\pm$  SD. *n* = 6 rice plants. Weed control efficacy in soil treated with (C) CPAM-paraquat or (F) CPAM-diquat. Source data are provided as a Source Data file.



**Supplementary Fig. 10. Field crop-weed competition of Guiyu NO.11, GY-oslat5 and weeds in soil treated with CPAM-diquat.** (A) Plant height of Guiyu NO.11 and GY-oslat5 after 10 days. Difference was analyzed using the multiple *t*-test. Data represent mean  $\pm$  SD. *n* = 9 rice plants. (B) Weed control efficacy after 10 days. (C) Field performance after 10 days. (D) Field performance after 30 days. Control refers to the treatment with only water. DQ refers to diquat. Source data are provided as a Source Data file.



**Supplementary Fig. 11. *OsLAT* knockout mutants in rice.** (A) *oslat1*, (B) *oslat3*, (C) *oslat5* and (D) *oslat7* knockout mutants generated in Zhonghua11 background. (E) *oslat5* knockout mutant generated in Guiyu NO.11 background.

**Supplementary Table 1. Primers sequences used in this study.**

| Name             | Primer sequence (Bold font indicates vector sequence)        | Note                                   |
|------------------|--------------------------------------------------------------|----------------------------------------|
| pENTR-OsLAT1     | P1: <b>ACCAATTCAGTCGACTGGATCC</b> ATGGCGGACACCGGCGGAC        | Vector:<br>pENTR 2B<br>Dual            |
| pENTR-OsLAT5     | P2: <b>TACAAGAAAGCTGGGTCTAGATATC</b> CTACGGAACCAACGGCTCG     |                                        |
|                  | P3: <b>ACCAATTCAGTCGACTGGATCC</b> ATGGAGGATTGTGTTGGTAT       |                                        |
| pENTR-OsLAT7     | P4: <b>TACAAGAAAGCTGGGTCTAGATATC</b> TACGACACACAAGTGGGATT    |                                        |
|                  | P5: <b>ACCAATTCAGTCGACTGGATCC</b> ATGACCGGAGCCTGCGAGG        |                                        |
| pENTR-OsLAT3     | P6: <b>TACAAGAAAGCTGGGTCTAGATATC</b> CTAATAATTCTCCTTGCTGACAC |                                        |
|                  | P7: <b>ACCAATTCAGTCGACTGGATCC</b> ATGAGTGAGCTCACCATGGAC      |                                        |
|                  | P8: <b>TACAAGAAAGCTGGGTCTAGATATC</b> CTACGTACCTGCTGCGTCAG    |                                        |
| 35S-OsLAT1       | P9: <b>ACCCGGGGATCCTCTAGAGTCGA</b> ATGGCGGACACCGGCGGAC       | Vector:<br>pCAMB130<br>0-35s           |
| 35S-OsLAT5       | P10: <b>ATGATACGAACGAAAGCTCTGCA</b> CTACGGAACCAACGGCTCG      |                                        |
|                  | P11: <b>ACCCGGGGATCCTCTAGAGTCGA</b> ATGGAGGATTGTGTTGGTAT     |                                        |
| 35S-OsLAT7       | P12: <b>ATGATACGAACGAAAGCTCTGCA</b> TCAGCACACAAGTGGGATT      |                                        |
|                  | P13: <b>ACCCGGGGATCCTCTAGAGTCGA</b> ATGACCGGAGCCTGCGAGG      |                                        |
| 35S-OsLAT3       | P14: <b>ATGATACGAACGAAAGCTCTGCA</b> CTAATAATTCTCCTTGCTGACAC  |                                        |
|                  | P15: <b>ACCCGGGGATCCTCTAGAGTCGA</b> ATGAGTGAGCTCACCATGGAC    |                                        |
|                  | P16: <b>ATGATACGAACGAAAGCTCTGCA</b> CTACGTACCTGCTGCGTCAG     |                                        |
| Actin (UBQ2)     | P17: TGCTATGTACGTCGCCATCCAG                                  | For<br>identifying<br>OE rice<br>lines |
|                  | P18: AATGAGTAACACGCTCCGTCA                                   |                                        |
| qRT-PCR-OsLAT1   | P19: ATCGGCTTCTTGGTCCTCC                                     |                                        |
|                  | P20: CCACTTCATCCACCCTTGC                                     |                                        |
| qRT-PCR-OsLAT5   | P21: CGCCTCCCGACCTTACAA                                      |                                        |
|                  | P22: GCACGAACCCAACCAGCA                                      |                                        |
| qRT-PCR-OsLAT7   | P23: GCCTGACAGCCTCCGTG                                       |                                        |
|                  | P24: CTGACACTGACGCCTTCTCC                                    |                                        |
| qRT-PCR-OsLAT3   | P25: TGATGAACAGCAAGGGCACC                                    | For<br>identifying<br>rice mutants     |
|                  | P26: GGAGTAGCGTGAGCTTGGTCTG                                  |                                        |
| Crispr-OsLAT1    | P27: GTAGCGATGCGACGAGAGAG                                    |                                        |
|                  | P28: AAATGTGCTGCGCGCTTTAT                                    |                                        |
| Crispr-OsLAT5    | P29: GTGTTGCATGGTGAAACAAGGA                                  |                                        |
|                  | P20: CAAGGGCTGAAGAGACCCAG                                    |                                        |
| Crispr-GY-oslat5 | P31: GCTAACTCAGCCTGTCTTCC                                    |                                        |
|                  | P32: AAGTAAGTGCAACTGTGAGG                                    |                                        |
| Crispr-OsLAT7    | P33: CTCGTCGAACACCTTGTTCG,                                   |                                        |
|                  | P34: TTGGAGAACCCGACGAGGAA                                    |                                        |
| Crispr-OsLAT3-a  | P35: AGATGATGAACAGCAAGGGC                                    |                                        |
|                  | P36: GACGAAGCCGCCGTTCCCCG                                    |                                        |
| Crispr-OsLAT3-b  | P37: AACTGAACCAGAGGCCATCGC                                   |                                        |
|                  | P38: ACAATGCTTAGGCCGCCCAA                                    |                                        |