Three Approaches to Enhancing Phytoremediation of Chlorpyrifos

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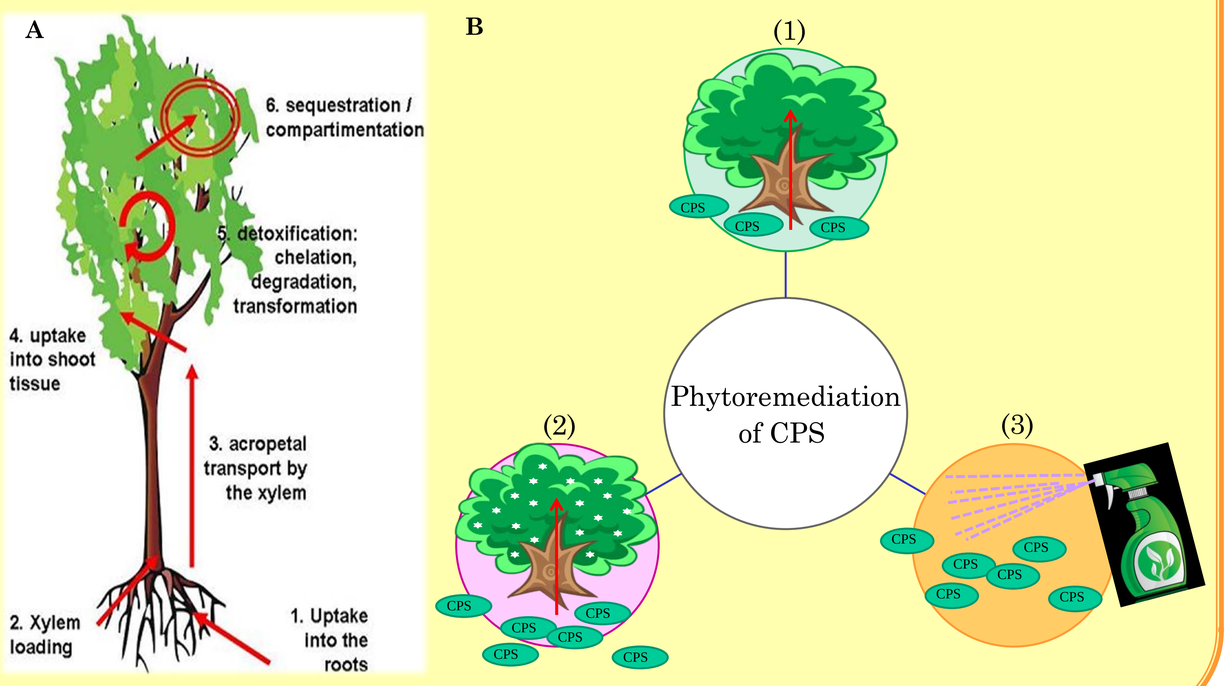
Introduction

Chlorpyrifos (CPS) is one of the commonly used organophosphorus insecticides that are implicated in environmental and human health problems. We hypothesized that these problems may be solved by the emerging phytoremediation technology (A), which is the use of plants for the cleanup of environmental contaminants. Here, we introduce three approaches (B) to enhancing phytoremediation of CPS.



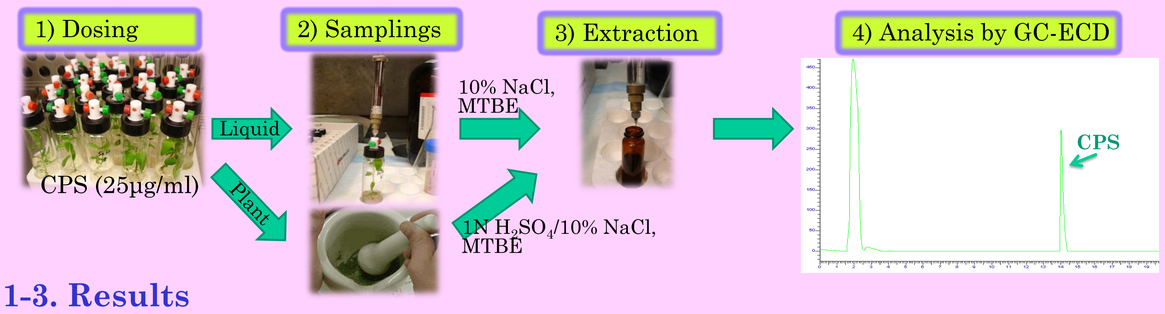
I. Phytoremediation of CPS by *Populus* and *Salix*

To evaluate plant potential for CPS uptake, several plant species were investigated. Analysis of the CPS removal from solution showed that CPS can be taken up by plant roots and significant amounts of CPS were accumulated in plant tissues. CPS did not persist in the plants after taking up by plants, suggesting further metabolism of CPS in plant tissue. To our knowledge, this work represents the first report for phytoremediation of CPS using poplar and willow.

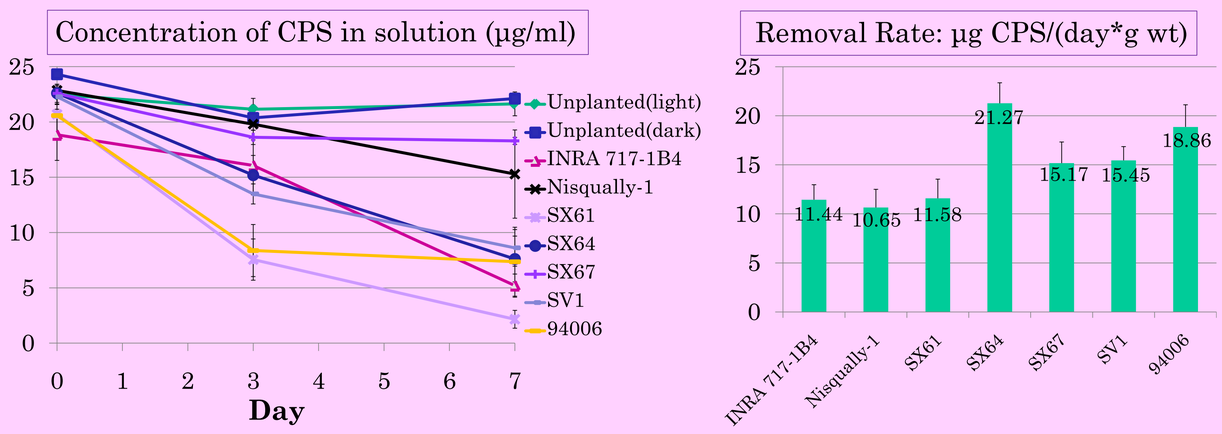
1-1. Plant Materials

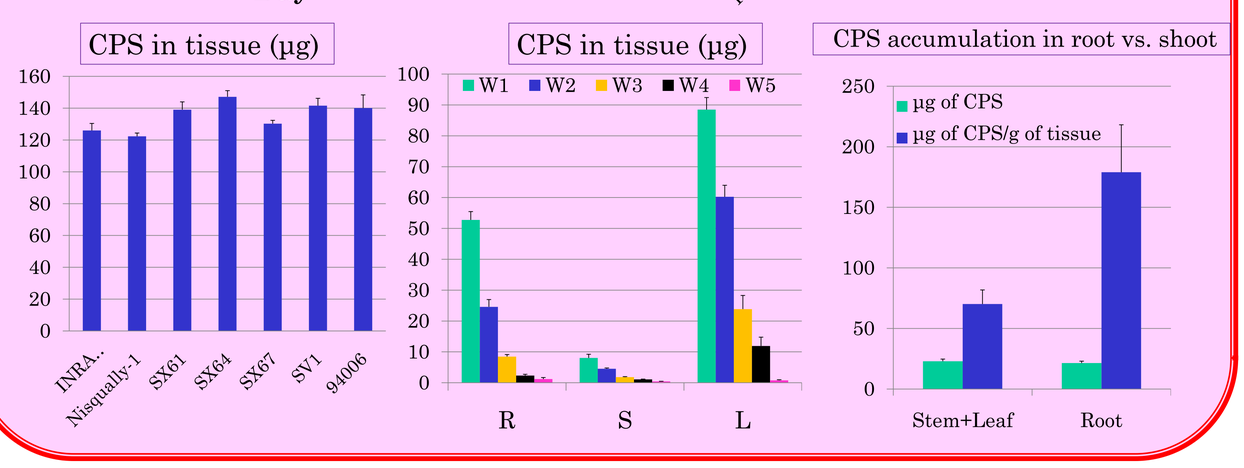
- Hybrid poplar 'INRA 717-1B4' (*Populus tremula* x *P. alba*)
- Black cottonwood 'Nisqually-1' (*P. trichocarpa*)
- Willow 'SX61' (*Salix sachalinensis*), 'SX64' (*S. miyabeana*), 'SX67' (*S. miyabeana*) 'SV1' (*S. dasyclados*), '94006' (*S. purpurea*)

1-2. Experimental Design



1-3. Results





Acknowledgments

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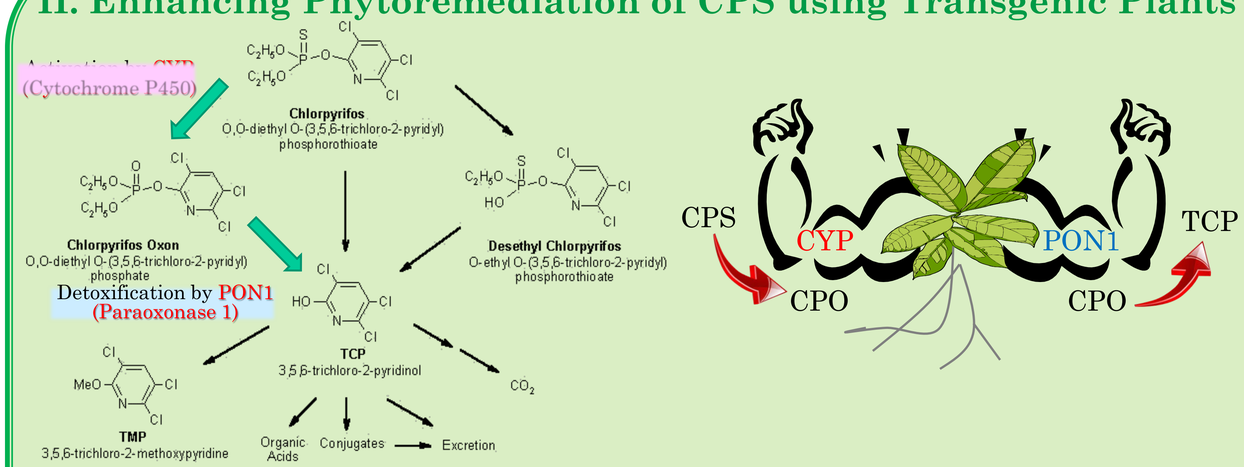
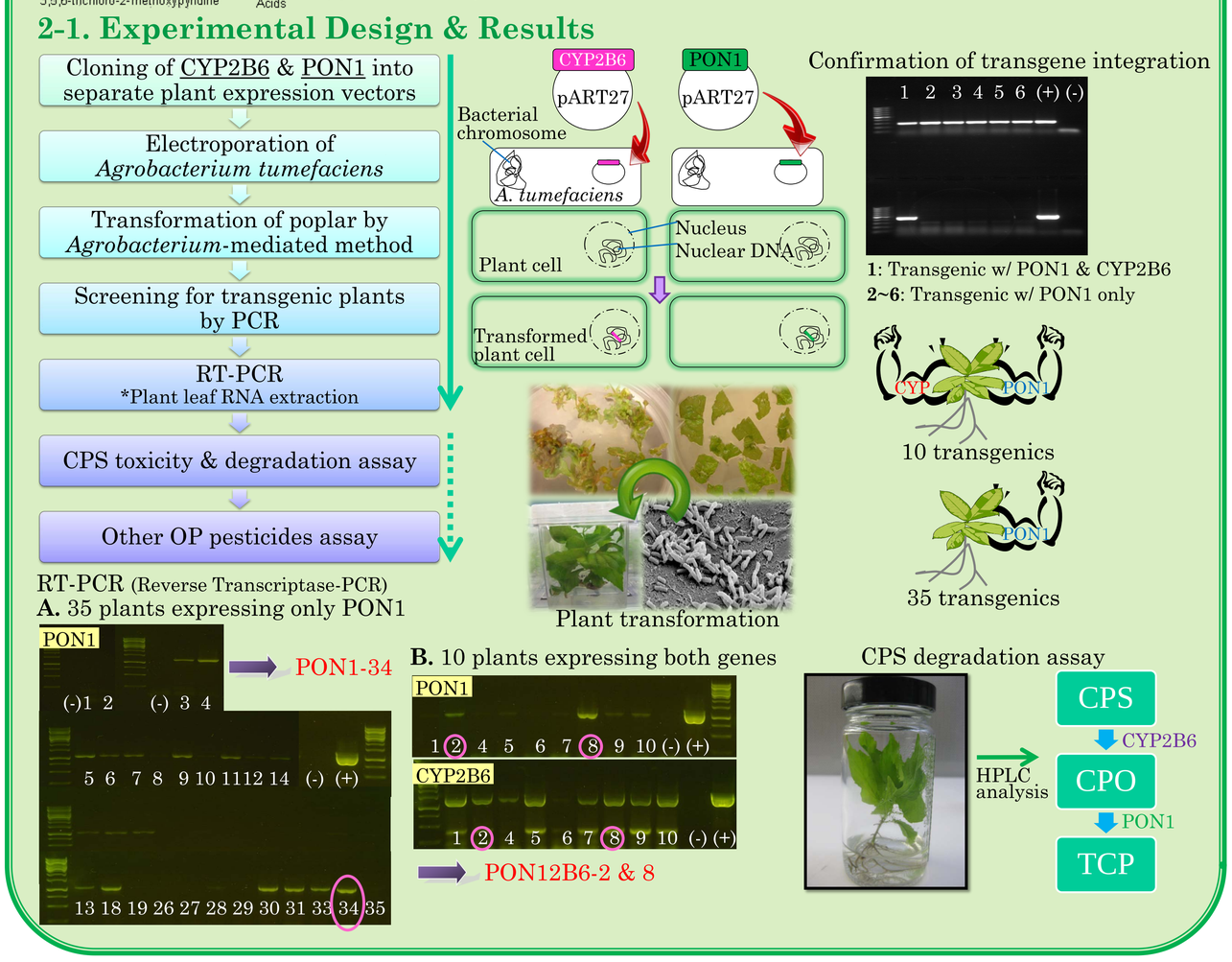
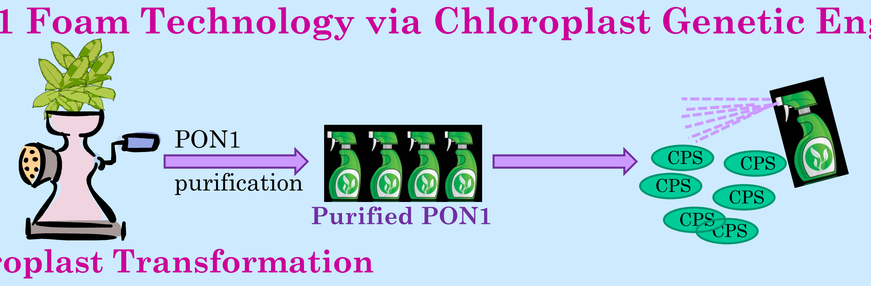
II. Enhancing Phytoremediation of CPS using Transgenic Plants



2-1. Experimental Design & Results

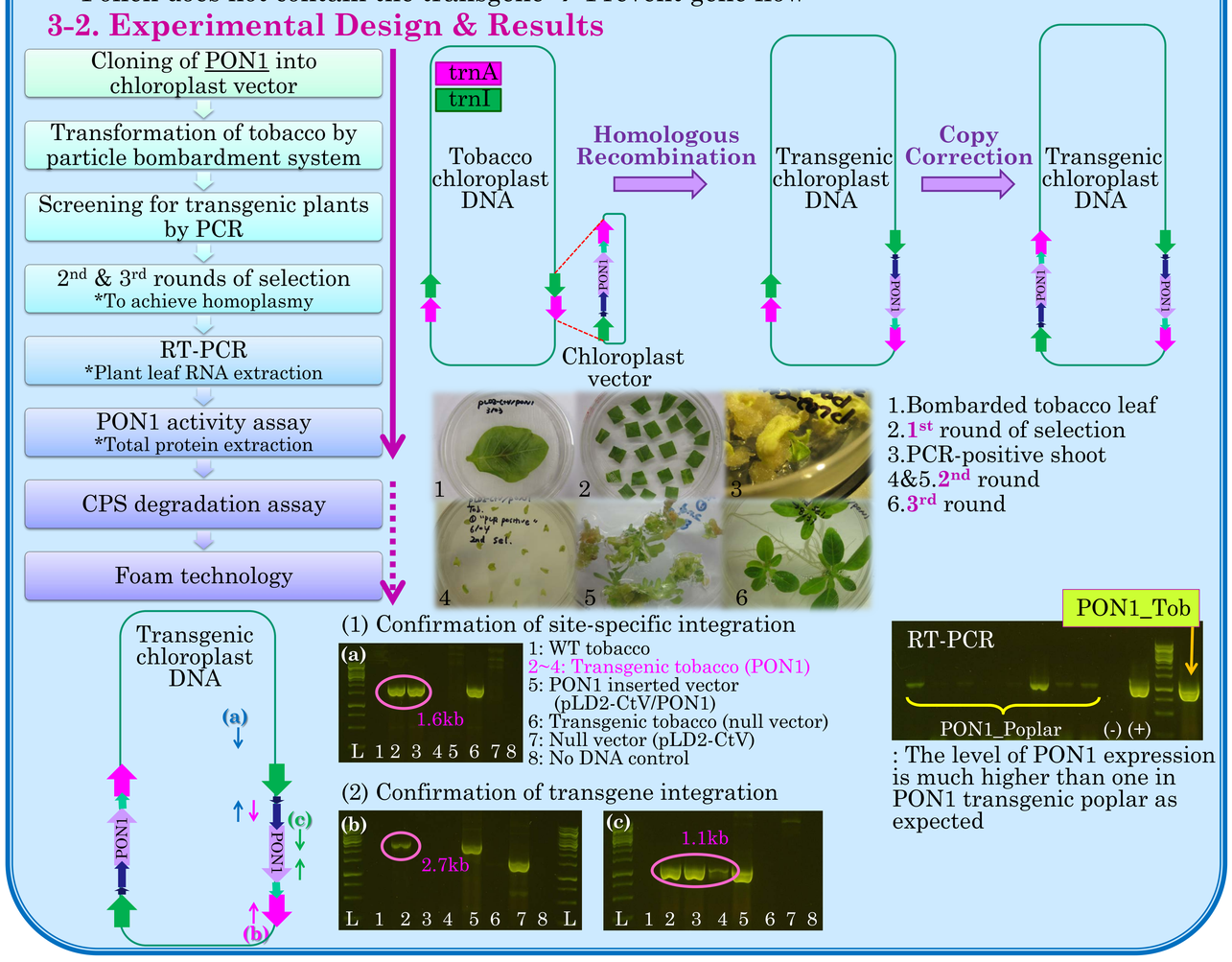


III. PON1 Foam Technology via Chloroplast Genetic Engineering



3-1. Chloroplast Transformation

Instead of the nuclear DNA, the DNA in the plant's chloroplasts is modified.

- Accumulate large amounts of foreign protein (up to 46%)
- Pollen does not contain the transgene → Prevent gene flow

3-2. Experimental Design & Results