Membrane-associated Cytochromes P450 (P450s) are one of the most important enzyme families for biosynthesis of plant-derived medicinal compounds. However, the hydrophobic nature of P450s makes their use in robust cell factories a challenge. Here we explore a small library of N-terminal expression tag chimeras of the model plant P450 CYP79A1 in different Escherichia coli strains. Using a high-throughput screening platform based on C-terminal GFP fusions, we identify several highly expressing and robustly performing chimeric designs. Analysis of long-term cultures by flow cytometry showed homogeneous populations for some of the conditions. Three chimeric designs were chosen for a more complex combinatorial assembly of a multigene pathway consisting of two P450s and a redox partner. Cells expressing these recombinant enzymes catalysed the conversion of the substrate to highly different ratios of the intermediate and the final product of the pathway. Finally, the effect of a robustly performing expression tag was explored with a library of 49 different P450s from medicinal plants and nearly half of these were improved in expression by more than 2-fold. The developed toolbox serves as platform to tune P450 performance in microbial cells, thereby facilitating recombinant production of complex plant P450-derived biochemicals.