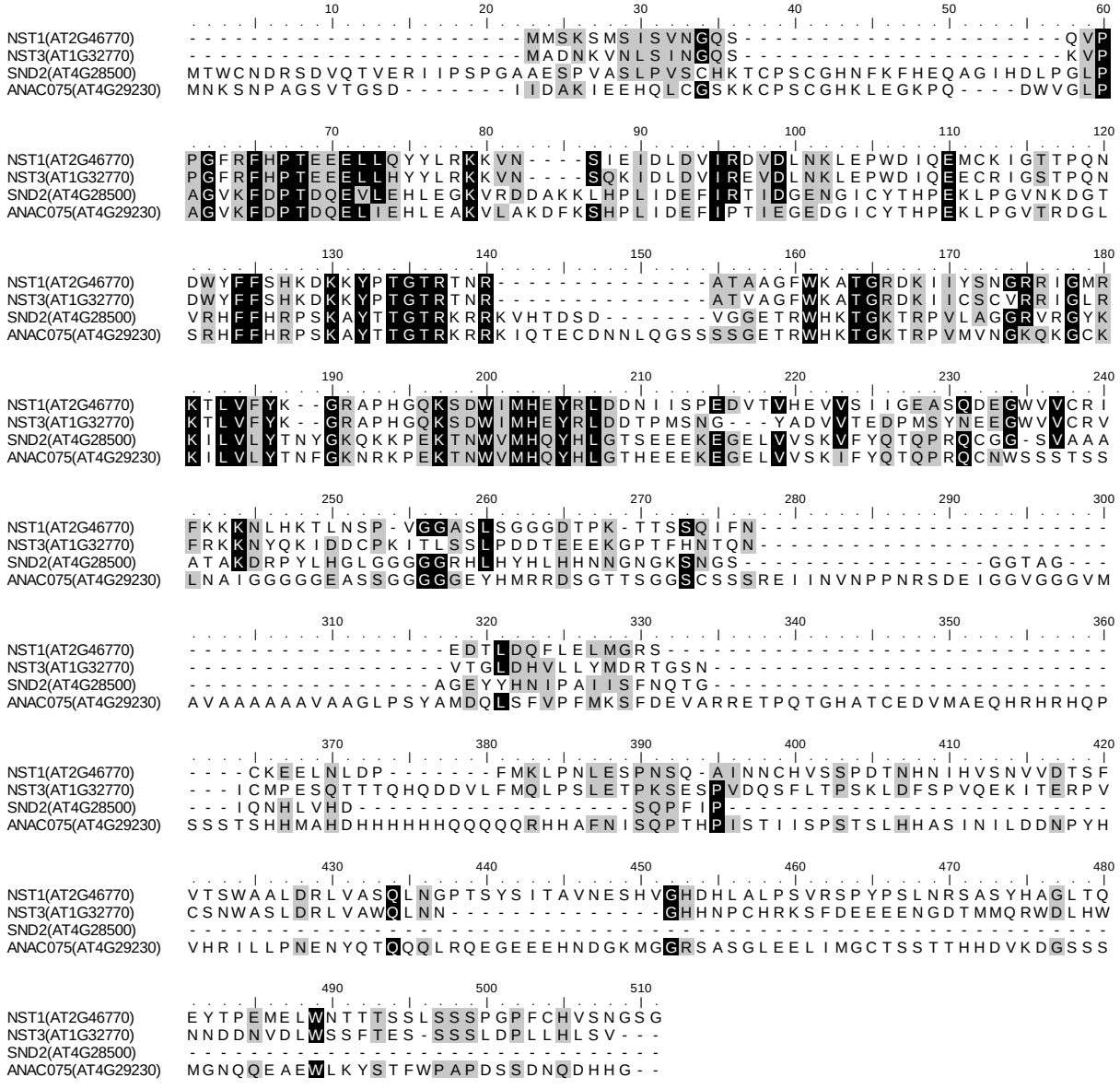
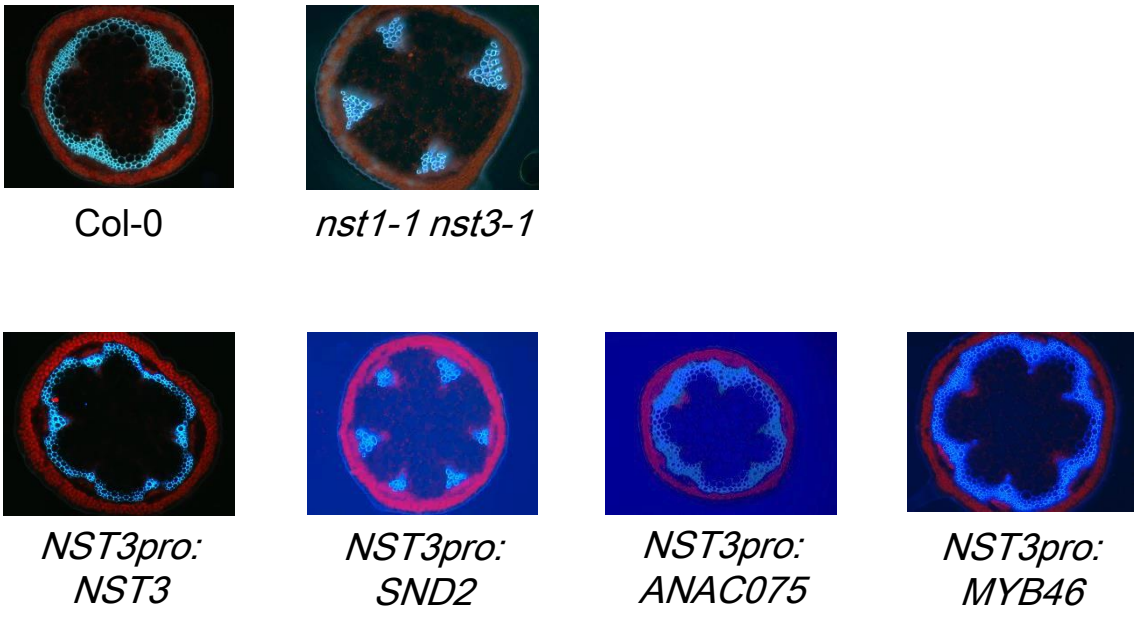
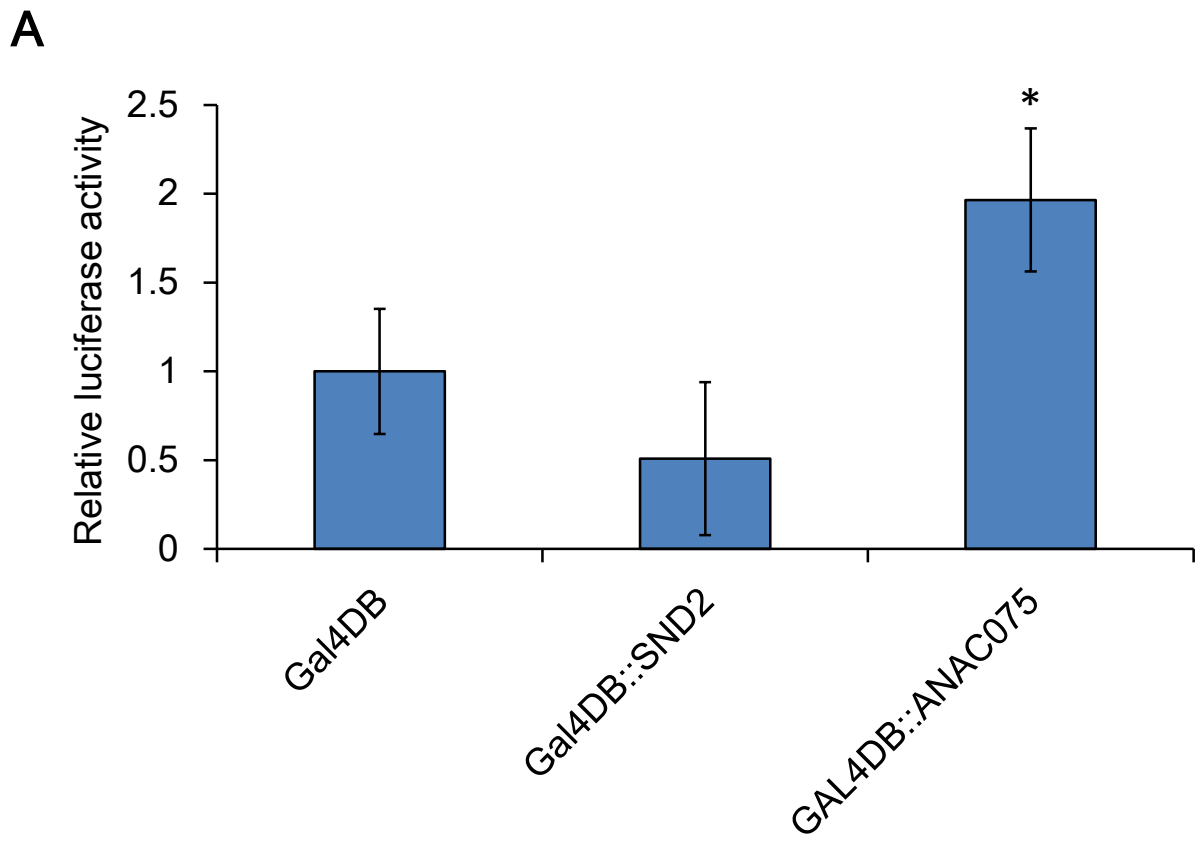



**Supplementary Fig. S1** Comparison of the amino acid sequence of NAC family transcription factors. The amino acid sequences were aligned using ClustalW program at the web site for NST1(AT2G46770), NST3(AT1G32770), SND2(AT4G28500), and ANAC075(AT4G29230). Threshholds are set to 75% and the same or similar character amino acids are shown in black or gray, respectively.

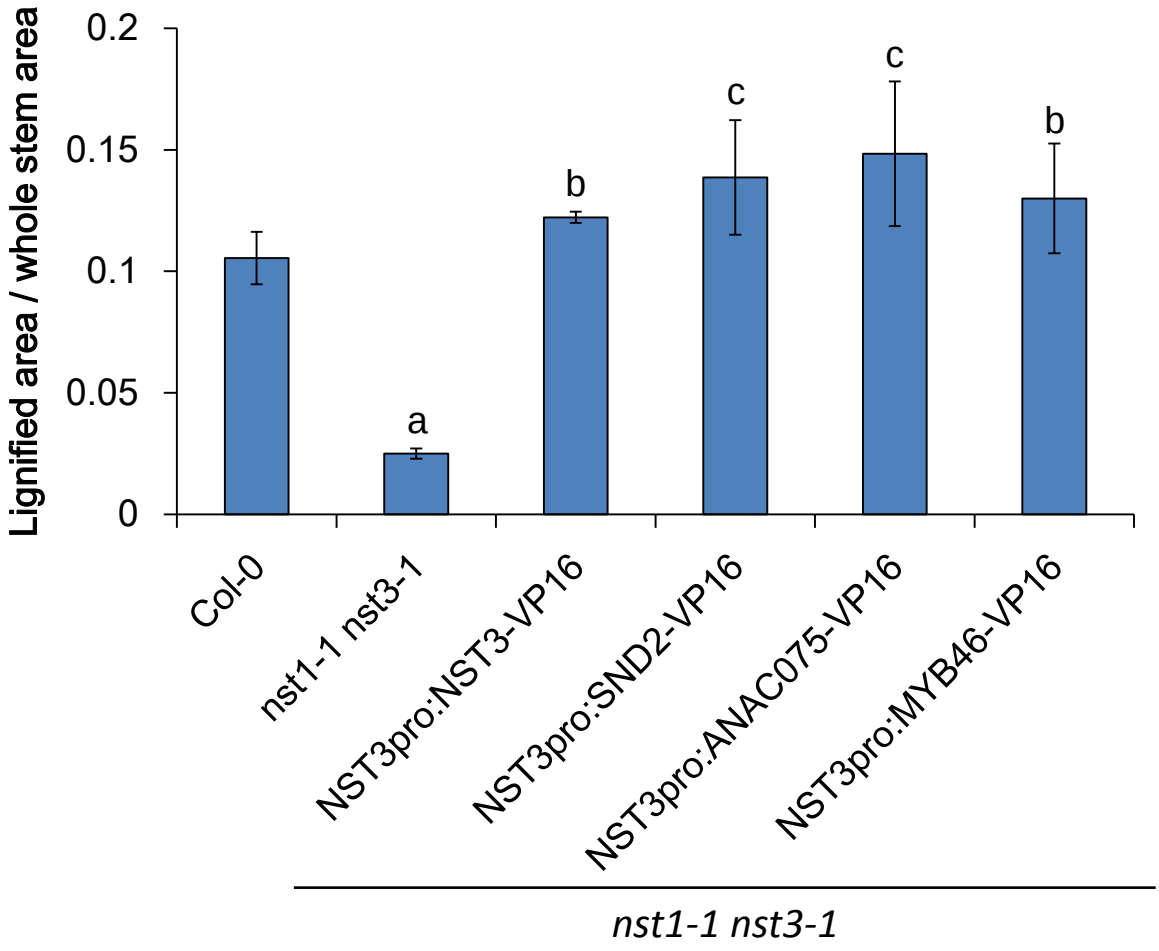



**Supplementary Fig. S2** Secondary wall restoration in *nst1-1 nst3-1* double mutant by some transcription factors. Blue color shows an auto-fluorescence from lignin and disappeared in the inter fascicular fiber cells of the *nst1-1 nst3-1* double mutant. The disappearance is recovered by the expression of NST3, ANAC075, and MYB46 driven by NST3 promoter, while SND2 does not.




**Supplementary Fig. S3** The abilities of transcriptional activation and ectopic secondary cell wall formation. (A) The plasmids of transcription factor fused with Gal4 DNA binding motif (Gal4DB), the Firefly luciferase driven by Gal4 DNA binding element, and Renilla luciferase driven by 35S promoter were co-bombarded into *Arabidopsis* rosette leaves and incubated in dark for 12 h. The relative luciferase activity is calculated as the Firefly luciferase / Renilla luciferase and the score in Gal4DB is set to 1. Error bars mean SD (n = 3). Asterisk shows the significant difference ($P < 0.05$) from the score of Gal4DB. (B) Ectopic secondary wall formation in epidermis cells of the overexpressor of NST3, SND2-VP16, ANAC075, and MYB46.


**Supplementary Fig. S4** Five-weeks-old transgenic plants of NST3pro:VAMP722-VP16 on Col-0 shown as control (left), which has no morphological difference with wild-type plant, and NST3pro:ASL19-VP16 on *nst1-1 nst3-1* (right) with petiole-less leaves.




**Supplementary Fig. S5** Area index of UV autofluorescence from lignified area in inflorescence stem. Lignified area was measured as the area of green color divided by the area of all color using ImageJ software. Error bar indicates SD (n=3). The letter above each bar indicates statistically significant difference (Dunnett's test, $P < 0.05$) from the wild type (a), from the *nst1-1 nst3-1* double mutant (b), and from both the wild type and *nst1-1 nst3-1* (c).