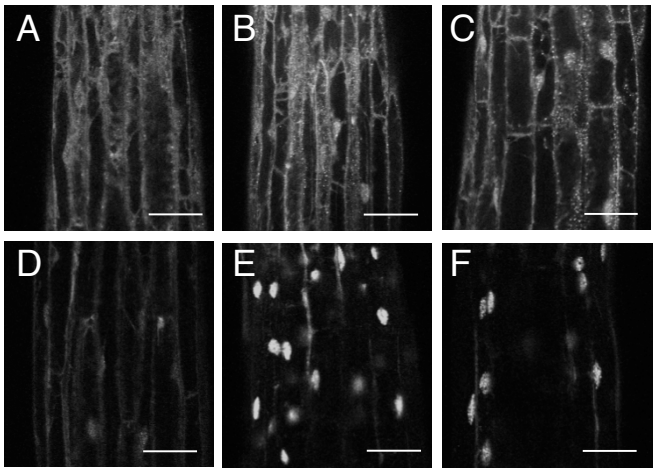
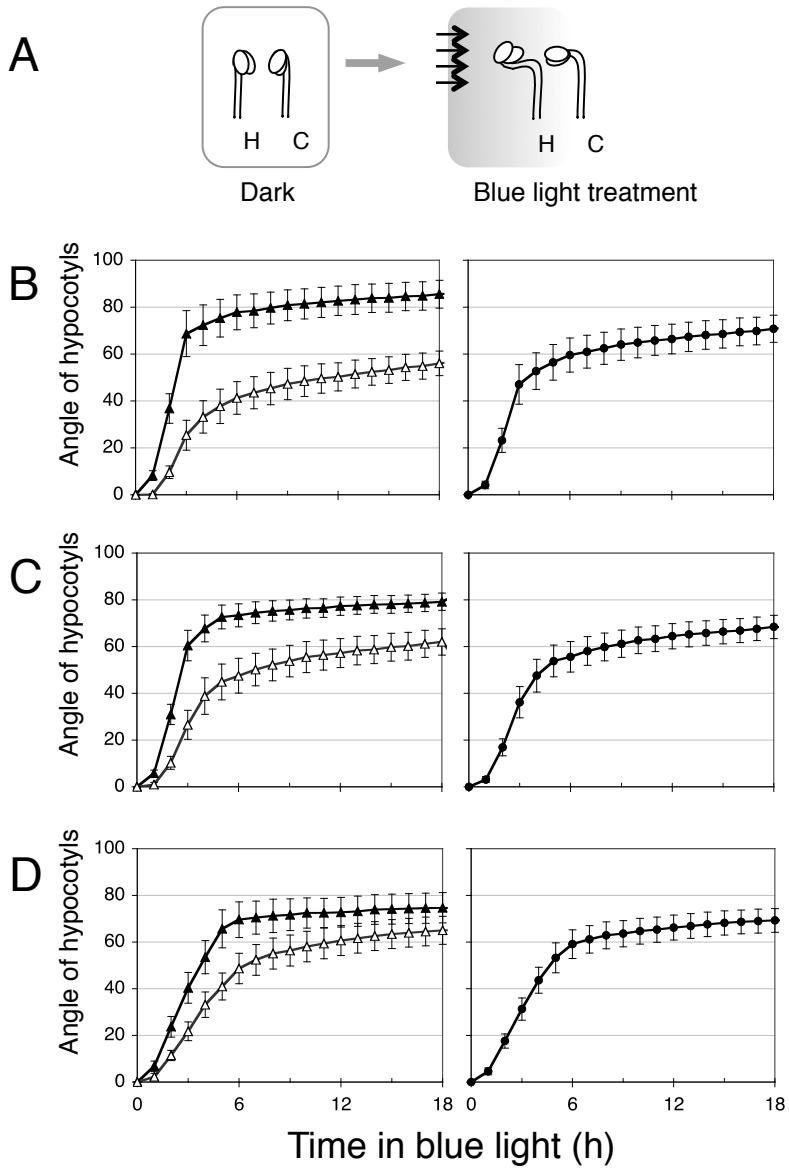


Supplemental Figure 1. Subcellular localization of a constitutively localized phyA

Subcellular localization of phyA-GFP and phyA-NLS-GFP. Dark grown *phyA* seedlings (4 – 5.9 mm length) transformed with PHYA-GFP or PHYA-NLS-GFP were analyzed by confocal laser scanning microscope. The seedlings were analyzed directly (dark) or after 1-4 hours irradiation with blue light (0.1 μ mol m^{-2} s^{-1}). A; phyA-GFP seedling in the darkness, B; phyA-GFP seedling after 1 hour blue light irradiation, C; phyA-GFP seedling after 2 hours blue light irradiation, D; phyA-GFP seedling after 4 hours blue light irradiation, E; phyA-NLS-GFP seedling in the darkness, F; phyA-NLS-GFP seedling after 4 hours blue light irradiation. Bar, 50 μmm.



Supplemental Figure 2. Phototropism kinetics depends on the length of the hypocotyl and the orientation of the cotyledons

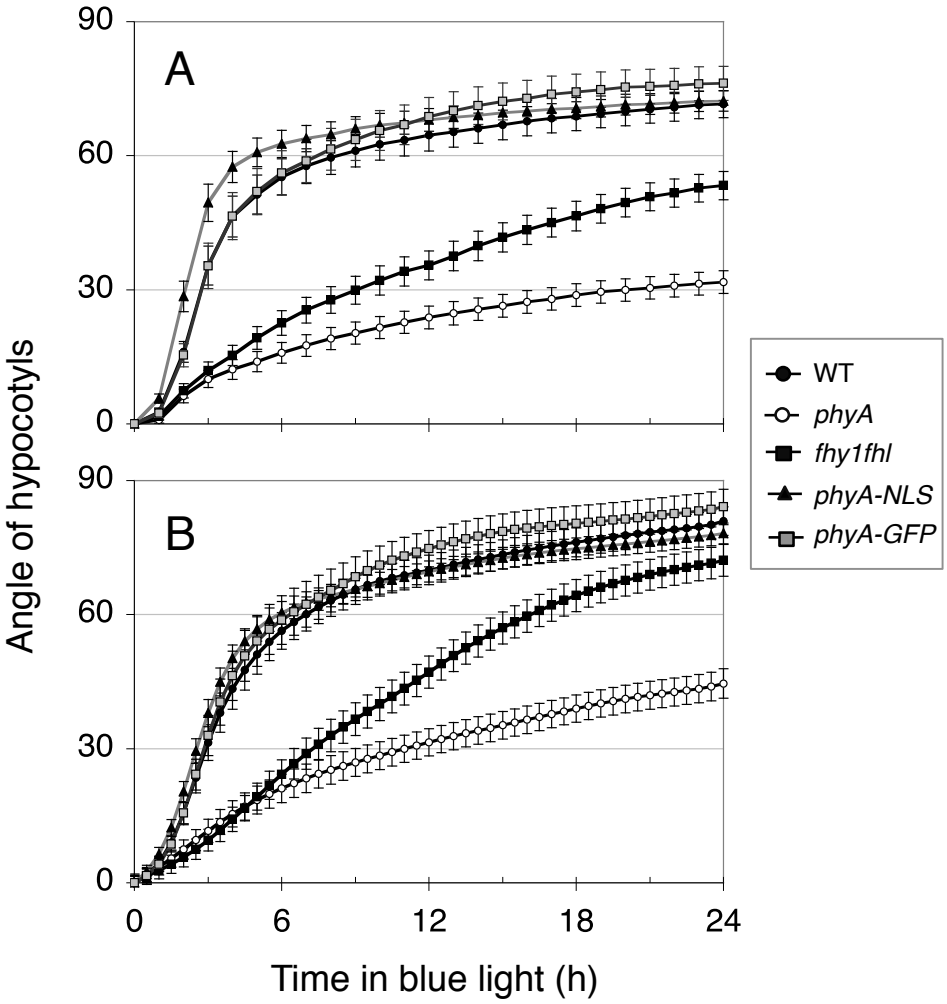
Dark grown seedlings were exposed unilateral blue light (0.1 μ mol m^{-2} s^{-1}) for 24 hours.

A: Schematic representation of the two positions of the cotyledons (C: cotyledon facing blue light, H: cotyledon in the opposite direction) relative to the incoming light.

B : Kinetic analysis of phototropism in seedling with a hypocotyl length of 1 - 3.9 mm. The left panel shows the kinetics for position H (full triangle) and C (open triangle) separately. The right panel shows the average data of seedlings with both positions. Each data are average with -/+ 2 × SE of hypocotyl angles (n= 50, 25 hypocotyls of C and 25 of hypocotyls H).

C: As in B but with hypocotyl length between 4 - 5.9 mm.

D: As in B but with hypocotyl length between 6 - 8.9mm.

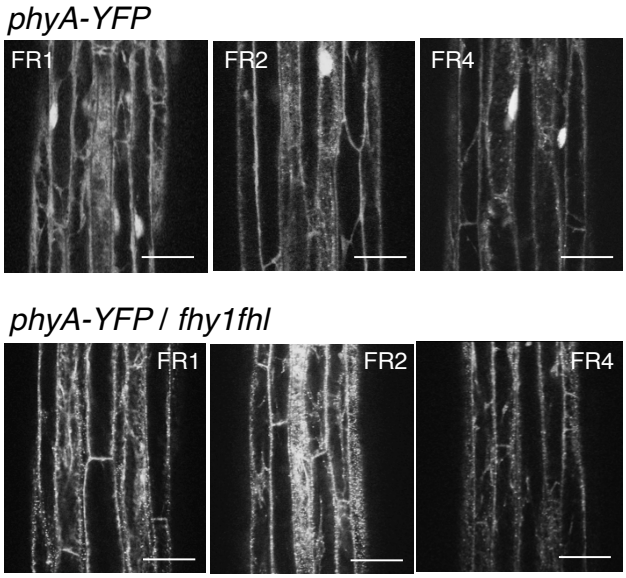


Supplemental Figure 3. Comparison of phototropism kinetics by using manual measurement and semi-automatic measurement with same time-laps images

Dark grown seedlings (4 – 5.9 mm length) were exposed unilateral blue light (0.1 μ mol m^{-2} s^{-1}) for 24 hours. The kinetics shows the total average of both cotyledon position with -/+ 2 × SE. All of data were collected more 30 each cotyledon position (WT: 46C+46H, *phyA*: 37C +37H, *fhy1fhll*: 34C+34H, phyA-NLS: 61C+ 61H, phyA-GFP: 33C +33H).

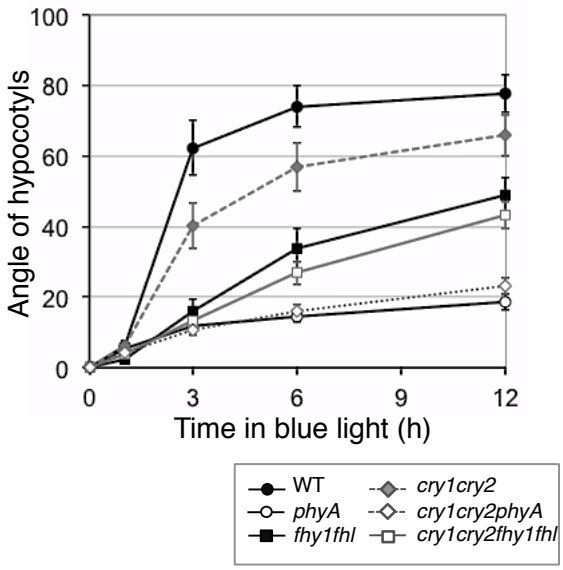
A: Phototropism kinetics by using Maunal measurement with ImageJ

B: Phototropism kinetics by using Semi-automatic measurement (HypoPhen). Data for the WT, phyA-NLS and phyA-GFP are the same as those presented in figure 3.



Supplemental figure 4. phyA localization (phyA-YFP) in WT or *fhy1fhl* under far-red light

Dark grown (4 – 5.9 mm length) PHYA-YFP in *phyA* and *fhy1fhl* seedlings were analyzed by confocal laser scanning microscopy. The seedlings were analyzed directly (dark) after 1, 2 or 4 hours irradiation with far-red light (5 μ mol m^{-2} s^{-1}) . FR1, FR2 and FR4; 1, 2 or 4 hours far-red light treatment. Bar, 50 μmm.



Supplemental figure 5. Comparison of phototropism kinetics in WT, *phyA, fhy1fhl, cry1cry2, cry1cry2phyA* and *cry1cry2fhy1fhl* under low blue light

Dark grown seedling (4 – 5.9 mm length) were exposed unilateral blue light (0.1 μ mol m^{-2} s^{-1}) for 12 hours. Each data show total average of both cotyledon position (n=20C+20H) and -/+ 2 × SE of hypocotyl angles.