EFFECT OF LIGHT ON LEAF INCLINATION OF *TRITICUM AESTIVUM*

II. Intensity of Blue Light

Kazuyoshi KIMURA

As has been shown in a previous paper (Kimura 1974), the inclination angle of the first leaf blade in wheat plant was greatly increased by blue light, but not so much by white light. Green and red light had little effect. Maximum inclination of the leaf blade was observed when 9-day-old seedlings were exposed to blue light for 48 hours at 20-25°C.

In rice plants, Maeda (1969) reported that all spectral regions of visible light at low intensity reduced the blade inclination. On the other hand, Inada (1969) reported that inclination angle of the leaf blade of rice plant was increased by blue light. The cause of these opposite results may be due to the difference of the duration and the intensity of light applied. In order to find the effect of intensity of blue light on blade inclination in wheat plants, the present investigation was undertaken.

MATERIAL AND METHODS

Seedlings of *Triticum aestivum*, "Shirasagi Komugi", were used as material. Procedure of experimentation and light sources were similar to those described in a previous paper (Kimura 1974). Plants grown on vermiculite in darkness at 20°C for 9 days were exposed to continuous irradiation of blue light at various intensities. Radiant energy of blue light was adjusted by changing the number and/or height of the lamps. Generally, 20-40 plants were used for each treatment.

RESULTS AND DISCUSSION

1) Wheat seedlings were exposed to blue light of 0, 600, 2000, 4000 and 6000 erg/cm^2/sec. Immediately after the treatments, the inclination responses were examined. Results are presented in Fig. 1.

In both 24- and 48-hour treatments, blue light of 2000 erg/cm^2/sec was fully effective, and further increase in light intensity had no effect. However, the inclination angle of the blade after a 24-hour treatment was only one third of that after a 48-hour treatment.

2) To obtain more detailed information on the effect of intensities of blue light, the second experiment was carried out. Plants were exposed to blue light of lower intensities than those used in the first experiment,

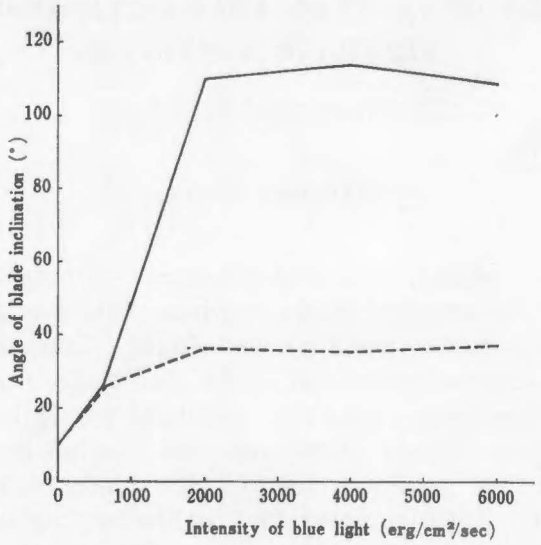

Fig. 1. Effect of intensity of blue light on the leaf blade inclination of wheat plants. Plants were cultured in darkness at 20°C for 8 days, and then subjected to continuous blue light of various intensities.

– – – –: 24-hour treatment, ———: 48-hour treatment

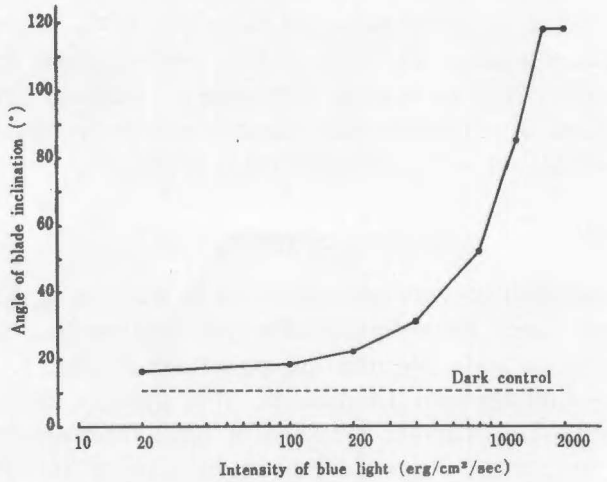

Fig. 2. Effect of blue light of various intensities (20-2000 erg/cm²/sec) on the leaf-blade inclination of wheat plants. Plants were cultured in darkness for 8 days at 20°C, and then exposed to continuous blue light of various intensities for 48 hours.

i.e. radiant energy of blue light was adjusted to 0, 20, 100, 200, 400, 800, 1200, 1600 and 2000 erg/cm²/sec. Immediately after the 48-hour treatment, the blade inclination was examined. As shown in Fig. 2, blue light was slightly effective even at the intensity of 20-100 erg/cm²/sec, and maximum response was obtained at 1600 erg/cm²/sec.

3) Nine-day-old dark-grown seedlings were exposed to continuous blue light of 0, 200, 400, 800, 1600 and 4000 erg/cm²/sec for various durations at 20°C, and at the end of each treatment, the blade inclinations were determined (Fig. 3).

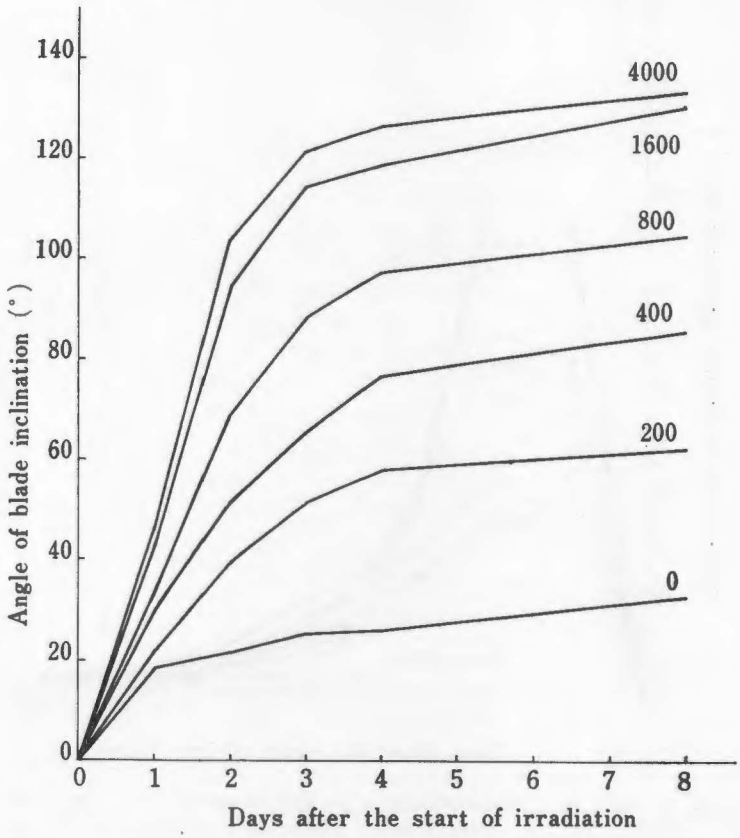

Fig. 3. Leaf-blade inclination in wheat plants under continuous irradiation with various intensities of blue light. Plants were cultured in darkness at 20°C for 8 days, and then exposed to continuous blue light. Numerals in the Figure show the energy (erg/cm²/sec) of blue light.

In all plants, the inclination of the blade increased rapidly during the first 1-2 days after the start of the irradiation, and reached to near maximum on the 4th day. The maximum level of the inclination in-

creased with increasing intensity of blue light up to 1600 erg/cm²/sec, but further increase had little effect.

When the plants were exposed to continuous blue light of 0, 200, 400, 800, 1600 and 4000 erg/cm²/sec for 8 days, the final inclination angles of leaf blade were 32.5°, 61.0°, 85.6°, 104.9°, 130.5° and 133.1°, respectively.

Fig. 4 shows the calculated rate of leaf movement per day under various intensities of blue light (data from Fig. 3). The movement was rapid during the first 2 days after the start of blue light treatments but became negligible after the 6th day.

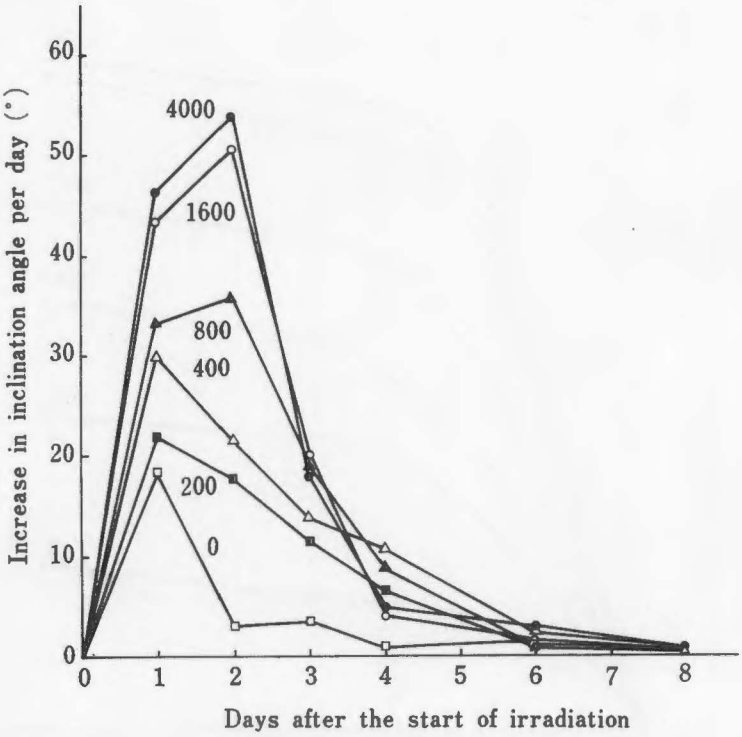

Fig. 4. Rate of blade movement per day under various intensities of blue light in wheat plants. These were calculated from the data in Fig. 3. Numerals in the Figure show the energy (erg/cm²/sec) of blue light.

Although Maeda (1969) reported the inhibitory effect of low-intensity light on blade inclination in rice plant, such inhibitory effect was not observed in wheat plant. In the present experiments, effect of blue light on the blade inclination decreased with lowering light intensities, but blue light of 20 erg/cm²/sec still slightly promoted the inclination.

Blade inclination of wheat under continuous blue light is determined

by at least two factors. One determined by light intensity and one determined by the time of observation. At any light intensity, maximum response is observed 4-6 days after the start of irradiation, and the level of this maximum response is determined by light intensity.

SUMMARY

Effect of intensity of blue light on leaf-blade inclination was investigated in wheat seedlings.

1) The promotive effect of blue light on blade inclination was recognized even at 20 erg/cm²/sec, and increased with increasing intensity of the blue light. Blue light of 1600 erg/cm²/sec was fully effective and further increase in light intensity had no effect.

2) Under continuous irradiation of blue light, the leaf blade moves downward rapidly during the first 1-2 days and takes the final position on 4-6th day.

3) The final position was influenced by the intensity of light. The lower the intensity, the higher the position, i. e. the smaller the inclination angle.

ACKNOWLEDGMENT

Grateful acknowledgment is made to Prof. A. Takimoto, Kyoto University, for his helpful comments on the manuscript. Sincere gratitude is also due to Miss E. Kimoto for her generous assistance and finally, to Prof. K. Takasu for his constant encouragement through this work.

REFERENCES

1. Inada, K. 1969. Effect of blue light on the photonastic reaction of rice leaves. Plant & Cell Physiol. 10: 845-854.
2. Kimura, K. 1974. Effect of light on leaf inclination of *Triticum aestivum*. I. Monochromatic light. Ber. Ohara Inst. landw. Biol. Okayama Univ. 16: 47-56.
3. Maeda, E. and Sugiura, T. 1969. Effects of monochromatic light on the lamina inclination in rice seedlings. Proc. Crop Sci. Soc. Japan 38: 615-621.