

Setting proper cultivation conditions for the production of sprouted adlay

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Background

Adlay (*Coix lacryma-jobi* var. *ma-yuen* (Rom.Caill.) Stapf) is one of the medicinal crops with a wide cultivation area in Korea. Despite its economic importance, little is known about adlay sprouts because they are not yet a food ingredient. This study investigated the growth and cultivation characteristics of adlay sprouts to prepare for the future food industry.

Materials and Methods

To find the optimal seeding density, the size and weight of the seeds were estimated. Coixol content and antioxidant activity were tested according to each method. After finding the optimal seeding density, a light quality test was conducted to find an appropriate light wavelength region to increase production. For the light quality, first, red, blue, and green light LEDs were irradiated with a luminous intensity of 50 $\mu\text{mol}/\text{m}^2/\text{s}$.

Results

As a result, the length of each 1000 seeds was $5.93 \pm 0.31\text{mm}$, the width was $7.50 \pm 0.70\text{mm}$, the occupied area was 35.02mm^2 , and the weight of the kernel was $125.73 \pm 0.15\text{g}$. When the seeds were sown at 2.2, 2.8, 3.3, and 3.9 kg/m^2 , the overlapping multiples were 1.0, 1.2, 1.4, and 1.6. When the seeding density increases, the yield per unit area increases, but when the density is higher than a certain density, the yield per area decreases. When analyzing based on the dry weight of sprouts, the optimal seeding densities (overlapping multiples) are 2.8 kg/m^2 (1.2) and 3.3 kg/m^2 (1.4). The antioxidant activity (IC_{50} ; $728.13 \mu\text{g}/\text{mL}$) was the highest at an overlap multiple of 1.4, but the coixol content of adlay sprouts was not significantly different between the dental treatment groups. As for the optimal light quality, red light showed a high sprout productivity, and among monochromatic lights, red light was found to be the most useful.

Table 1. Seed of characteristics in adlay (*Coix lacryma-jobi* L. var. *ma-yuen* Stapf.).

Form	Color	Length (mm)	Width (mm)	L/W ¹⁾	1,000GW ²⁾ (g)
Oval	Dark Brown	9.02 ± 0.84	5.93 ± 0.31	1.52	126.22 ± 0.15

Mean values \pm SD from triplicate separated experiments using 10 seeds are shown.

¹⁾ L/W; Length/Width, ²⁾1000GW; 1,000 seed weight.

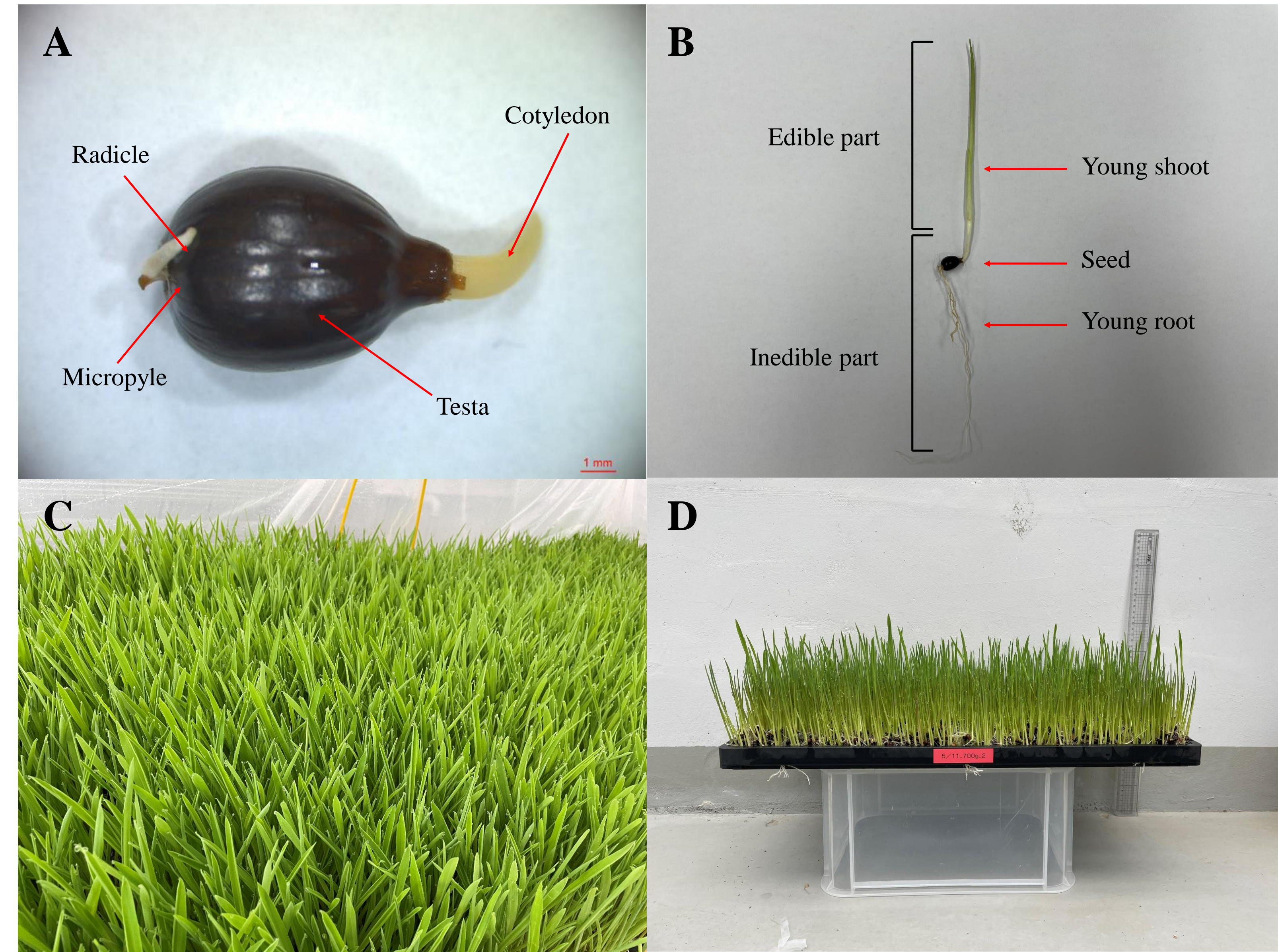


Fig. 1. Growth, ripening, germination, production and harvest of adlay (*Coix lacryma-jobi* L. var. *ma-yuen* Stapf.). **A**; Shape of seed germination of adlay (*Coix lacryma-jobi* L. var. *ma-yuen* Stapf.), **B**; Diagram of 7 days old adlay sprout, **C**; Growth of adlay sprouts, **D**; Optimal growth of adlay sprouts.

Table 2. Converting seed density per unit area to seed occupying area and seed overlapping multiple.

Seed density per unit area (kg/m^2)	2.2	2.8	3.3	3.9	4.4	5.0	5.6	6.1
Seed overlapping multiple	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.0

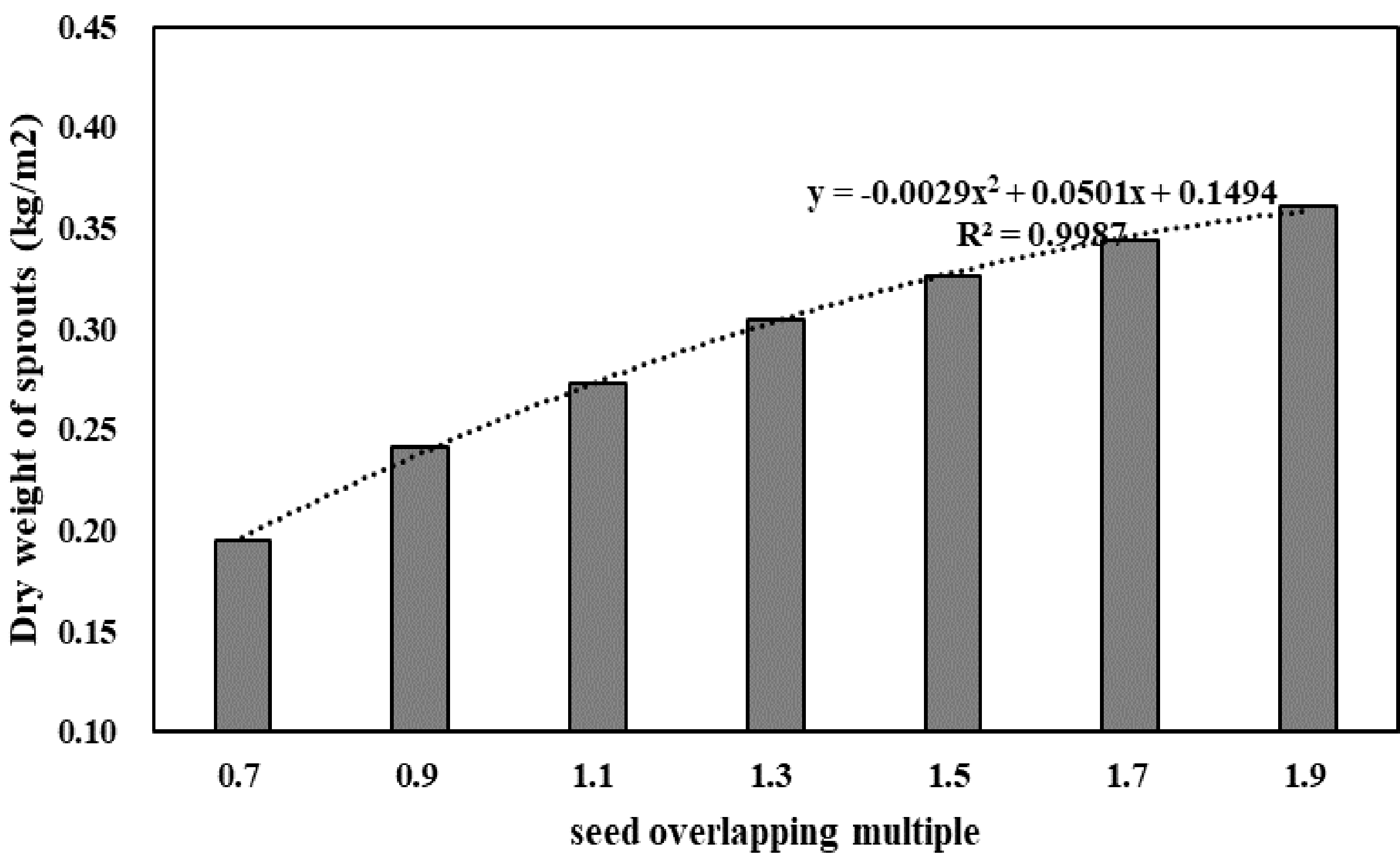


Fig. 2. Dry weight of adlay according to the seed overlapping multiple. When the seeds were sown as 2.2, 2.8, 3.3, 3.9, 4.4, 5.0, 5.6, 6.1 kg/m^2 , overlapping multiple was 0.7, 0.9, 1.1, 1.3, 1.5, 1.7, 1.9, 2.0. Natural light was used as a light source for growth.

Table 3. Shoot length of adlay seed according to the seed overlapping multiple.

Seed overlapping multiple	0.7	0.9	1.1	1.3	1.5	1.7	1.9
Shoot length (cm)	14.8	14.4	15.2	15.1	14.5	14.9	14.8

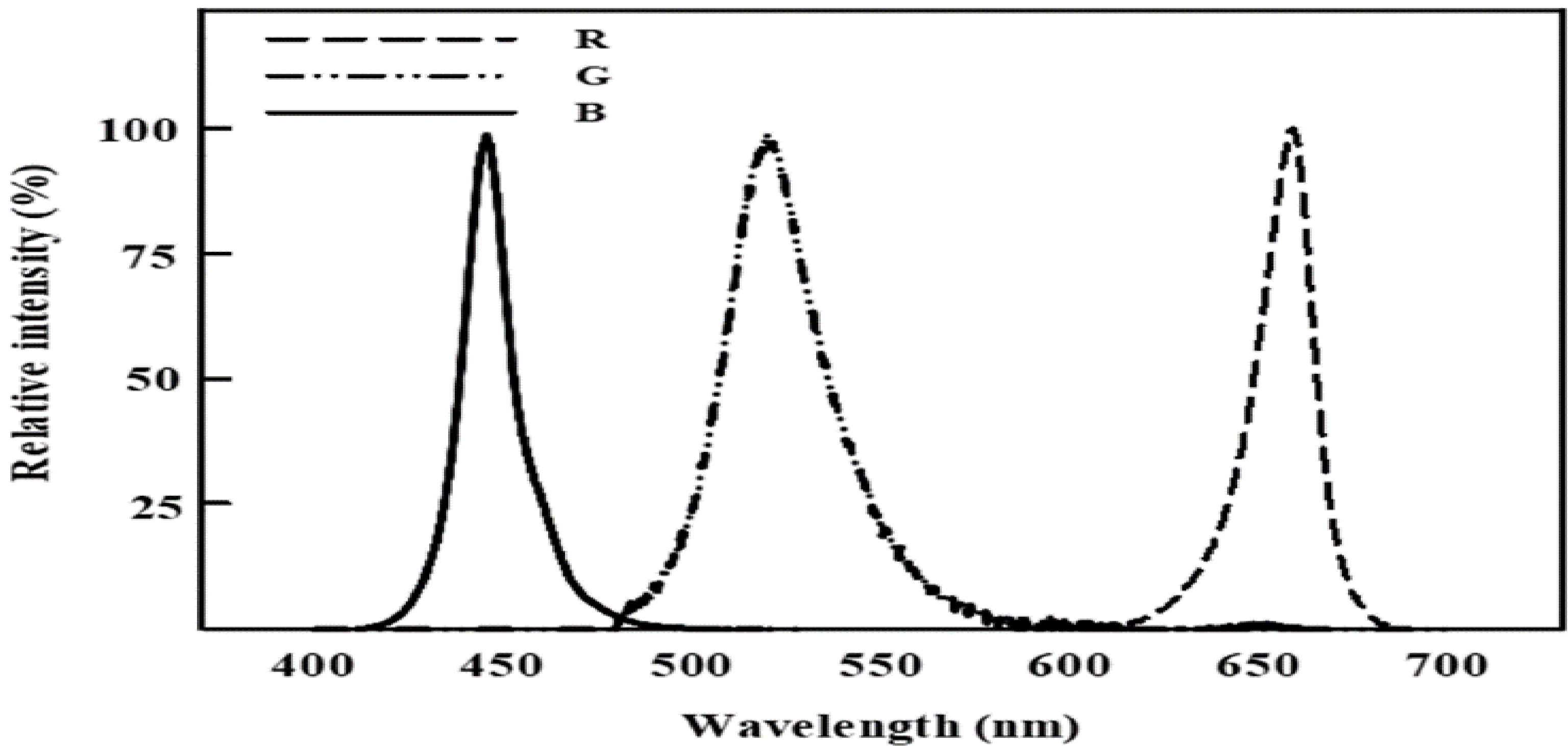


Fig. 3. Relative spectral distribution of monochromatic red (R), green (G), and blue (B) LEDs.

Table 4. Growth characteristics of sprouted adlay according to the light quality.

Form	Sprout length (cm)	Dry weight of sprouts (kg/m^2)
R	15.0	0.12
G	7.0	0.02
B	5.8	0.01

Light intensity : 50 $\mu\text{mol}/\text{m}^2/\text{s}$, Irrigation : sprinkler (10 min, 6 times/day)

Conclusion

Adlay sprouts are excellent in functionality, so continuous research is needed for industrialization by preparing a basis for safe ingestion as food through toxicity tests.