

Selection and Germination of Tomato Seeds

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The effect of seed selection method on the germination percentage of a tomato cultivar (BF Okitsu 101) was studied. Seed characteristics such as weight, color, specific gravity, soluble protein content, and amylose enzyme activity influenced seed germination. Heavier seeds had a higher percentage of germination and cotyledon expansion and the young seedlings were more vigorous after germination. White seeds had a higher percentage of germination and cotyledon expansion than the darker and black seeds. Seeds which sank in a NaCl aqueous solution had a higher percentage of germination than those which floated. One hundred percent of the seeds selected from the 15% NaCl solution germinated. There was a positive correlation between the germination percentage and the soluble protein content and the amylase activity of the seeds.

MATERIALS AND METHODS

For selection by seed weight, 200 seeds were picked at random and classified into three groups: under 1.4 mg, 1.4 to 1.8 mg, and over 1.8 mg. For selection by seed colour, seeds were graded visually into white, medium, and black groups. Selected seeds were sown in a plug tray with 406 cells for the germination test in three replications. The seeds, covered with 1 cm of soil, were grown under five fluorescent lamps at 25°C and 95% RH. The germination percentage was measured every 12 h after sowing. For selection by specific gravity, seeds were suspended in 0, 7.5, 10, and 15% (w/v) NaCl aqueous solutions and germination tests were carried out on the seeds which sank and those which floated. The seeds which sank in 15% (w/v) NaCl solution achieved 100% germination. Seeds which sank in 7.5% NaCl solution achieved 65% germination. Minerals, sugar, soluble protein, and amylose activity in these selected seeds were determined.

RESULTS AND DISCUSSION

Selection by Seed Weight. Seed germination started 3 days after sowing in each group (Fig. 1). Fifty percent of the seeds over 1.8 mg germinated after 3.7 days, and reached 89% and 100% germination after 5 and 7 days, respectively. The seeds over 1.4 mg started to germinate on the same day, but the final germination percentage was lower. The seeds under 1.4 mg germinated slowly and the germination percentage at 8 days was only 85%.

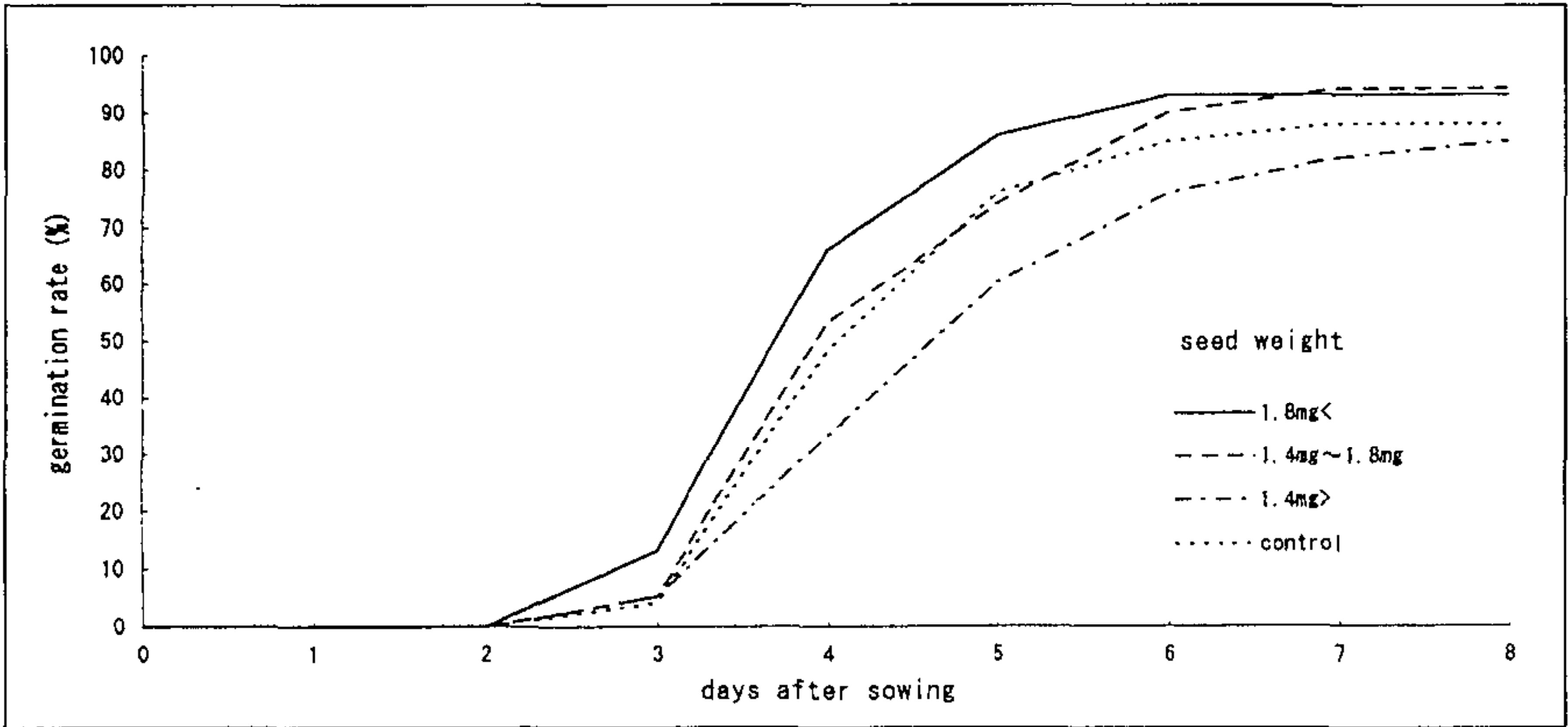


Figure 1. The correlation between germination percentage and seed weight.

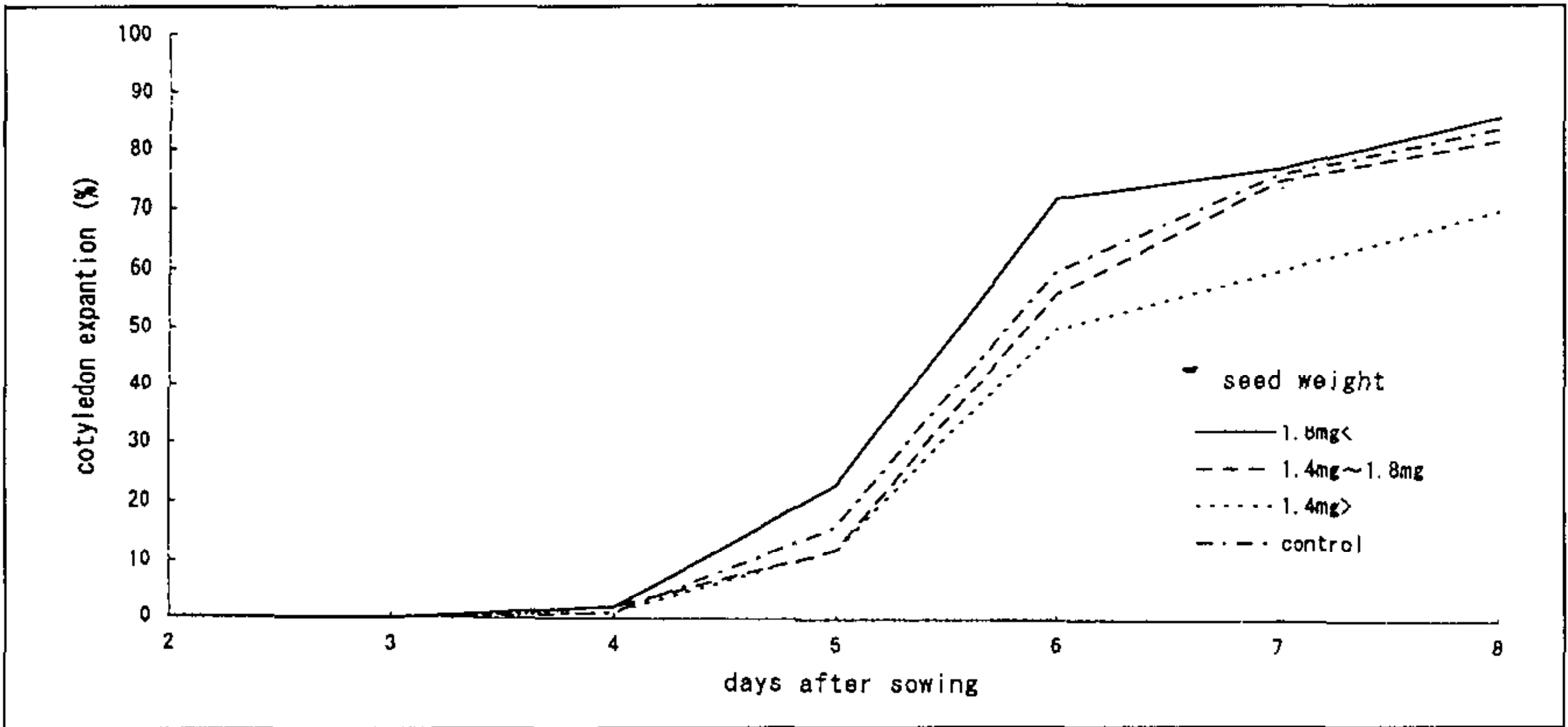


Figure 2. The correlation between cotyledon expansion and seed weight.

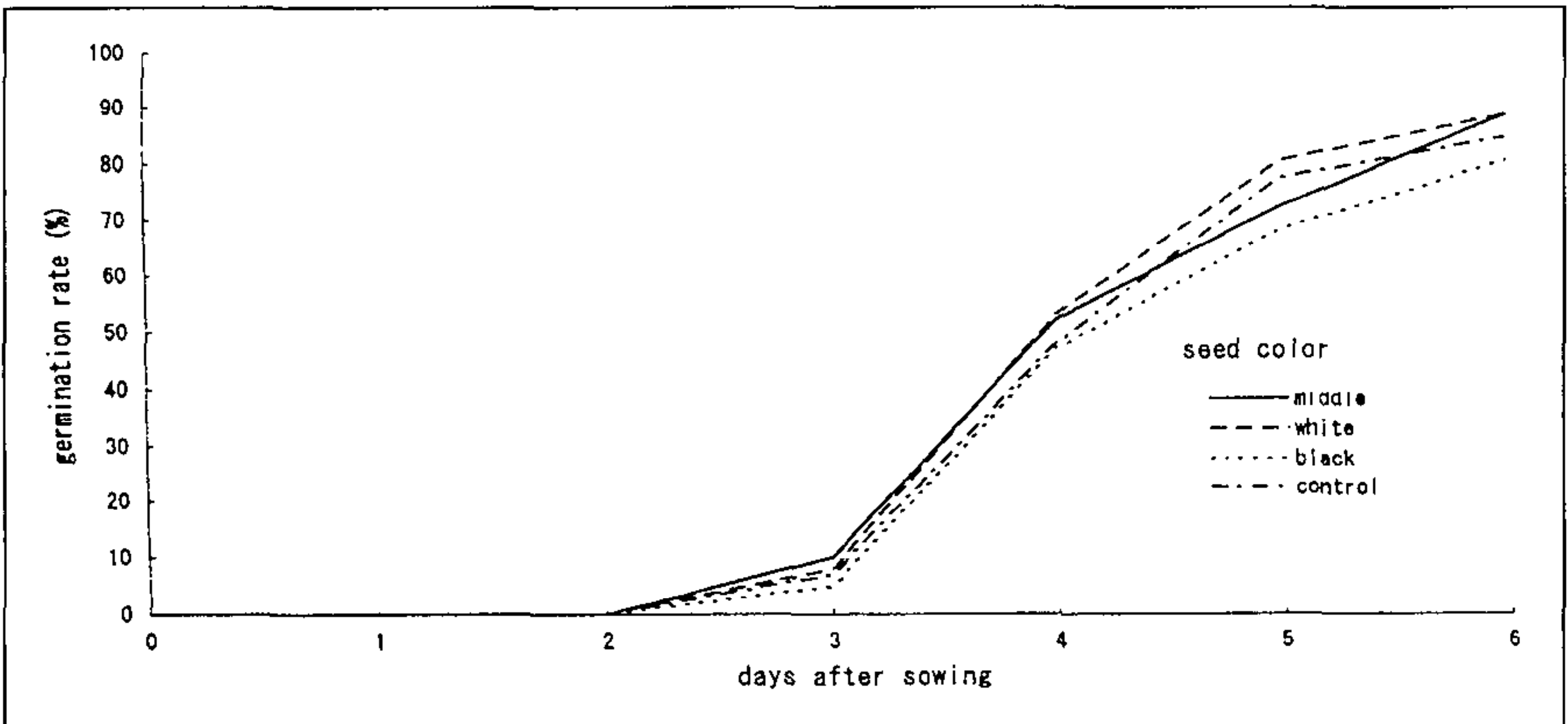


Figure 3. The correlation between germination percentage and seed color.

Cotyledon expansion started 5 days after sowing (Fig. 2). That is, the cotyledon expansion started within 2 days after germination. After 2 days of cotyledon expansion, seeds over 1.8 mg had a 15% greater cotyledon expansion than the seeds under 1.4 mg. This difference continued for 8 days after sowing.

Selection by Seed Colour. Germination started 2½ days after sowing (Fig. 3). The black seeds had a 10% lower final germination rate than the white seeds. No difference in germination was found between the medium-coloured and white seeds, and the germination rate was 50% after 4 days. The seeds started to expand their cotyledons 3½ days after sowing—that is, the leaf opened soon after germination (Fig. 4). With the progress of leaf expansion, differences in the cotyledon expansion percentage became clear and the white seeds had a higher percentage of expansion. The black seeds expanded their cotyledons slowly at 6 days, and had a lower percentage of leaf expansion. The difference in leaf expansion between the white and black seeds was about 15% at 7 to 8 days after sowing.

Selection of Seed by Specific Gravity. The germination percentage was higher in the seeds which sank in solution than those which floated, in any seed group (Table 1). The seeds selected with 15% NaCl solution especially showed complete germination (100%). The selections with 7.5% and 10% NaCl solutions seemed to eliminate the dead seeds as much as possible and germination approached 100%. This method of seed selection was considered the most effective.

Table 1. Effect of seed selection by specific gravity on germination percentage.

NaCl conc. (%)	Floated seed (%)	Germination (%) Days after seeding		
		2	3	4
15.0%	50	77	94	98
15.0%		81	100	100
10.0%	15	50	72	85
10.0%		51	93	99
7.5%	10	37	49	68
7.5%		47	93	97
0.0%	0.2	0	50	50
0.0%		29	89	98

The results of mineral and sugar contents in the 65% and 100% germinated seeds showed no big difference. The soluble protein content was relatively high at the start (Fig. 5). The soluble protein content of the 65% germinated seeds during the first 3 days was about 60% compared to that of the 100% germinated seeds. Therefore, a positive correlation was observed between the soluble protein and the germination percentage. Differences in amylase activity became greater with time and 3 days after sowing the 65% germinated seeds reached 60% activity against the 100% germinated seeds (Fig. 6). A positive correlation was recognized between the amylase activity and the germination percentage. These results suggest that

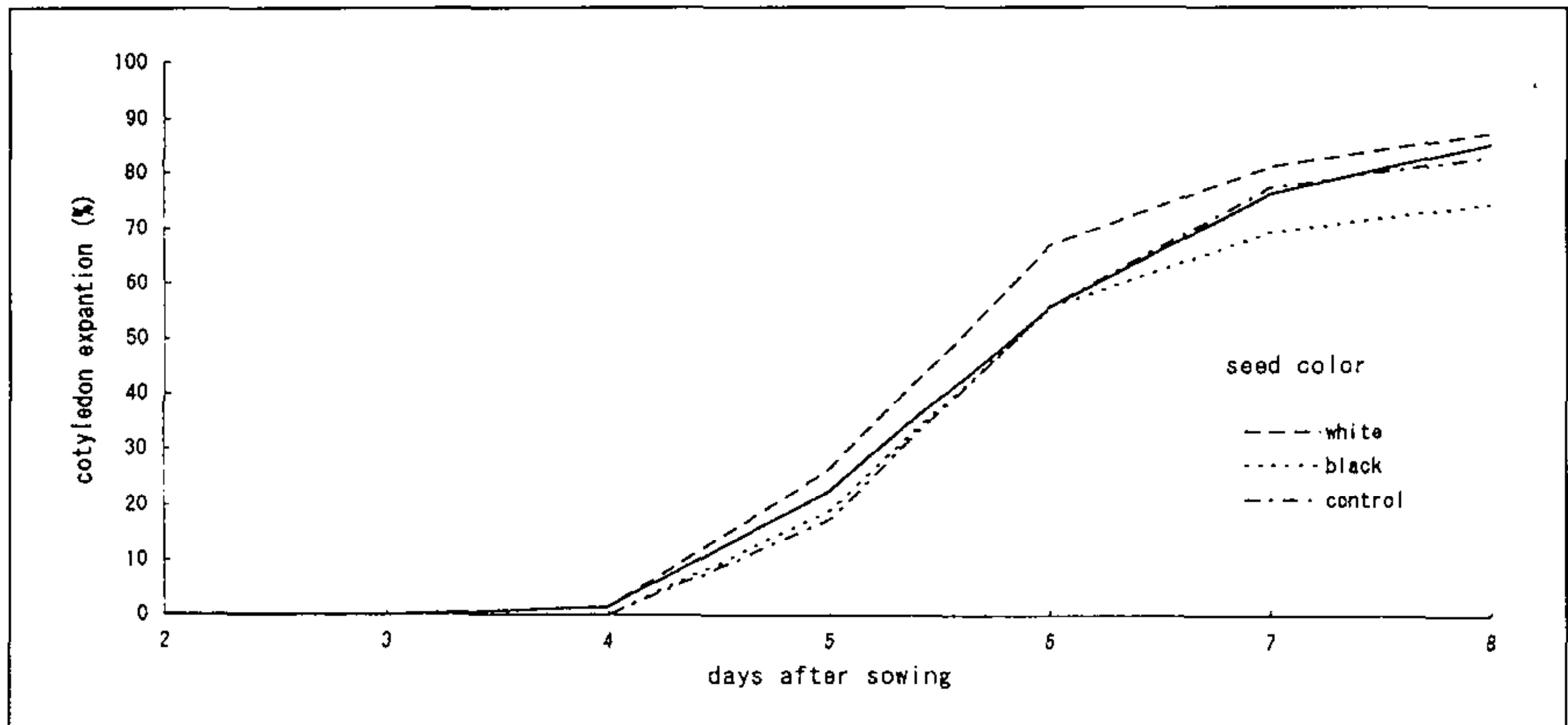


Figure 4. The correlation between cotyledon expansion and seed color.

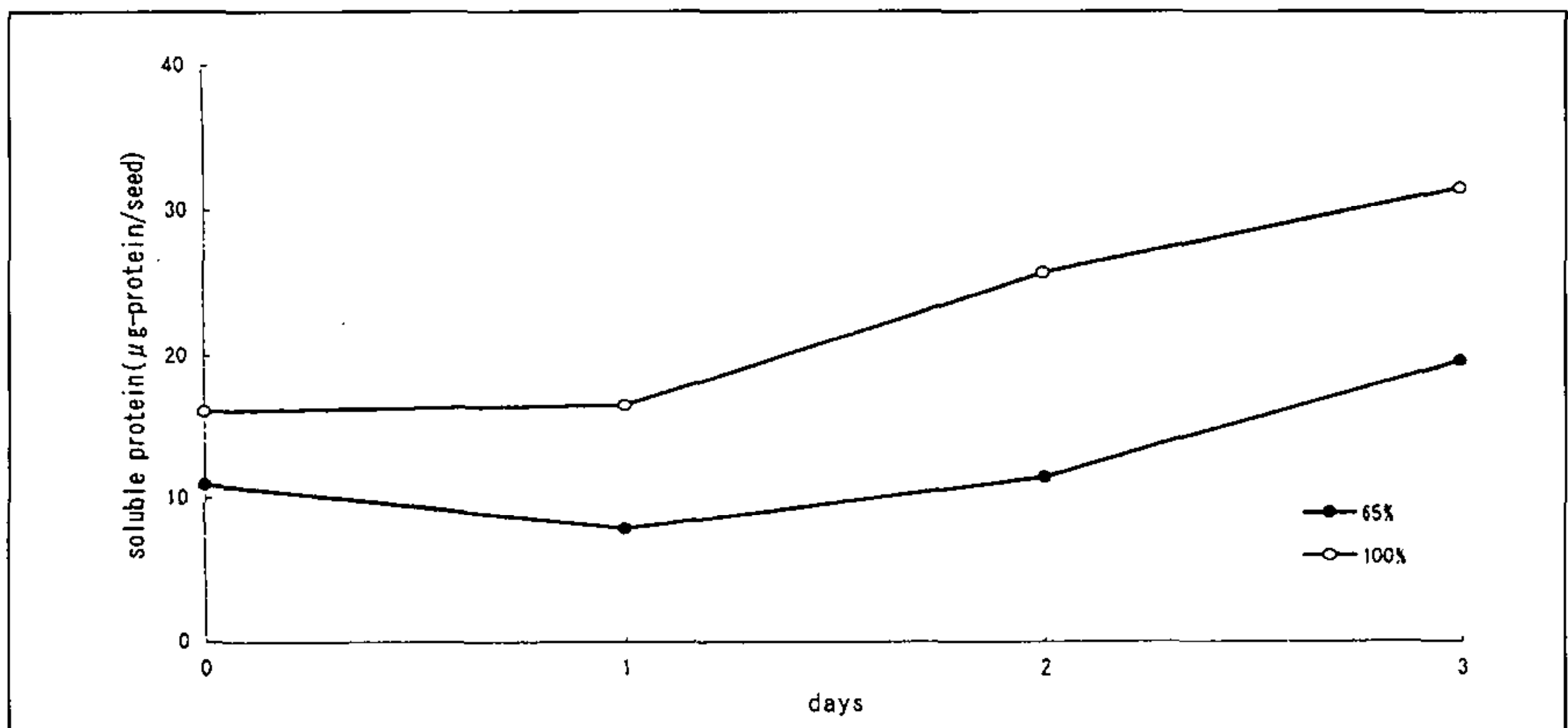


Figure 5. The correlation between soluble protein and germination percentage.

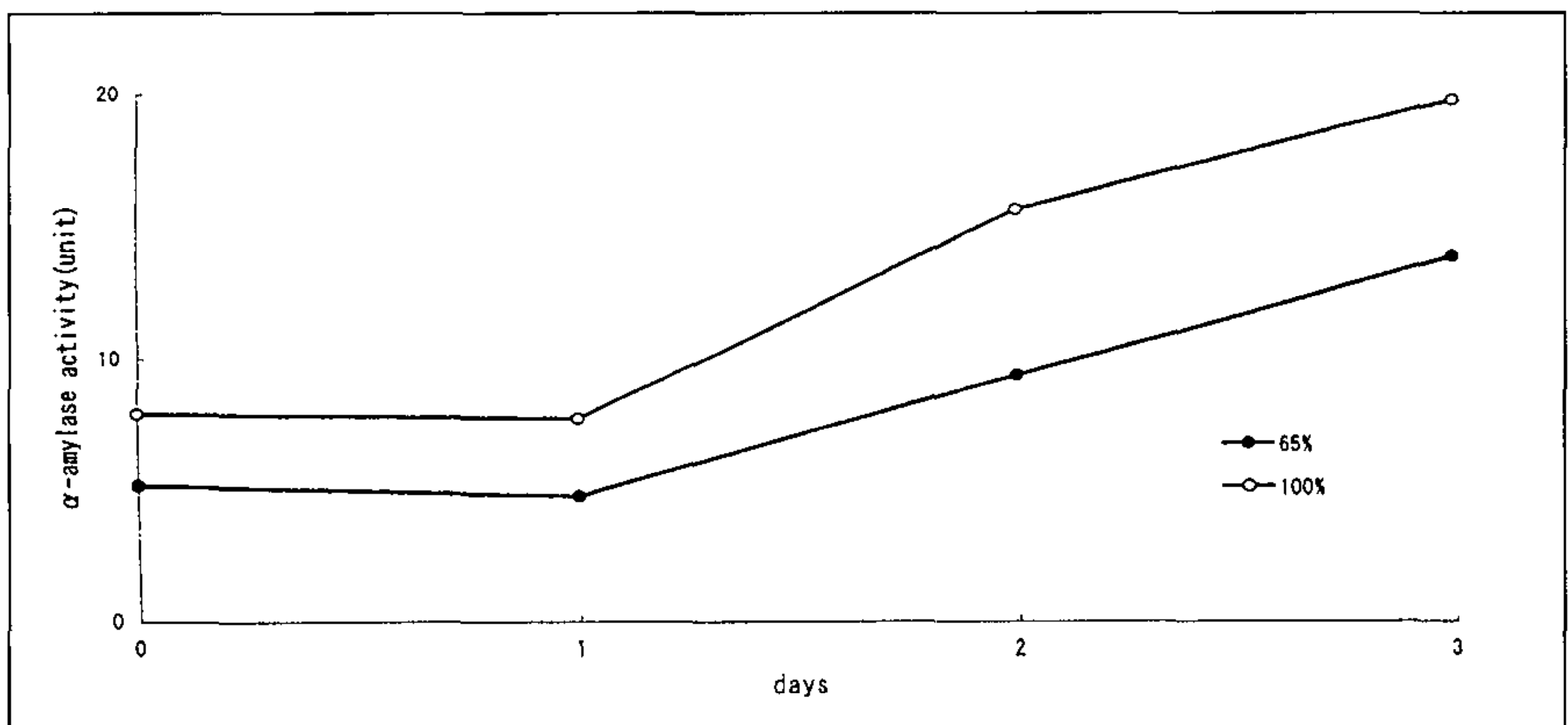


Figure 6. The correlation between α-amylase activity and germination percentage.

amylase synthesis was inhibited or the induction of amylase activity was slowed down after absorption of water by the seeds.

CONCLUSIONS

Seed characteristics such as weight, color, specific gravity, soluble protein content, and amylose enzyme activity influence seed germination. We believe that these points should be considered in selecting seeds in the future for better germination.

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