Appendix

Estimates of gene effects were performed using the following formulas (Hayman, 1960):

$$\mathrm{m} = \overline{\mathrm{F2}}$$

$$\mathrm{a} = \overline{\mathrm{BC1P1}} - \overline{\mathrm{BC1P2}}$$

$$\mathrm{d} = -\frac{\overline{P1}}{2} - \frac{\overline{P2}}{2} + \overline{\mathrm{F1}} - (4 \times \overline{\mathrm{F2}}) + [\,2 \times (\overline{\mathrm{BC1P1}} + \overline{\mathrm{BC1P2}})]$$

$$\mathrm{aa} = -(4 \times \overline{\mathrm{F2}}) + [\,2 \times (\overline{\mathrm{BC1P1}} + \overline{\mathrm{BC1P2}})]$$

$$\mathrm{ad} = -\frac{\overline{P1}}{2} - \frac{\overline{P2}}{2} + \overline{\mathrm{BC1P1}} + \overline{\mathrm{BC1P2}}$$

$$\mathrm{dd} = \overline{P1} + \overline{P2} + \overline{\mathrm{F1}} + (2 \times \overline{\mathrm{F1}}) + (4 \times \overline{\mathrm{F2}}) - [\,4 \times (\overline{\mathrm{BC1P1}} + \overline{\mathrm{BC1P2}})]$$

The components of phenotypic variance, genetic (G), environmental (E), additive (D), and dominance (H) was estimated as described by Warner (1952) and Wright (1968), for each trait in two crosses:

$$\sigma^2_{\mathrm{P}} = \sigma^2_{\mathrm{F2}}$$

$$\sigma^2_{\mathrm{E}} = \frac{\sigma^2_{\mathrm{P1}} + \sigma^2_{\mathrm{P2}} + (2 \times \sigma^2_{\mathrm{F1}})}{4}$$

$$\sigma^2_{\mathrm{G}} = \sigma^2_{\mathrm{P}} - \sigma^2_{\mathrm{E}}$$

$$\sigma^2_{\mathrm{A}} = (2 \times \sigma^2_{\mathrm{F2}}) - (\sigma^2_{\mathrm{BC1P1}} - \sigma^2_{\mathrm{BC1P2}})$$

$$\sigma^2_{\mathrm{D}} = \sigma^2_{\mathrm{F2}} - (\sigma^2_{\mathrm{A}} + \sigma^2_{\mathrm{E}})$$

The broad-sense heritability (h_b) and narrow-sense heritability (h_n) were estimated using the following methods, Allard (1999) and Warner (1952):

$$h_b = \frac{F2 - \frac{P1 + P2 + F1}{3}}{F2}$$

$$h_n = \frac{2(\sigma^2_{\mathrm{F2}}) - (\sigma^2_{\mathrm{BC1P1}} + \sigma^2_{\mathrm{BC1P2}})}{\sigma^2_{\mathrm{F2}}}$$

Genetic gain from one cycle of selection was estimated using the method described by Hallauer and Miranda (1988). The constant values of selection differential (K) were 2.06, 1.76, and 1.40 based on the three intensities of selection 5%, 10%, and 20%, respectively.

$$\text{Genetic gain} = \mathrm{h_n} \times \sqrt{\sigma^2_{\mathrm{p}}} \times \mathrm{K}$$

Minimum number of effective factors in controlling the quantitative traits was calculated for all of the studies traits using the following formulas (Wright, 1968; Mather and Jinks, 1982; Lande 1981):

$$\text{Wright's method} = \frac{(\overline{P1} - \overline{P2})^2 \times \left\{1.5 - \left[2 \times \frac{\overline{F1} - \overline{P1}}{\overline{P2} - \overline{P1}} \times \left(1 - \frac{\overline{F1} - \overline{P1}}{\overline{P2} - \overline{P1}}\right)\right]\right\}}{8 \times \left[\sigma^2_{F2} - \frac{\sigma^2_{P1} + \sigma^2_{P2} + (2 \times \sigma^2_{F2})}{4}\right]}$$

$$\text{Mather and Jinks's method} = \frac{\frac{(\overline{P1} - \overline{P2})^2}{2}}{(2\sigma^2_{\mathrm{F2}}) - (\sigma^2_{\mathrm{BC1P1}} + \sigma^2_{\mathrm{BC1P2}})}$$

$$\text{Lande's method I} = \frac{(\overline{P1} - \overline{P2})^2}{8 \times \left[\sigma^2_{F2} - \frac{\sigma^2_{P1} + \sigma^2_{P2} + (2 \times \sigma^2_{F2})}{4}\right]}$$

$$\text{Lande's method II} = \frac{(\overline{P1} - \overline{P2})^2}{8 \times [(2\sigma^2_{\mathrm{F2}}) - (\sigma^2_{\mathrm{BC1P1}} + \sigma^2_{\mathrm{BC1P2}})]}$$

$$\text{Lande's method III} = \frac{(\overline{P1} - \overline{P2})^2}{[8 \times (\sigma^2_{\mathrm{BC1P1}} + \sigma^2_{\mathrm{BC1P2}} - \sigma^2_{F1})] - \frac{(\sigma^2_{P1} + \sigma^2_{P2})}{2}}$$