4.3. Correlations of total GDD to RM and GDD-to-silking to total GDD

Total GDD or GDU (growing degree units) measures the cumulative effective temperature from planting or emergence to physiological maturity (i.e. blacklayer), whereas RM (relative maturity or comparative relative maturity, in days) measures the duration from planting or emergence to the stage when grain moisture content is suitable for harvest (Hall, 1995; Nielsen and Thomison, 2003). RM ratings vary across seed companies, depending on the operational procedures and criteria, as well as geographic locations (Hall, 1995). In comparison, GDD values for hybrids of similar maturity are more stable across companies, although the starting time for GDD computation differs. Most seed companies compute GDD starting from planting, but some start from emergence.

We compiled RM and total GDD data, as of January 2005, from 12 major maize seed companies in the US. The data are published by those companies either in print format or online sources (Table 4.1). For hybrids from the same company (i.e., the same seed brand), there exists a strong brand-specific correlation between total GDD values and RM ratings (Table 4.1). For the pooled data, however, total GDD spreads into a wider band over RM and the variation in total GDD corresponding to a same RM is significant. The user must exercise caution when comparing RM values across brands, or when using RM to set maturity for unknown brands (i.e., **Generic)**.
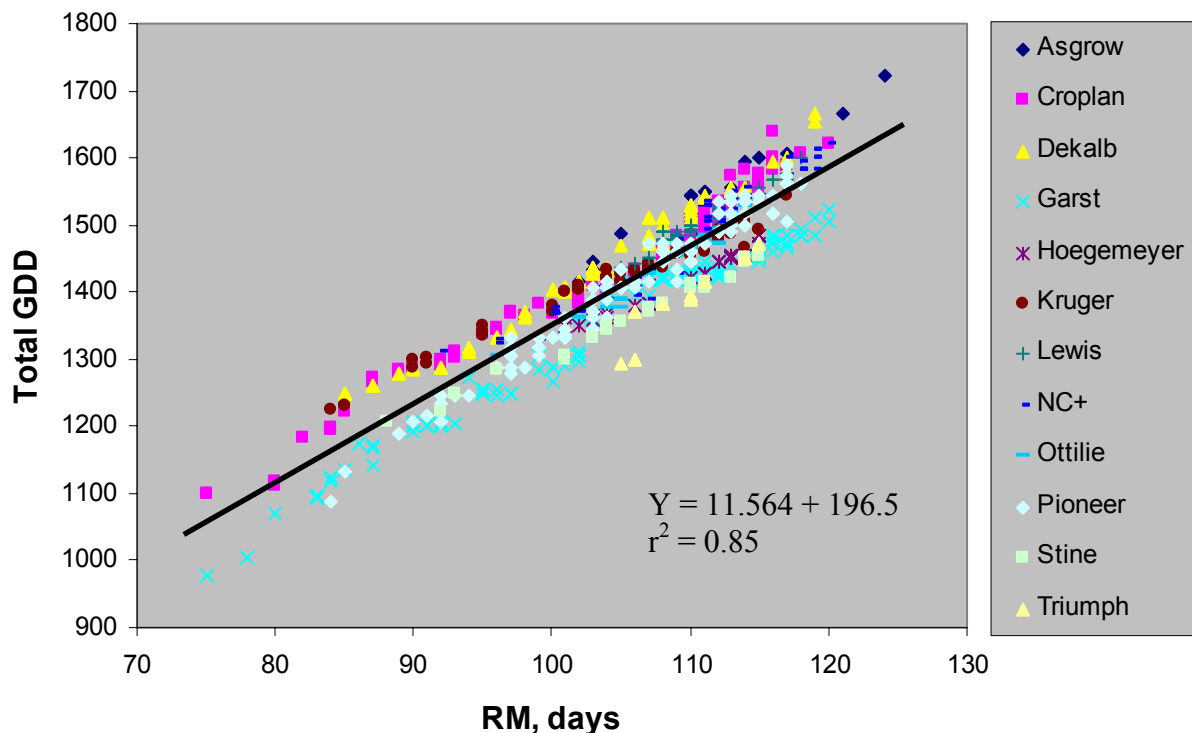

$$Y = 11.564 + 196.5$$
$$r^2 = 0.85$$

Fig. 4.1. Relationship of total GDD with relative maturity (RM, in days) for 12 commercial maize brands. The black line and the equation represent the regression of the pooled data. The GDD values refer to $^{\circ}$C.

Table 4.1. Data sources for RM ratings, total GDD and GDD-to-silking, and regression functions of total GDD to RM and GDD-to-silking to total GDD. All GDD values refer to $^{\circ}C$ (by dividing the original $^{\circ}F$-based GDD values by 1.8).

| Company	Data source	Total # of hybrid entries, range of RM (d), range of total GDD	Regression of total GDD (Y) to RM (X)	Regression of GDD-to-silking silking (Y) to total GDD (X)
Asgrow	www.monsanto.com/monsanto/us_ag/layout/seed/default.asp#	27 102 – 124 1417 - 1722	Y = 12.764X + 119.6 $r^2 = 0.92$	Y = 0.514X – 30.4 $r^2 = 0.80$
Croplan	www.croplangenetics.com/	155 75 - 120 1100 - 1639	Y = 11.576X + 222.5 $r^2 = 0.98$	N/A*
DeKalb	www.monsanto.com/monsanto/us_ag/layout/seed/default.asp#	93 85 - 119 1250 - 1667	Y = 0.0801X^2 - 4.334X + 1025.5 $r^2 = 0.99$	Y = 0.308X + 273.3 $r^2 = 0.86$
Garst	www.garstseed.com/GarstClient/	161 75 – 120 978 - 1522	Y = 11.28X + 176.9 $r^2 = 0.97$	N/A
Hoegemeyer	Seed Guide 2005 (print)	30 101 - 115 1350 - 1483	Y = 0.3991X^2 – 77.002X + 5057.5 $r^2 = 0.99$	N/A
Kruger	www.krugerseed.com/	63 84 - 117 1225 – 1544	Y = 8.729X + 505.2 $r^2 = 0.98$	N/A
Lewis	www.lewishybrids.com/	61 105 - 118 1436 - 1600	Y = 11.704X + 206.2 $r^2 = 0.96$	N/A
NC+	www.nc-plus.com/corn/corn.html	84 92 - 120 1311 - 1622	Y = 0.1792X^2 – 25.807X + 2147.5 $r^2 = 0.96$	Y = 0.52X – 2.3 $r^2 = 0.87$
Ottilie	www.ottilieseed.com/	44 96 - 114 1306 - 1533	Y = 14.037X – 77.6 $r^2 = 0.97$	N/A
Pioneer	Pioneer Brand Products for 2004-2005 (print)	107 84 - 118 1089 - 1589	Y = 13.419X – 5.9 $r^2 = 0.97$	Y = 0.453X + 97.1 $r^2 = 0.97$
Stine	www.stineseed.com/	35 88 - 115 1206 - 1456	Y = 9.546X + 353.1 $r^2 = 0.99$	N/A
Triumph	www.triumphseed.com/	21 105 - 115 1294 - 1472	Y = 15.1X – 265.8 $r^2 = 0.88$	N/A
GENERIC	pooling of sources above	881 75 – 124 978 - 1722	Y = 11.564X + 196.5 $r^2 = 0.85$	Y = 0.41X + 145.4 $r^2 = 0.78$

* : data of GDD-to-silking are not available.
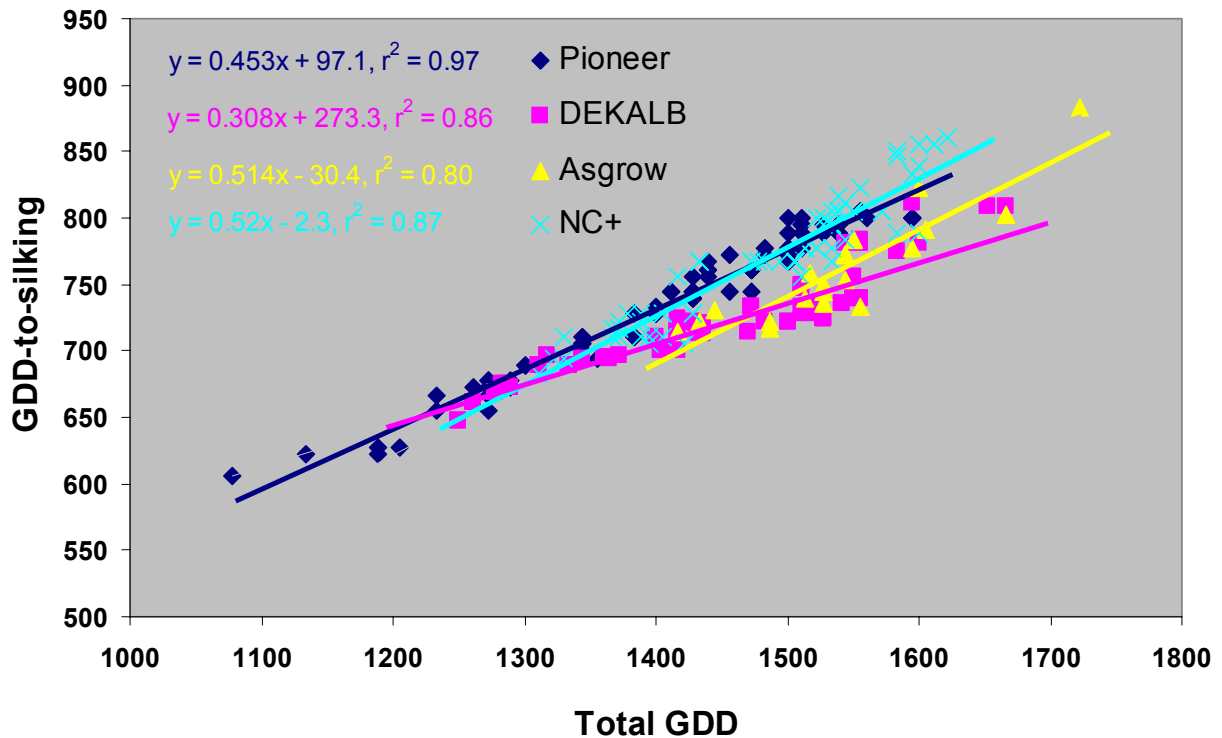
Fig. 4.2. Relationship of GDD-to-silking to total GDD for four commercial maize seed brands. The GDD values refer to $^{\circ}C$.

As reported by Yang et al (2004), GDD-to-silking of maize tends to correlate with total GDD for the same maize brand. Among the 12 seed brands in Table 4.1, four of them have published data of GDD-to-silking. The corresponding regressions of GDD-to-silking to total GDD proved to be seed brand specific (Fig. 4.1). In addition, the goodness of fit of the regression varies among the four brands. As a result, a correct seed brand should be selected when only total GDD is known in order to obtain an accurate estimate of GDD-to-silking for yield simulation. When all data are pooled, the corresponding linear regression function is y = 0.41X + 145.4, r^2 = 0.78. This function is used for the **Generic** brand choice in the model input settings. Although the regression r^2 of the pool data is low (0.78), selecting **Generic** is an acceptable alternative when no seed rand specific information is available.