2. Using the Hybrid-Maize Model

2.1. Installation

System requirements:

- Free disk space: depending on weather data included. Full installation amounts to about 18.5 MB, including 6.8 MB of weather data for selected U.S. Corn Belt states.

- Processor: Pentium II minimum, Pentium III or IV recommended

- Operating system: Microsoft Windows 95/98/2000/or XP

- Video: 256 colors at 800 x 600 screen resolution or better

Installation steps:

The following instructions refer to installation using the purchased CD or download package of the Hybrid-Maize version 2006. For users who upgrade from the Hybrid-Maize versions 2004 or 2005 using the free download upgrade package, please follow the instruction in the file 'Readme for upgrade.txt' in the upgrade zip package.

- **From CD**: Insert CD-ROM and the installation procedure will start automatically if the CD auto run feature of the computer is enabled. If the setup program does not start automatically, use Windows Explorer or **Start → Run [CD drive]\ HM2006_Setup.exe** to manually launch the file **HM2006_Setup.exe** found on the CD. Then follow the on-screen installation instructions.

- **From downloaded zipped package:** unzip the downloaded file **HM2006.zip** into a temporary folder on the computer. Then launch the file **HM2006_Setup.exe** and follow the on-screen installation instructions.

*No questions asked installation: Hybrid-Maize will be installed in the default directory C:\Program files\Hybrid-Maize, including subfolders containing weather data. If a previous version of the Hybrid-Maize program is currently installed, the new version will automatically replace the old version. If the user wants to keep the old version, choose the **Advanced Options Installation** described below and select a different folder.*

Advanced Options Installation: Hybrid-Maize will be installed in the directory chosen by the user, including subfolders containing weather data. When a previous version of the Hybrid-Maize program is currently installed, using this option will enable keeping the old version while installing the new version.

The installation procedure will automatically set up a shortcut for launching the model on both the desktop and in the Programs list in the Windows Start menu on the lower left corner of the screen.

2.2. A Quick Simulation Run

The following example provides an initial trial run with the Hybrid-Maize model with instructions about how to select appropriate input values and how to review the results. We use the default English measurement units in this example. The scenario for this simulation trial run is to simulate maize growth and yield potential (i.e., the yield with optimal irrigation and nutrient supply) in the year 2004 at Clay Center, south-central Nebraska and compare it with the long-term yield potential at this site based on 24 years of weather data. The soil is a deep loess with no significant constraints to growth. Optimal irrigation is provided throughout crop growth

whenever rainfall does not meet crop water requirements. The maize hybrid grown requires 2650 growing degree days (GDD, Fahrenheit based) from emergence to physiological maturity (blacklayer), which represents a comparative relative maturity (CRM) of about 110 d. Maize is typically planted on May 1, and the final plant population is 30,000/acre.

1. Launch the Hybrid-Maize program by clicking on the desktop icon or select from the Start menu. Enter all model inputs based on the description below. If the lower right corner of the front page indicates **Metric units**, then change it to English units by clicking **Settings** on the menu bar, select **General Options** and choose **English units** under the entry Measurements units.

    a. **General Input:** Select the weather file for this site by clicking on the button **Select weather file**. Browse and choose the file for **Clay Center (SC), NE.wth**. Select **Single year** as simulation mode and choose the year **2004** from the drop-down list of available years. Also check the option **with long-term runs**. For **Start from**, use the default option **Planting** and enter **5** as month and **1** as day for a May 1 planting date. Note that the default planting depth is set at 1.6 inch. For **Seed brand**, use the default **Generic.** For **Maturity**, select **GDD50F** and change the default to **2650**, which is the GDD for the hybrid to be grown. For final **Plant population**, change the default value to **30** (=30,000 plants/acre).

    b. **Water:** Select **Optimal** because the goal is to simulate yield potential.

    c. **Soil:** No selection is needed because we assume that irrigation is applied whenever required to avoid water deficit.
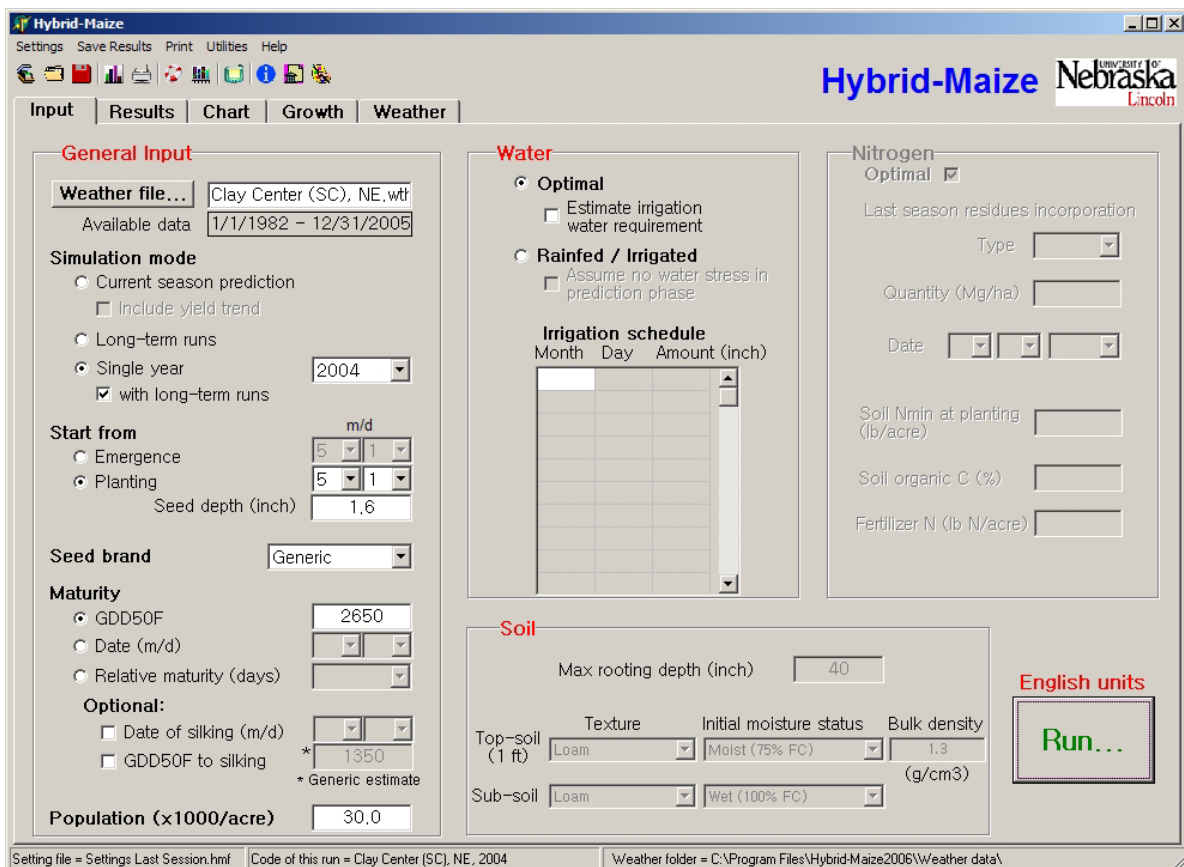
2. Verify all entries. Click on the button **Run…** on the lower right. A beep will sound when the simulation is completed.

3. The first simulation output is a summary table comparing the simulated yield potential in 2004 with the median, 25% and 75% percentiles, the range, the long-term mean and associated coefficient of variance (in %), and the range of the long-term climatic yield potentials simulated using all available weather data from 1982 to 2005 when the same hybrid was planted on May 1 in each of these years. The table provides values for simulated grain yield at standard moisture content (15.5%, in bu/acre), and dry matter yield (in short tons per acre at zero moisture) for grain, stover, and total aboveground biomass. Other data in the table include simulated harvest index (which is the ratio of dry matter grain yield to total aboveground biomass yield), the length of vegetative and reproductive growth periods (**vDays** and **rDays**, respectively, and **V+R**, which gives total days from emergence to maturity), and mean values for climatic variables during the growing season. In this example, simulated yield potential in 2004 (259.6 bu/acre = 16.3 Mg/ha) was about 30 bu/acre (=1.88 Mg/ha) below the maximum yield of 289.1 bu/acre (=18.16 Mg/ha) predicted for this site in 1996, but 18.6 bu/acre (1.16 Mg/ha) above the long-term mean yield. The reasons for the high yield potential in 2004 was a relatively long grain filling period, which resulted from cool mean temperature during grain filling (**rTmean**) that led to increased cumulative intercepted solar radiation (**tSola**) compared to long-term mean values.

Hybrid-Maize

Hybrid-Maize Nebraska Lincoln

Input | Results | Chart | Growth | Weather

○ Individual run
● Across-run summary
☐ Show all years

☐ Allow editing
Upload to spreadsheet

Results of 2004 along with long-term runs using historical weather data from 1982 to 2005

Rank	Year	Gr.Y	Gr.DM	Stover	tDM	HI	vDays	rDays	V+R	tSola	Tmin	Tmax	Tmean	vTmean	rTmea
Best yield	1996	289.1	6.85	5.28	12.12	0.56	66	87	153	67195	55.3	77.9	66.6	69.7	64.3
75% percentile	2004	259.6	6.15	5.95	12.10	0.51	73	66	139	64107	56.6	80.6	68.6	67.6	69.8
Median yield	1997	249.5	5.91	5.18	11.09	0.53	67	59	126	61758	58.9	82.4	70.7	69.2	72.4
25% percentile	1990	221.9	5.26	7.16	12.42	0.42	62	54	116	61877	60.2	84.4	72.3	70.6	74.2
Worst yield	1985	202.2	4.79	5.40	10.19	0.47	77	69	146	68445	54.1	77.5	65.8	66.7	64.8
Long-term mean		241.0	5.71	5.74	11.45	0.50	67	60	127	62481	58.6	82.4	70.5	69.3	72.0
Long-term CV, %		10	10	12	7	9	9	16	11	7	4	3	3	3	5
Task-run	2004	259.6	6.15	5.95	12.10	0.51	73	66	139	64107	56.6	80.6	68.6	67.6	69.8

Among the six years above, frost damage during grain filling occcurred in:
    1985

Overall probability of frost occurrence during grain filling (%) : 8

Note:
  The ranking is based on GRAIN yield.
  Gr.Y is grain yield in bu/acre at 15.5% moisture content, Gr.DM, Stover and tDM are dry matter for grain, stover and total abovegroud biomass in short ton/acre.
  The long-term means are the numerical averages of all years.

Abbreviations:
  HI   : harvest index, i.e., the ratio of grain dry matter to total aboveground dry matter
  vDays : days from emergence to silking (i.e., vegetative phase)
  rDays : days from silking to maturity (i.e., reproductive phase)
  V+R   : days from emergence to maturity
  tSola : total solar radiation from emergence to maturity (Langley)
  tRain : total rainfall from emergence to maturity (inch)
  Tmin, Tmax, Tmean and ETref : mean daily Tmin, Tmax, Tmean, and ET-reference, respectively, from emergence to maturity (F)
  vTmean, rTmean : mean daily Tmean from emergence to silking (i.e., vegetative phase) and from silking to maturity (i.e., reproductive phase), respectively (F)
 tIrri : total irrigation (inch)

User-specified inputs:
  Weather file : Clay Center (SC), NE.wth
  Start from planting on (m/d) : 5/1 (DOY=122)
  Seed brand : Generic
  Total GDD50F : 2650

Setting file = Settings Last Session.hmf | Code of this run = Clay Center (SC), NE, 2004 | Weather folder = C:\Program Files\Hybrid-Maize2006\Weather data\

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4. Graphic presentation of outputs, including growth dynamics and weather data may also be viewed for individual model runs or to compare up to five different model runs at one time. At top of the page, click on the tab **Chart** to view a bar graph of grain yield or other simulated variables, thus allowing visual comparison with the simulated outcomes from other years or the long-term mean value for all years included in the weather database. For long-term runs or single runs with inclusion of long-term runs, click **Five ranks/All years** will toggle between results of ranked years and results of all years.
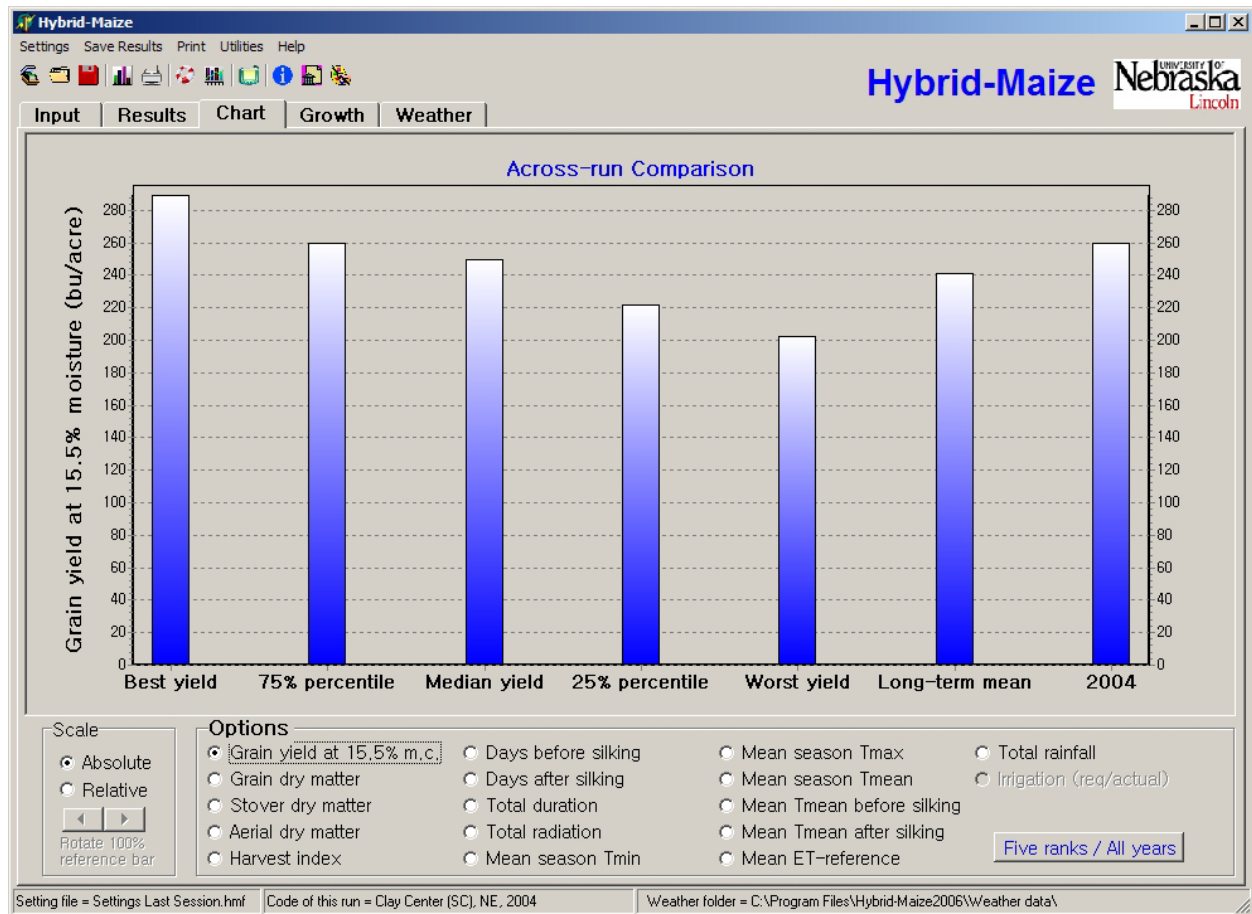
5. Click page tab **Growth**. The growth curves from emergence to maturity for leaf area index (LAI, on the right axis) and total aboveground biomass (total aerial dry matter, on the left axis) are shown for 2004. Select **Stover dry matter**, **Grain dry matter**, and **Root dry matter** in the variable list to add those variables to the graphic display. Click the button **DAE / Date on X-axis** to toggle the time scale on the x-axis between days after emergence (DAE) and the corresponding calendar date. Day of silking is indicated by a short yellow bar, and can be removed by deselecting it in the variable selection list
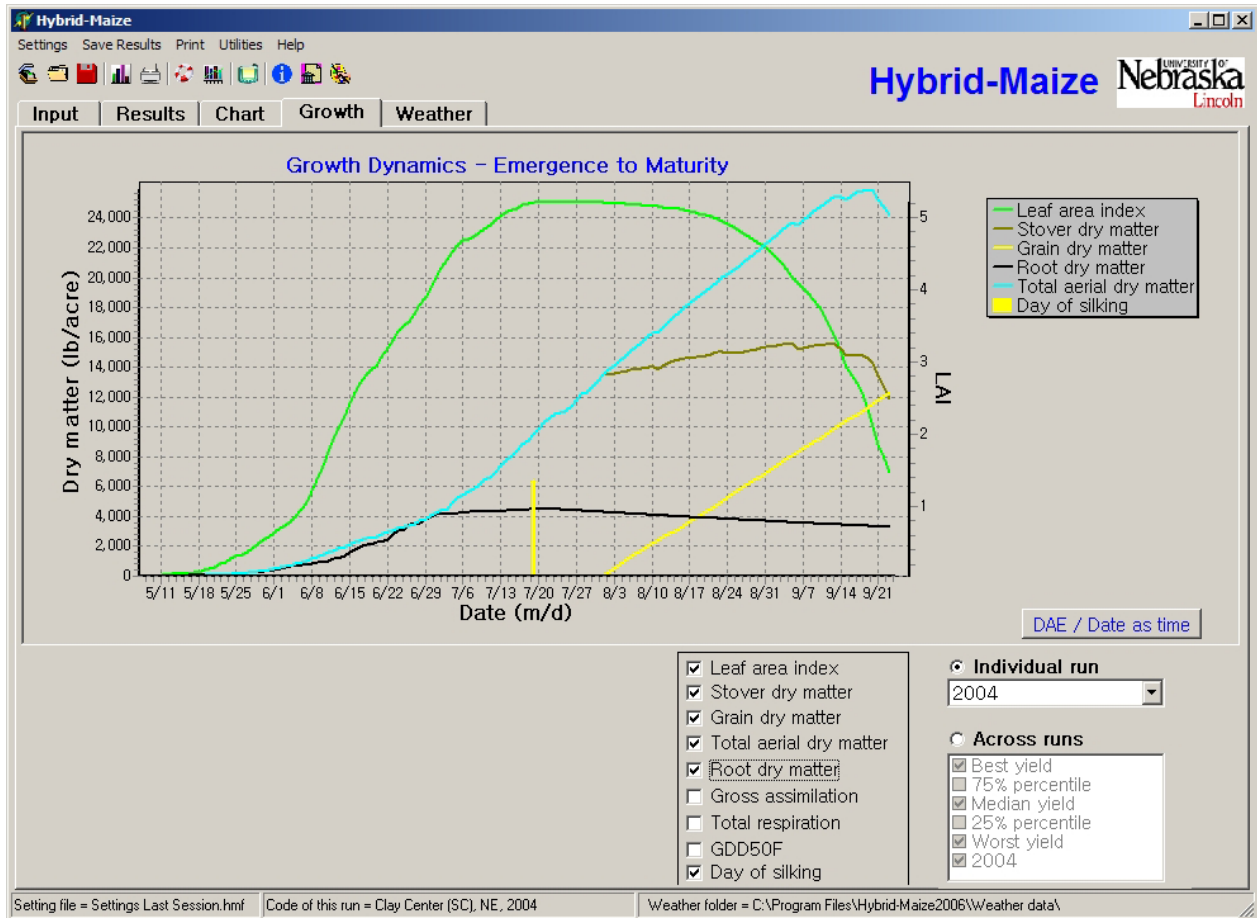
6. Click page tab **Weather** to display the seasonal dynamics of daily maximum and minimum temperatures for 2004 as well as seasonal weather statistics. Select **Rainfall** and **ET-reference** (reference evapotranspiration) to add these variables to the graph (right y-axis is for rainfall and ET units). As on the page **Growth**, day of silking is indicated by a short yellow bar.
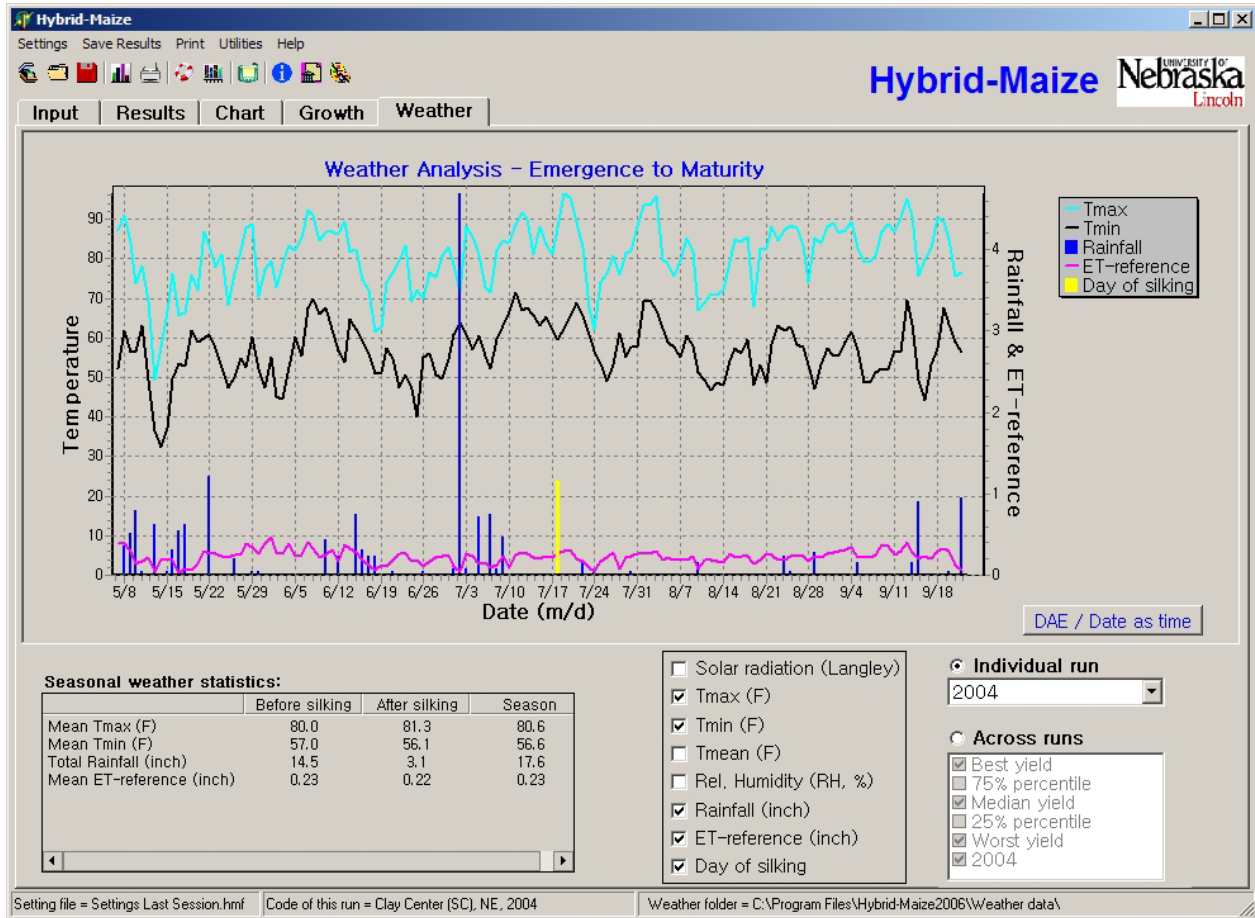
7. To quit the program, either click the **X** on the upper right corner of the window, or go to **Settings** on the menu bar, then click **Quit**, or press **Ctrl-Q**.