width of the combine. When data from the PC card is printed as text, it appears in massive tables.

Three successive lines of yield data from a yield-mapping system are shown in figure 11.7. Using the known bushel weight for each crop, each line of data can be used to calculate the bushels per acre of crop at the sample location. Each line of data thus becomes one colored "square" or "dot" on a yield map.

Yield data in figure 11.7 were collected at one-second intervals. If printed as text onto an 8 ½ x 11 inch page, data from 20 acres would require about 100 pages. It thus becomes obvious why any field sensor used in precision farming to collect data at small time intervals creates extensive amounts of data — even for a typical farm in a single year. Field maps become an efficient method to present and understand these large volumes of information (figure 11.8).

Not all yield sensors have GPS and mapping processors. These systems simply give in-cab readings of yield and are referred to as yield monitoring systems. Yield maps may not be created and data are not recorded. A yield monitor can be a low-cost and simple approach to help determine if your fields have enough yield variation to encourage use of precision farming.

Support Services

Sophisticated gadgets will not replace the need for strong human input into precision farming. Judgment of farmers and their advisors will play a key role in data collection and final decisions implemented. Computer models, satellites, and complicated electronics will all help, but are only tools. The old rule of "garbage in, garbage out" will apply to precision farming.

People will ultimately be responsible for making the equipment perform properly and assuring that quality data are used in decision-making. For example, are enough soil samples taken and are they properly collected and analyzed? Are yield monitors calibrated? Are fields frequently and thoroughly scouted for all probable problems?

Although some farmers will perform all a sion farming, many will rely on support se Independent consultants, consultants working for regional co-ops or independent fertilizer and chemical dealers, the extension service, and other input suppliers all can provide services for precision farming.

Many services require specialized skills. For example, effectively using complex GIS software requires well-trained individuals who also understand the principles of crop production.

Field scouting is another important human role required with precision farming. Precise actions can only be taken when there is a detailed understanding of problems within a field. Aerial photographs and remote sensing may assist scouting, but many times this input will come too late for action to be taken that season or will need to be ground-truthed to determine the actual cause.

Soil sampling, data storage, agronomic recommendations, instrumentation, remote sensing, and financial analysis are other examples of skills that are necessary to effectively use precision farming. Specialists will not need to be hired in all these areas, but it is important to develop a working relationship with those individuals needed. They should understand local conditions and have your trust.

3. Integrating Precision Farming

There will be three steps most producers will move through in their use of precision farming. These steps will not be totally independent, but recognizing each helps develop a better game plan:

Step 1: Agronomic data gathering.

Step 2: Improved crop management decisions.

Step 3: Financial management integration.

The first step involves gathering of agronomic data. Much of this data will need to be collected for a number of years to be of maximum use.

Data in a Yield-Mapping System

Longitude	Latitude	Grain Mass lb/sec	Time sec	Travel Distance inches	Grain Moisture %	Crop Yield Bu/a
90.098785	41.672234	20.80	30402803	64	17.3	
90.098785	41.672203	20.05	30402804	66	17.0	
90.098785	41.672188	19.13	30402805	64	17.3	

Figure 11.7. Three successive lines of data captured at one-second intervals on a yield-mapping system. Each line of data can create one data point on a yield map.

Yield Map of a Corn Field

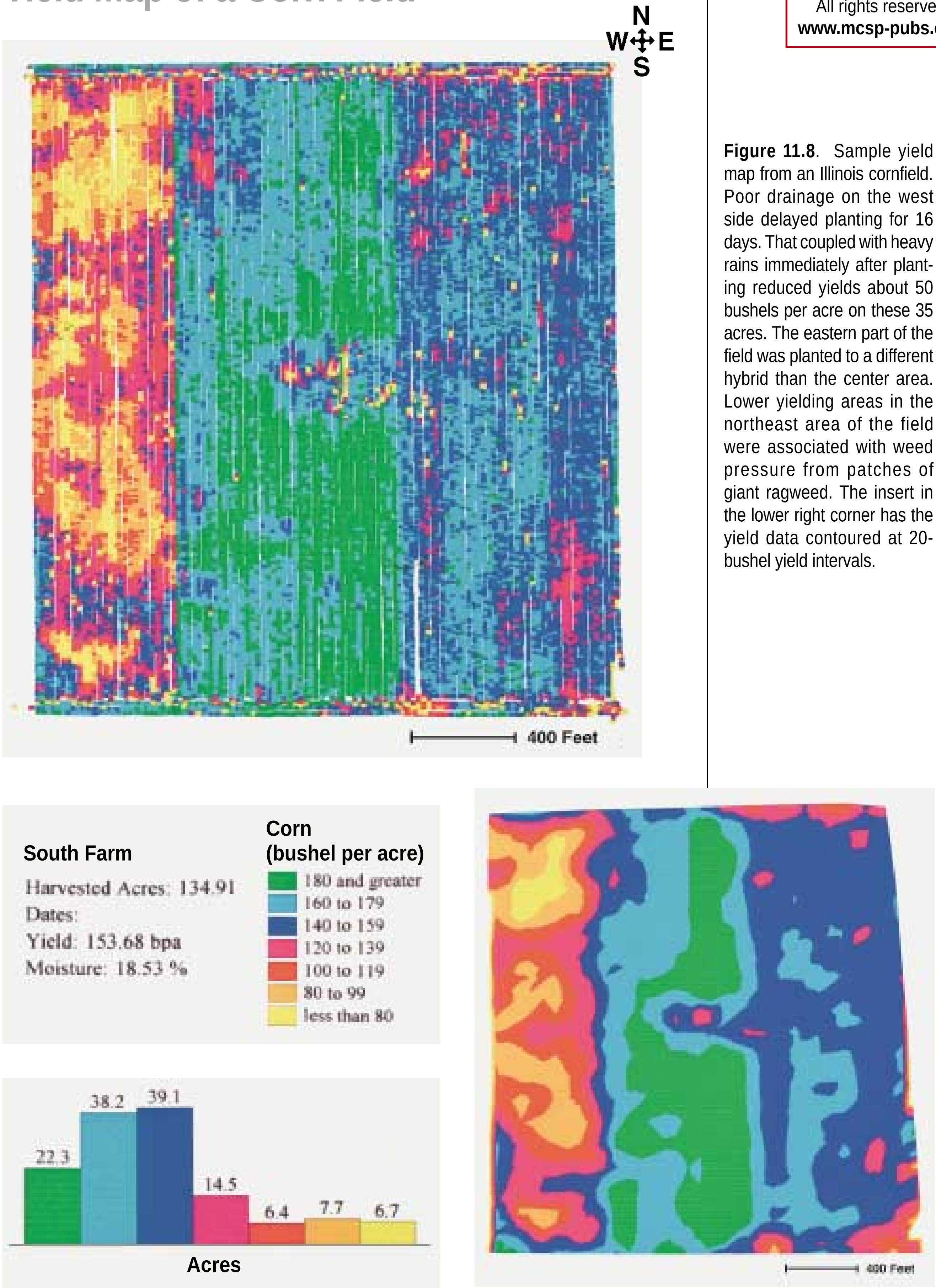

Figure 11.8. Sample yield map from an Illinois cornfield. Poor drainage on the west side delayed planting for 16 days. That coupled with heavy rains immediately after planting reduced yields about 50 bushels per acre on these 35 acres. The eastern part of the field was planted to a different hybrid than the center area. Lower yielding areas in the northeast area of the field were associated with weed pressure from patches of giant ragweed. The insert in the lower right corner has the yield data contoured at 20-bushel yield intervals.