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& SERVICES](#)
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& ANALYSIS](#)
[NEWS  
& COMMENTARY](#)
[My Local Pioneer Team](#)
[My Farm & Accounts](#)

## Crop Insights: Putting Variable-Rate Seeding to Work on Your Farm

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- [Summary](#)
- [Developing a Variable-Rate Strategy](#)
- [Selecting a Hybrid and Seeding Rates](#)
- [Creating and Implementing a Field Prescription](#)
- [Evaluating VRS Prescription Effectiveness](#)
- [Interpreting the Results](#)
- [Sources](#)

### Summary

- Extensive field research has documented the value of planting higher seeding rates in more productive field areas and decreasing rates where productivity is lower.
- To maximize VRS value, appropriate crop management zones must be defined for the field. Long-term yield maps are usually the best source to determine management zones.
- To help understand appropriate seeding rates for each management zone, Pioneer has conducted hundreds of population trials across North America. Growers may also have their own data to include for this purpose.
- Growers should typically designate three to four seeding rates per field. To be meaningful, seeding rates should differ by at least 3,000 to 4,000 seeds/acre.
- Create each field prescription using mapping software and export the prescription to a storage device (USB device or memory card). Field prescriptions should include check strips or blocks to evaluate prescription effectiveness.

Each year, more new planters come with variable-rate capability, and more farmers report using this feature to vary corn seeding rates. Those using the technology expect it to help increase yields as well as maximize the value of their seed investment. With today's high grain prices, the value of any yield increase is further enhanced.

The growing number of VRS-enabled planters and widespread on-farm use of GPS technology make it easier than ever to deploy a VRS strategy. However, growers still need reliable methods to identify candidate fields, select appropriate seeding rates and evaluate whether their strategy ultimately worked. This *Crop Insights* will discuss guidelines for developing a VRS strategy, designating management zones, selecting seeding rates, creating and implementing a field prescription, and determining if the strategy actually improved profitability.

### Developing a Variable-Rate Strategy



A growing number of VRS-enabled corn planters allows for more widespread implementation of variable-rate seeding strategies.

Growers new to VRS may benefit by partnering with someone knowledgeable in this area, such as a farmer group, consultant, or Pioneer sales professional.

The first step in developing a VRS strategy is to identify candidate fields. Such fields require sufficient variation in yield potential to warrant VRS strategies:

- VRS has limited potential value in higher-yielding fields with minimal variability of < 50 bu/acre.
- VRS has higher potential value in lower-yielding fields with variability of >100 bu/acre.
- To maximize VRS value, appropriate crop management zones must be defined for the field.

Designating management zones within a field is usually based on one or more of the following:

- Yield map results over several years (**Appendix 1a**). Long-term yield maps are usually the best source to determine management zones
- Crop productivity ratings based on soil type (**Appendix 1b**)
  - Soil type maps alone are often inadequate for delineating management zones
- Topography, landscape, slope or drainage (**Figure 1**)
- Grower knowledge of yield history, cropping history, and general productivity of field areas
- Soil electrical conductivity and/or soil color
- Remote imagery (aerial and satellite), NDVI, bare soil, crop vigor

The grower is best qualified to identify management zones that will be stable from year to year, based on consistent performance trends over years. For example, low-lying field areas may perform best in dry years and poorly in wet years, and the grower is most familiar with such nuances.

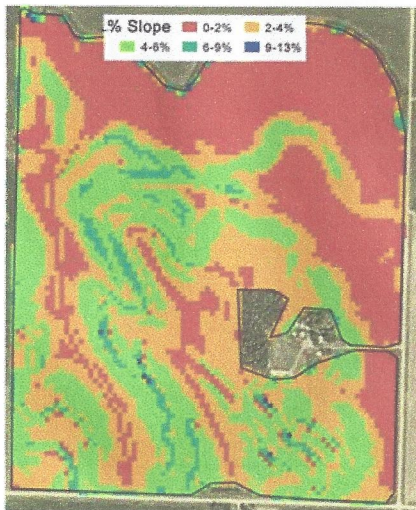


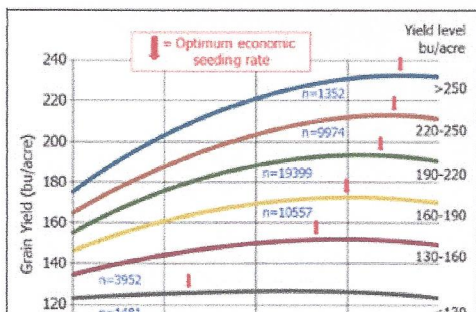
Figure 1. Slope maps provide a valid basis for delineating management zones. For this field, however, soil and yield maps provided a better basis (see **Appendix**).

[back to top](#)

### Selecting a Hybrid and Seeding Rates

**Selecting a Hybrid:** The next step is selecting the proper corn hybrid for the field, taking into account the range of possible growing conditions and resulting yield potential of field areas. Your local Pioneer sales professional can help identify the right product for your growing environment.

**Selecting Seeding Rates:** Extensive field research has documented the value of planting higher seeding rates in more productive areas and decreasing rates where productivity is lower. In addition, many growers have their own data on variable planting rates gathered using yield monitors. Pioneer also conducts numerous field trials annually in North America to help understand grain yield response to planting rate across yield levels (Butzen, 2011). **Figure 2** and **Table 1** depict this response and the resulting suggested planting rates, respectively. The graph and table are derived from studies conducted in dozens of Pioneer Agronomy Sciences research locations from 2007 to 2011. Over 100 hybrids were included in the studies.



levels, 2007 to 2011. Arrows indicate the economically optimum seeding rate within each yield level\*. Data averaged across hybrids, n = number of observations.

\*5% overplant assumed in calculating economic optimums.

Table 1. Recommended planting rates by yield level, based on Pioneer plant population studies, 2007 to 2011.

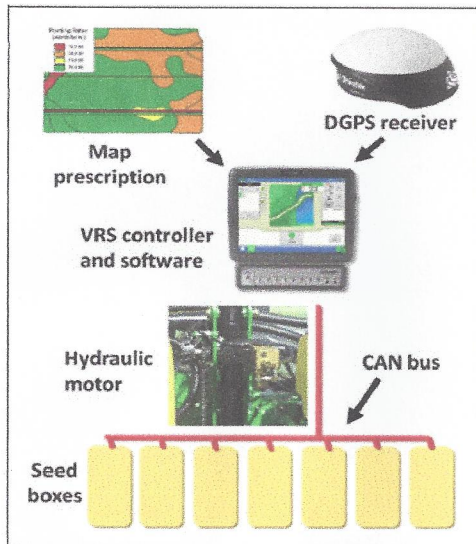
| Corn Grain Yield Level (bu/acre) | Recommended Planting Rate (seeds/acre) |
|----------------------------------|--|
| >250                             | 38,000-40,000                          |
| 220-250                          | 37,000 - 39,000                        |
| 190-220                          | 36,000 - 38,000                        |
| 160-190                          | 34,000 - 36,000                        |
| 130-160                          | 31,000 - 34,000                        |
| 100-130                          | 25,000 - 30,000                        |
| <100                             | 20,000 - 24,000                        |

Growers should typically designate three to four seeding rates per field. To be meaningful, seeding rates should differ by at least 3,000 to 4,000 seeds/acre.

[back to top](#)

### Creating and Implementing a Field Prescription

- Create each field prescription using mapping software and export the prescription to a storage device (USB device or memory card). This should include check strips or blocks to evaluate prescription effectiveness (see [Appendix](#)).
- Upload information to your variable-rate controller. Set parameters correctly, including offset distance between GPS receiver and planter units. **Make sure the controller is set to record as-planted information!**



Processes involved in implementation of VRS prescription.

[back to top](#)

### Evaluating VRS Prescription Effectiveness

**Setting up Checks** - There are two common methods of evaluating the effectiveness of VRS prescriptions - planting "check" blocks or strips at rates higher and lower than those prescribed for the management zone. By comparing performance of the prescribed rates vs. these "check" rates, the effectiveness of the prescription can be determined.

**Blocks:** Place blocks of higher and lower planting rates inside at least one management zone of each prescription rate (see square blocks with black borders in the [Appendix 1a](#) prescription planting rate map). Make sure the check block is well within the zone rather than on the edge, and that it does not comprise most of the area of the zone. Each check block typically encompasses about one to two acres in area and is relatively square.

several management zones (**Appendix 1b**). A strip should be placed so that it crosses management zones of most or all other rates. There should be at least one strip for each designated seeding rate. Strips are typically one planter pass wide.

**In-season Monitoring** - After stand establishment, take stand counts in the different planting rate zones and check areas (blocks or strips). It is important to verify that target populations were actually attained to assure the validity of the test. Pay special attention to high stress areas such as poorly drained spots or high crop residue areas.

[back to top](#)

**Interpreting the Results**

- Use yield mapping or Geographic Information System (GIS) software to compare yield results. Compare yields within check blocks or strips to yields in areas immediately adjacent to these checks.
- Did higher seeding rates produce greater yields in the low productivity zones? Did lower seeding rates produce equal yields in the high productivity zones? If yes, then adjust the prescription planting rates accordingly next time corn is planted in the field.
- Evaluate profitability by comparing yields and accounting for seed costs for any two rates in question. If there are additional costs to implementing the VRS strategy, include these costs in your equation.
- Repeat planting comparisons in different fields over several years to better understand the value of variable- or uniform-rate seeding strategies.

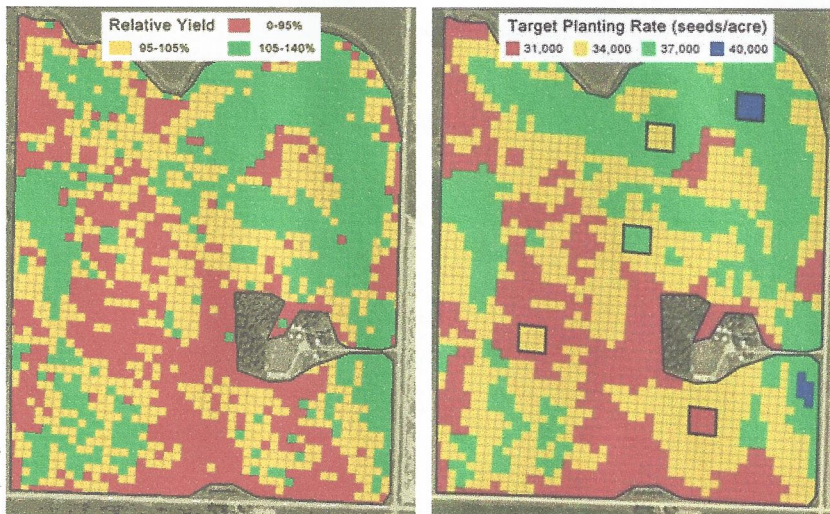
[back to top](#)

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**Appendix 1a.** Left: Four-year yield map expressed as relative yield (% of field average). Right: Prescription planting rate map based on relative yield map. Includes check blocks to evaluate effectiveness of prescribed rates.

