Cornell University
Cooperative Extension

Agronomy Fact Sheet Series **Fact Sheet #124**

Single-Strip Spatial Evaluation Approach

Conducting on-farm research is the most reliable way to answer questions like "Can I reduce nitrogen side-dress rates?", "Should I add sulfur?", or "Does planting green impact the corn crop that follows?". On-farm research can help a farmer improve overall production efficiency, farm profitability, and environmental stewardship. In the past, on-farm research required randomized trials with at least *four* replications (randomized complete block designs, see Agronomy Fact Sheet #68). This approach takes up space and can slow down field work during busy times on the farm. Here we introduce a new approach, the Single-Strip Spatial Evaluation Approach (SSEA), that takes away a major barrier to implementing on-farm research and provides more reliable results.

Why SSEA?

Because yield monitors take readings every second as a harvester goes through a field, they generate dense spatial data, allowing for targeted evaluations and improved statistical analysis. The SSEA uses yield monitor data to answer research questions using a single treatment strip per field (Figure 1).

How Does SSEA Work?

There are six steps to be followed when conducting on-farm research using the SSEA.

Step 1: Equipment requirement

Use of the SSEA requires harvesting with a yield monitor system to collect yield and moisture data every second during harvest. Reliable data are essential, so farms that conduct on-farm research using SSEA will need to ensure yield monitor systems are well-calibrated (Agronomy Fact Sheets #104, #105).

Step 2: Define the study question

A study question in the SSEA consists of a comparison of two treatments, typically a "business as usual" approach versus a management change such as a different application rate, change in tillage method, change in timing, method of application, or materials.

Step 3: Select field and strip location

The SSEA is most useful for farms that already have yield stability zone maps (Figure 1). In such maps, each field has up to four colors: green for zones that are consistently (across years) yielding higher than the whole farm average yield, red for zones that are consistently low yielding (below farm average), and blue and yellow for zones that are highly variable in yield over the years but on average higher (blue) or lower (yellow) than the whole farm average. For more information on yield stability zone maps, see Agronomy Fact Sheet #123.

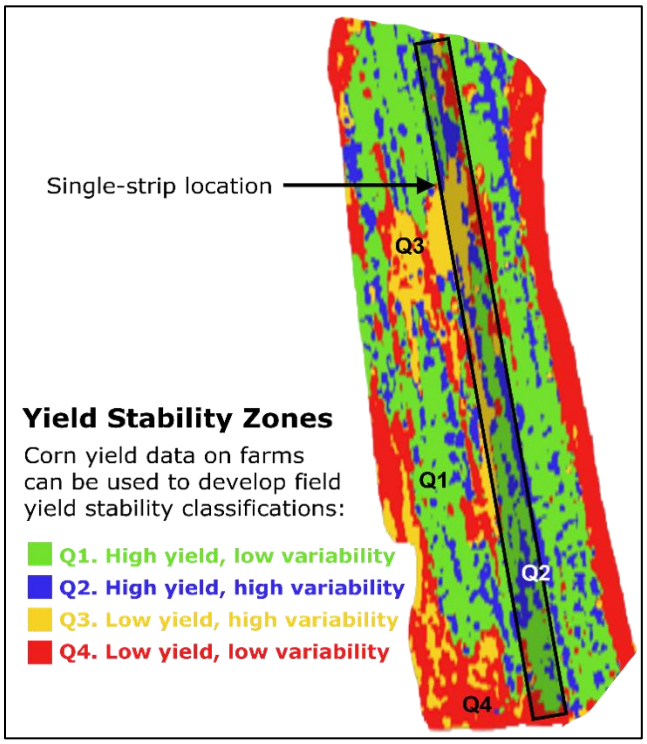

Figure 1: When a farm has yield stability zones (requires three years of yield data or more), the single-strip spatial evaluation approach (SSEA) can target specific zones by placing single-strip treatment covering a specific set of zones (mostly green and blue in this example).

Field selection will be determined by the research question. For example, if a farmer wants to know if more N is needed for higher-yielding areas, fields with green yield stability zones should be selected.

The SSEA *can* be used without zone maps, but conclusions can only be drawn for the area where the strip was placed and the control strips surrounding it (not per zone). If a farm has less than three years of yield monitor data for a row crop (corn silage, corn grain, soybeans, small grains), it is recommended to continue to collect yield data so that yield stability maps can be generated in future years and research findings can be extrapolated to other fields.

Step 4: Implement the strip

Trial implementation requires putting in a single strip of an alternative treatment across a field in the direction of harvest (longer=better). The strip width must be at least two and no more than four chopper or combine widths and have adequate space for equally wide control strips on both sides (*do not place the strip at the field edge*). All other crop management practices (pest control, seed bed preparation, fertility management, etc.) should be applied uniformly across the entire field including the strip area. Mark both the name of the field and the strip location in the field (GPS coordinates for each of the four corners). The GPS locations will be essential for evaluating yield data and drawing conclusions.

Step 5: Data collection

Ensure the yield monitor is well-calibrated, flow and moisture sensors are working properly, and data are cleaned post-harvest. Harvest the field as if the trial were not in it (do not stop or adjust for harvesting of the strips) to ensure data quality. If additional information (e.g. corn stalk nitrate test, forage quality, or soil samples) is helpful to answer zone-based research questions, make sure to sample (and geo-reference) both within and left and right of the actual strip location within a zone.

Step 6: Statistical analyses

Yield data within the strip and both sides directly surrounding it are used to evaluate if the treatment impacted yield that year using a spatial regression model. Yield responses are evaluated per zone. The statistical model determines if the treatment impacted yield. Table 1 represents our level of confidence in the estimated average yield response. This allows a farmer to compare which zones achieved the yield response needed to cover the cost of treatment and where the management change was less likely to pay off.

Table 1: Example of results of a single-strip spatial evaluation approach (SSEA) in a field with four yield stability zones (Q1, Q2, Q3, Q4). The table shows how confident we are that a specific yield response was obtained.

Confidence table for treatment yield response

	Yield response (tons/acre)	Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)
Loss	≤ −1.00	0	0	0	0
	≤ −0.75	0	0	0	0
	≤ −0.50	0	0	0	0
	≤ −0.25	1	1	0	0
Benefit	≥ 0	97	95	100	100
	≥ 0.25	90	85	100	100
	≥ 0.50	76	65	99	100
	≥ 0.75	55	40	95	98
	≥ 1.00	33	19	87	92
	≥ 1.25	15	6	71	79
	≥ 1.50	5	2	49	59
	≥ 1.75	1	0	27	36
	≥ 2.00	0	0	12	17

High | Somewhat | Neutral | Low | Not confident

New York On-Farm Research Partnership

A farmer who shares yield and SSEA data with the New York On-Farm Research Partnership, will receive a report that show impact of the treatment per zone as illustrated in Table 1. Sharing of data aids in development of science-based guidance. Individual farm data or reports will be held strictly confidential.

Additional Resources

- Nutrient Management Spear Program Agronomy Fact Sheet Series: nmsp.cals.cornell.edu/index.html.
- New York On-Farm Research Partnership: nmsp.cals.cornell.edu/NYOnFarmResearchPartnership/.

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information

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Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

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2022