MISSISSIPPI STATE UNIVERSITY EXTENSION

Beyond Variety Selection: Management Strategies for Reducing Effects of Iron Deficiency Chlorosis in Soybean

Background

Iron deficiency chlorosis (IDC) is common when soybeans are grown on calcareous soils, such as those in the Black Prairie region of Mississippi. Symptoms include:

- Interveinal chlorosis (Figure 1)
- Reduced root nodule formation
- Reduced yield
- Plant death

The severity of IDC symptoms can be affected by several soil properties:

- High calcium carbonate ($CaCO_3$) content
- High soil pH
- High nitrate (NO_3^-) content
- Wetter soil conditions

Symptoms typically appear during the V1–V3 growth stages, but some plants may have lingering symptoms (Figure 2). Some plants may recover on their own if plant growth conditions improve.

Variety selection is the first line of defense for alleviating IDC symptoms. However, research has shown that higher yields can be achieved when a tolerant variety is combined with select management practices known to decrease symptoms.

Figure 1. Interveinal chlorosis on a soybean plant affected by IDC.

Figure 2. A field with IDC symptoms (the light green areas of the field).

Management Strategies

- Reduced IDC symptoms and increased yields have been seen when soybeans are rotated with corn in alternate years.
- In areas where soil nitrate is high, using an oat cover crop can help reduce IDC symptoms.
  - Oats take up excess nitrates and moisture from the soil, which can create more favorable conditions for soybeans.
  - Oats are the most used cover crop to alleviate IDC symptoms due to their low cost, availability, and ease of termination with glyphosate.
  - Legume cover crops would add nitrogen to the soil profile and possibly have a negative impact.
- Other studies have shown that planting soybeans at 150,000 seeds per acre or more in wide rows (30 inches) can reduce chlorosis symptoms. Soybeans release acids from their roots to change iron into a form that can be absorbed. Higher seeding rates take advantage of this process and allow for more root activity among young plants.
- Plant IDC tolerant varieties.
- Use iron chelate (Fe-EDDHA) as a seed treatment or apply in-furrow at planting.

Plot Study

From 2019 to 2022, seven different cropping systems were tested, along with two seeding rates (160,000 and 120,000 seeds per acre) and six selected varieties (three more-IDC tolerant and three less-IDC tolerant) (Table 1). Visual ratings were taken weekly throughout the growing season starting at V2 growth stage (Figure 3). Less severe IDC symptoms resulted in a lower rating, while more severe symptoms resulted in a higher rating. Grain yield was harvested for each plot.

Table 1. Cropping systems evaluated from 2019 to 2022.

System	Seeds per acre
Planting after corn	160,000
Planting after corn + oat cover	160,000
Planting after soybean + oat cover	160,000
Planting after soybean + oat cover + roller	160,000
Planting after soybean + roller	160,000
Planting after soybean + roller	120,000
Planting after soybean	160,000

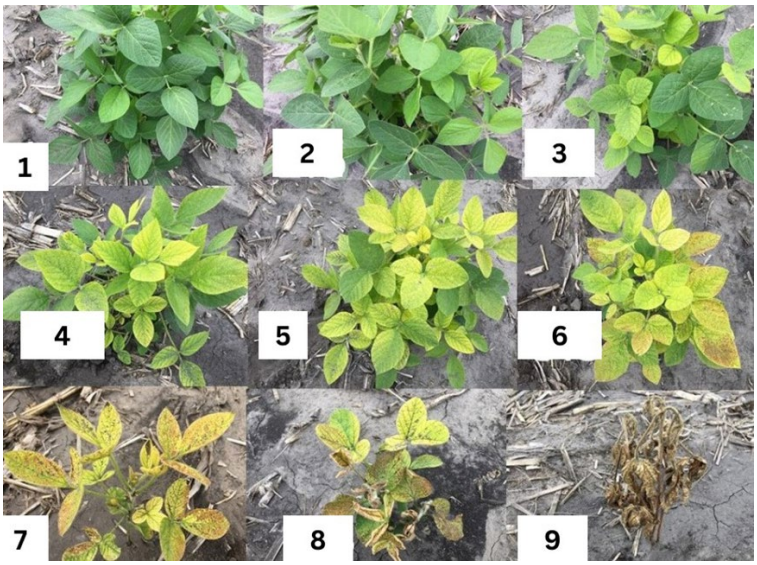

Figure 3. IDC rating scale. Used with permission from North Dakota State University.

Results

- Cropping systems containing a corn rotation in alternate years produced significantly higher grain yield than the other five systems (Figure 4).
- Cropping systems planted in continuous soybeans yielded significantly higher with an oat cover crop than continuous soybeans with no cover crop and simulated compaction.
- Symptoms still occurred in corn rotation, but cropping systems containing a corn rotation had lower IDC ratings than cropping systems in continuous soybeans (Figure 5).

Recommendations

- Plant IDC tolerant varieties.
- Rotate corn and soybeans in alternate years.
- Incorporate an oat cover crop in fields planted in continuous soybeans.
- Reduce saturated soil conditions if possible.
- Identify areas historically prone to IDC for management.

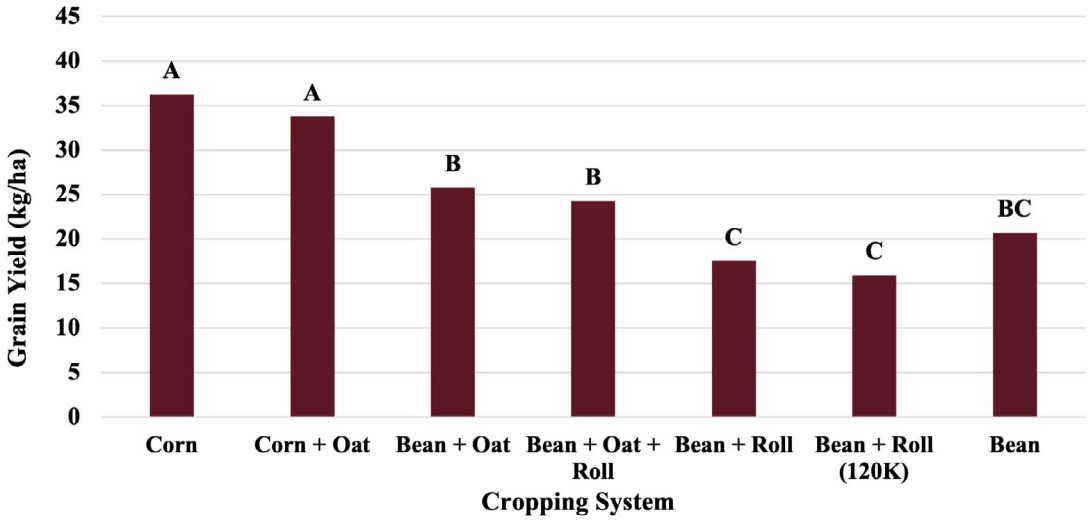

Figure 4. Average grain yield (bu/ac) by cropping system.

Cropping System	Yield (bu/ac)	Tukey Group
Corn	32.6	A
Corn + Oat	30.5	A
Bean + Oat	22.0	B
Bean + Oat + Roll	21.2	B
Bean + Roll	12.7	C
Bean + Roll (120K)	11.6	C
Bean	16.6	BC

Tukey groups that share a letter are statistically similar.

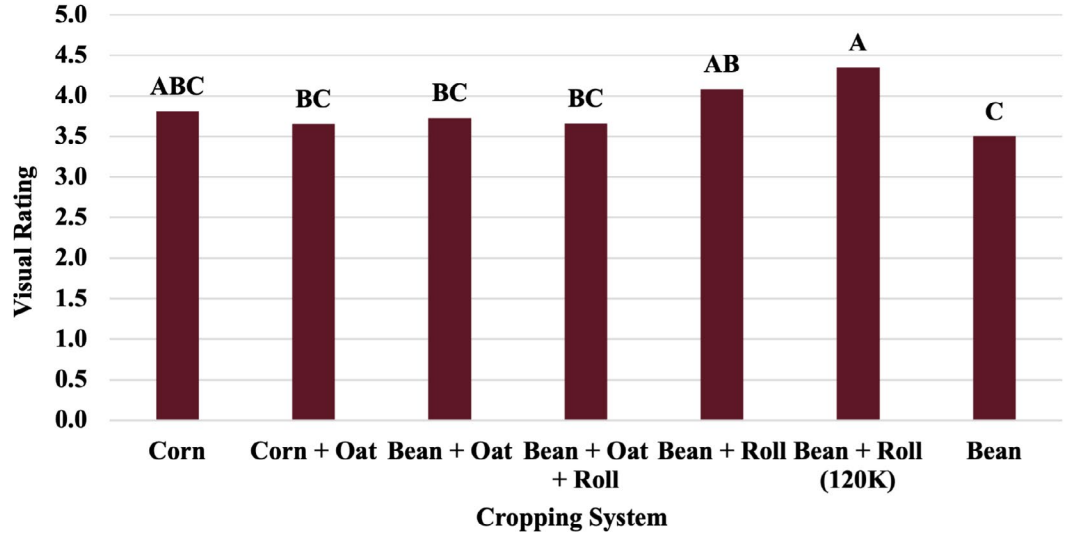

Figure 5. Average IDC visual rating by cropping system.

Cropping System	Rating	Tukey Group
Corn	3.8	ABC
Corn + Oat	3.7	BC
Bean + Oat	3.7	BC
Bean + Oat + Roll	3.7	BC
Bean + Roll	4.1	AB
Bean + Roll (120K)	4.3	A
Bean	3.5	C

Tukey groups that share a letter are statistically similar.

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