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GEOINT – Precision Ag

SOYBEAN CROP ANALYSIS

This high-resolution multispectral comparison of a Midwest soybean field across three flights (July 26, August 22, and September 12, 2026) shows strong mid-season vigor and competitive 50+ bu/ac yield potential (cores 62–70), with NDRE/LCI still holding in the best zones—while RGB and NDVI on September 12 confirm field-wide late-R6/R7 senescence, persistent anomalies (central island, compaction tracks, edges), and several thousand dollars in opportunity cost that now require immediate ground-truthing, harvest timing, and targeted next-season fixes.

July – August –
September 2026

Soybean Crop Comparative Analysis July to September

RGB – 7/25/26 vs RGB 8/22/26



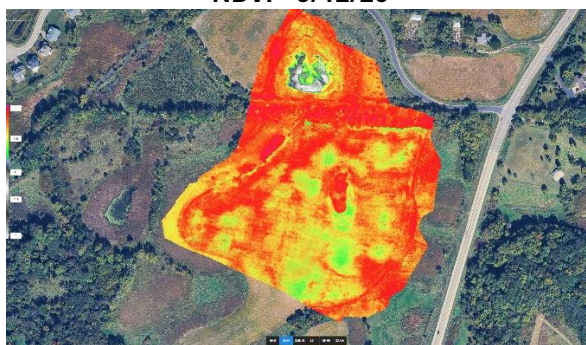
RGB – 9/12/26



NDVI – 7/25/26 vs NDVI 8/22/26



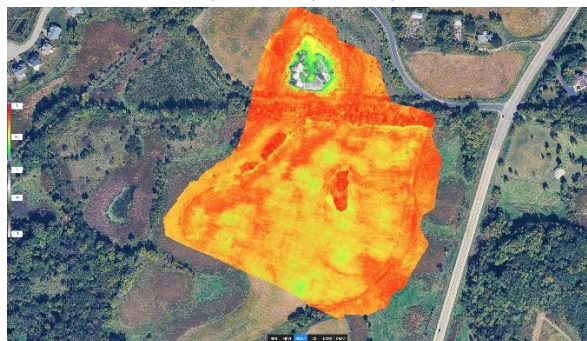
NDVI – 9/12/26



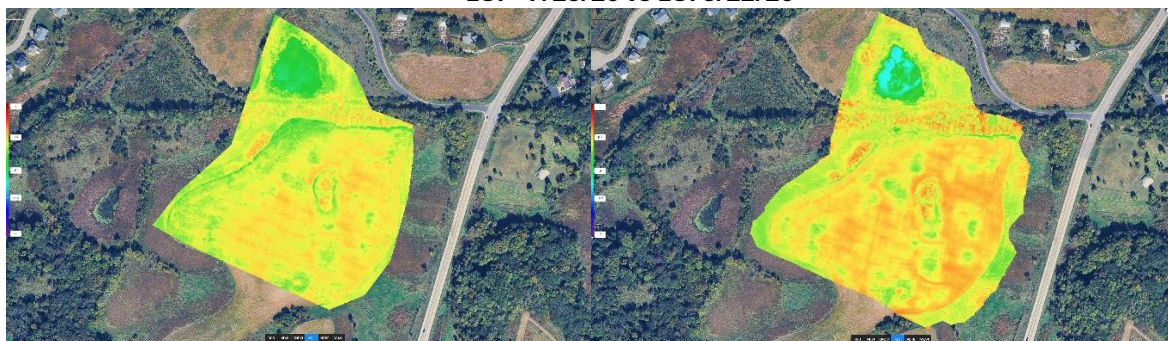
GNDVI – 7/25/26 vs GNDVI 8/22/26



GNDVI – 9/12/26



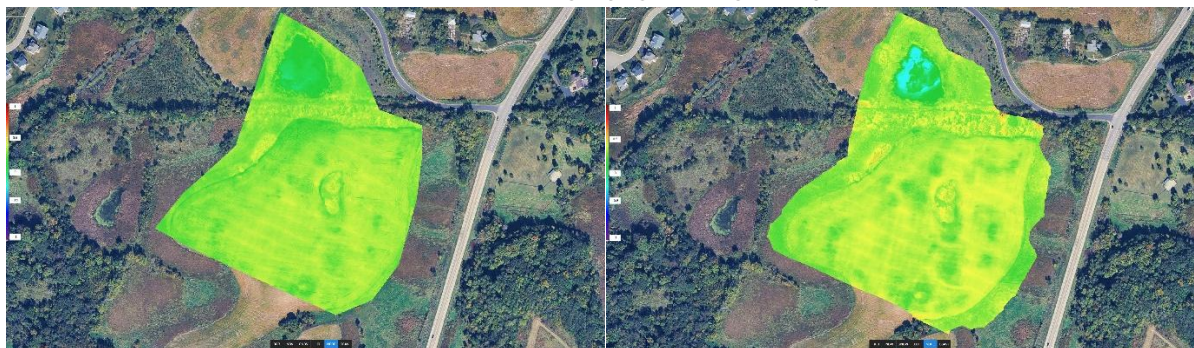
LCI – 7/25/26 vs LCI 8/22/26



LCI – 9/12/26



NDRE– 7/25/26 vs NDRE 8/22/26



NDRE– 9/12/26



OSAVI– 7/25/26 vs OSAVI 8/22/26



OSAVI– 9/12/26



Comparative Analysis

Comparison of three high-quality DJI M3M multispectral UAV flights over the same soybean field (UTM Zone 15N): July 26, 2026 vs. August 22, 2026 vs. September 12, 2026. All used ~56 m AGL, ~1.56–1.58 cm GSD original / 1.64 cm/px output, 472–473 photos, all Fix RTK POS, georeferencing RMSE ~0.018–0.019 m, and strong overlap (>10 in core). July coverage ~0.100 km² (~24.7 acres); August ~0.118 km² (~29.2 acres); September ~0.118 km² (~29.2 acres) after minor boundary differences (July slightly trimmed). Primary crop zone is the central-to-southern cultivated area (visually ~20–25 acres); northern pond/wetland + surrounding brush/woods are non-crop.

1. Image-by-image interpretation

RGB (true color)

July: Uniform medium-green soybean canopy with visible row structure, lighter patches (possible thinner stand or early stress), distinct central circular tree/brush island, and northern irregular pond/wetland with surrounding vegetation. Edges transition sharply to woods/brush.

August: Similar overall green but slightly more mature/dull tone in places; central island and northern wetland still prominent; some lighter tracks or stress patterns more visible. Indicates closed canopy in primary zones with limited bare soil exposure. Surrounding high-green areas are brush/wetlands, not crop.

September : Distinct field-wide color change. The primary canopy is olive-to-yellow-brown rather than lush green. Row structure still visible. Central island and northern wetland unchanged. This is visual senescence (typical late R6–R7), not just localized stress.

NDVI (biomass / canopy density; red = high ~0.8–1, blue/green = low)

July: Predominantly deep red (high biomass) across primary crop with concentric lighter orange rings and lower values near the central island and some edges. Northern wetland shows mixed green/yellow (non-crop vegetation).

August: Still mostly high red but with more internal variation—darker red cores, more orange/lower pockets, and clearer definition of the central low-vigor circle and linear features. Indicates strong overall biomass that has begun to differentiate spatially by mid-to-late reproductive stages; soil influence limited except in anomalies.

September 12: Clear loss of uniformity. High red remains in parts of the north and some cores, but large yellow-green zones appear in the south-central field and around the island. Biomass/greenness is declining spatially as the canopy yellows and thins.

GNDVI (green NDVI; chlorophyll/biomass sensitive)

July: High orange-red across the field, similar spatial pattern to NDVI but slightly smoother.

August: Remains high orange-red with more pronounced lower (yellow-green) zones near center and edges. Supports high canopy greenness early, with some mid-season differentiation.

September 12: Orange-red still dominates, but yellow-green lower zones are prominent in the southern half and around the central anomaly. Aligns with NDVI: mid-to-late season chlorophyll/biomass differentiation is now obvious.

LCI (Leaf Chlorophyll Index)

July: Mostly yellow-green with orange lower-chlorophyll patches and rings.

August: More heterogeneous yellow-orange-green mosaic; lower (more orange/red) zones expand around the central anomaly and some linear tracks. Indicates chlorophyll variability increasing; soil or stress influence visible in anomalies.

September 12: Main crop mostly green-to-yellow-green and more uniform in the central-south than August. Orange-yellow persists at edges, a northern band, and the island ring. Chlorophyll in remaining green tissue is still relatively high in cores.

NDRE (red-edge; best for chlorophyll / N status in dense canopies; less saturation than NDVI)

July: Relatively uniform light green-yellow (moderate-to-high chlorophyll) with subtle lower pockets near center and edges.

August: Still mostly uniform light green-yellow but with clearer lower-value (slightly darker or more variable) zones around the central island, some tracks, and edges. Critical for late-season assessment: values remain supportive of good chlorophyll but show early differentiation consistent with beginning senescence or localized stress rather than uniform stay-green.

September 12: Main cultivated area remains quite uniform bright lime-green. Yellow-orange at edges, northern strip, and island; pond cyan. NDRE is holding better than NDVI/RGB. That split is expected: NDRE tracks chlorophyll in remaining green leaves after NDVI and true-color begin to register yellowing and thinning.

OSAVI (Optimized Soil-Adjusted VI; reduces soil background effects)

July: Predominantly dark blue/purple (high vegetation signal) with some lighter patches.

August: Similar high blue/purple but with more internal texture and lower (lighter) areas matching other indices' anomalies. Confirms that soil influence is minor in the primary crop zone; anomalies are canopy-driven.

September 12: More mixed and darker overall. Expanded low-signal (black/dark) patches around the island, tracks, and some interior zones. Canopy is thinning; soil/background contribution is rising.

Cross-date pattern. Primary crop is the central-southern zone. Northern pond + brush and perimeter woods are non-crop. July was high and fairly uniform. August showed early spatial differentiation. September shows field-wide visual and NDVI/GNDVI decline with NDRE/LCI still relatively strong in cores — classic stay-green cores plus advancing senescence elsewhere.

2. Crop-health narrative

Vigor was strong through August. By September 12 the crop is in late R6 to early R7: seed fill is largely complete, leaves are yellowing, and harvest is approaching. RGB and NDVI make the senescence obvious; NDRE and LCI show that chlorophyll in the remaining green canopy is still decent in the better zones (stay-green behavior in cores, not uniform collapse). Suspect areas (all three dates; clearer or expanding on Sept 12):

Suspect areas (all three dates; clearer or expanding on Sept 12):

- Central circular anomaly (tree/brush island + lower-vigor ring): persistent lowest biomass and chlorophyll. Long-term feature (trees, old compaction, or soil difference)
- Linear / concentric tracks: compaction or wheel-track effects; more visible as the canopy thins.
- Edges and northern strip: brush encroachment and edge effects; lower indices and earlier yellowing.
- Northern wetland/pond: non-crop (open water + surrounding vegetation).
- Scattered interior yellow-green patches (Sept NDVI/GNDVI): stand, drainage, or fertility micro-zones now expressing as earlier senescence.

No widespread disease or bare-soil signature that would imply a crop failure. Yield is essentially set. Variation now is mainly maturity and residual canopy greenness, not new mid-season stress.

3. Recommended actions

1. Ground-truth immediately (next few days): Walk the central island ring, tracks, northern strip, and the yellow-green NDVI/GNDVI patches. Check maturity (pod color, seed moisture), compaction, drainage, and any late weed/brush. Tissue sampling is now low-value for in-season decisions; soil samples in high vs. low zones still useful for next year.
2. Herbicide / brush: Spot-treat only on wetland margins and crop-edge brush. No late broadcast. Watch PHI if anything is applied.
3. Nitrogen: Do not apply. At late R6/R7, N will not raise yield. Protein response in the literature is inconsistent and not worth the cost, application risk, or delayed maturity at this date.
4. Soil sampling / amendments: Zone-sample the island, tracks, and persistent low patches (0–6 in; deeper if compaction suspected). Plan lime/P/K/OM for fall or next spring.
5. Compaction / drainage: Probe tracks and the circular zone. Schedule selective deep-till or controlled-traffic for fall/spring if bulk density is high. Check whether the wetland is affecting adjacent rows.
6. Harvest and next season: Scout for maturity differences so the field can be harvested when the main body is ready without waiting on the greener cores or sacrificing the earlier-senescing edges. Use the three-date stack for VR seeding, fertility, and traffic maps next year. Consider a stress-tolerant variety on the anomaly and a brush-reclamation plan on the edges.

4. Yield estimation

NDRE at reproductive stages is the preferred remote proxy once canopies are dense; high-index Midwest soybean zones commonly support 50–70+ bu/ac. September RGB/NDVI show senescence, but NDRE remaining high in cores supports holding (not cutting) the prior range. Yield is largely determined by now.

- **Observed (primary crop, anomalies included):** 50-58 bu/ac (Mid-50s on most of the field; island + tracks + edges pull the average down)

- **Peak-potential yield range (highest-index cores):** 62–70 bu/ac. Stay-green cores on Sept 12 still support the upper range
- **USDA Sept 2026 national:** 52.8 (context only)
- **Total production (AOI ~25 acres primary crop):** Observed ~1,200–1,450 bu; peak potential ~1,500–1,750 bu. (Full mapped area including non-crop is larger but non-productive.)

5. Ag-economics section

Prices as of September 11–12, 2026: CBOT November 2026 ~\$12.96–\$12.97/bu; Midwest cash (IL/IA/IN/MO) typically \$12.25–\$13.10. Local cash range used: \$12.40–\$12.80/bu. USDA season-average farm price forecast \$12.00/bu

- **Gross revenue, observed (~54 bu/ac on ~23 ac)** \$15,400–\$15,900.
- **Gross revenue (peak 66 bu/ac on ~23 ac):** \$18,800–\$19,400.
- **Opportunity cost of not achieving peak vigor:** ~\$3,000–\$4,200 (mainly from central anomaly + tracks + edge losses).
- **Rough costs & ROI of top interventions:**
 - Ground-truthing + zone soil sampling: \$300–600; high information value.
 - Spot herbicide/brush control: \$150–400; protects 1–2 ac edges; multi-year if contained).
 - Compaction remediation: \$200–500 this fall / next spring; 3–8 bu/ac recovery in affected zones over years.
 - Next-season variable-rate fertility: \$5–15/ac; expected 2–5 bu/ac response in low zones is plausible.

If issues are left unaddressed: recurring 4–8 bu/ac drag (~\$1,100–\$2,400/year) plus continued brush encroachment. Corrected: closer to core potential, less wasted input, better soil structure. Quality: No late-N protein play is justified. Focus on uniform maturity and clean harvest. No obvious grade-discount risk if harvest timing matches the main body of the field. Break-even remains ~35–40 bu/ac; this field is well above. Every 2 bu/ac recovered is worth ~\$570–\$590 on the productive acres. ±\$0.50/bu price move shifts the opportunity-cost band by ~\$600–\$750.

6. Executive summary + action plan

Through August this field had strong vigor and competitive mid-50s yield potential with peak cores at 62–70 bu/ac. The full September 12 stack shows the crop has entered late R6–R7: RGB and NDVI document field-wide yellowing and thinning, while NDRE and LCI remain relatively high in the main cores (stay-green, not collapse). Yield is set. The same persistent problems — central island, compaction tracks, edges, and the northern wetland — still explain most of the gap to peak. Late N will not help. Opportunity cost of doing nothing is a few thousand dollars this year and more if brush and compaction are ignored.

Prioritized action list

1. Walk the island ring, tracks, northern strip, and yellow-green NDVI patches in the next few days (maturity, compaction, drainage).
2. Spot-treat brush on edges only.
3. Zone-sample soil and plan P/K or compaction work for fall/spring.
4. Do not apply N.
5. Time harvest to the main body of the field; do not wait on the greener cores.
6. Build next-season VR and controlled-traffic maps from the three-date stack.

7. Optional extras

Why these bands worked. NDVI/GNDVI/RGB caught the visual and biomass decline on Sept 12. NDRE/LCI stayed informative after NDVI began to drop — that is why red-edge is preferred in dense, late soybean canopies. OSAVI showed soil signal rising as the canopy thinned.

Follow-up. A final pre-harvest flight (or even a quick RGB pass) plus a few seed-moisture and pod-color checks would lock harvest timing. Ground SPAD in high- vs. low-NDRE zones would quantify remaining chlorophyll if you want a number to pair with the maps.

Caveats: Uncalibrated imagery; relative patterns only. No on-farm yield calibration. Weather, lodging, and harvest loss after September 12 can still move the final number. Confirm any input or tillage decision with an agronomist who has walked the field

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