

The Practitioner's Playbook

Manley Farms

A field operations manual for working small farms

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About this playbook

The Practitioner's Playbook is a free field-operations reference from Manley Farms. It collects the day-to-day calls that move yield - spray timing, irrigation, cover crops, tillage, forage, equipment calibration, and the records that keep it all straight - into one place you can keep on a clipboard or a phone.

Everything here is general reference, not professional advice, and every number is a planning range, not a prescription. Pesticide use in particular must follow the product label and all federal, state, and local rules. The label is the law. Verify anything regulatory against the governing agency, your product label, and your local Extension office before you act on it. See the full disclaimer at manleyfarms.com/disclaimer.

Part I - Field Operations Core

This section is the working core of day-to-day field decisions: when you spray, when you irrigate, how you trust your weather data, and how you mix product without destroying a tank or a crop. Numbers below are **working ranges drawn from common extension and industry practice**. They are not a substitute for the product label, your state pesticide rules, your water right, or your local Cooperative Extension recommendations. When a label, SDS, or regulator conflicts with anything here, the legal document wins.

Chapter 1: Spray Windows and Application Timing

A spray window is the short interval when four conditions line up at the same time: wind that limits drift, temperature and humidity that keep the product on target, enough rain-free time for rainfastness, and a crop or pest stage the label allows. Miss any of the four and you either waste product or violate the label. In the US, **the pesticide label is the law** (Federal Insecticide, Fungicide, and Rodenticide Act and state pesticide codes). “It was almost in range” is not a defense.

Most failed applications on small operations are not bad chemistry. They are bad commitment: equipment staged, crew paid, forecast tightening, and the decision to spray anyway. Build a go / no-go habit that can absorb a cancelled day.

1.1 Wind, temperature, humidity, and inversions

Read conditions **at boom height on the field you are spraying**, not at the house weather app and not from a forecast alone. A hand anemometer and a field check before the first pass beat any dashboard.

Condition	Typical working envelope	Why it matters	Notes
Sustained wind	About 3 to 10 mph at boom height for many foliar boom applications	Too low: inversion risk. Too high: physical drift	Many labels set product-specific max winds (often near 10 to 15 mph). Fine droplets need the lower end. Verify label.
Gusts	Gusts more than ~5 mph above sustained, or gusts over label max	Gusts throw off droplet path and buffer calculations	If gusts hit label max, stop even if average wind looks fine.
Air temperature			Ester herbicides and some formulations restrict high

Condition	Typical working envelope	Why it matters	Notes
	Common planning band 50 to 85 F for many products	Cold reduces uptake; heat increases volatility and droplet evaporation	temps (often near 80 to 90 F). Label controls.
Relative humidity	Rough planning band 40 to 90% RH	Low RH shrinks droplets; very high RH can slow drying and affect some adjuvants	Pair with delta-T (below). Do not use RH alone.
Inversion	Do not spray when inversion is present or forming	Cloud hangs or moves sideways off target	Classic: clear night, calm wind, cool ground, fog or smoke layering horizontally.
Rain / rainfast	Product-specific (often 30 min to 6+ hours)	Wash-off wastes product and can move chemistry off-site	Add margin for forecast uncertainty. A “30% chance after 6 p.m.” can arrive earlier.

Practical inversion flags (field-level, not a full sounding):

- Wind sustained under ~3 mph after sunset through early morning.
- Ground cooler than air a few feet up; smoke, dust, or spray hang or move sideways instead of rising and dispersing.
- Clear skies after a warm day; fog forming in low spots.

If any inversion flag is present, park the sprayer. Early morning is often the worst time, not the best, when inversions sit on the ground.

1.2 Delta-T (droplet survival index)

Delta-T is dry-bulb temperature minus wet-bulb temperature (or an equivalent psychrometric calculation from temp and RH). It is a practical index of evaporative demand on spray droplets. Many Australian and North American spray guides use it as a decision aid. Your label still governs; delta-T does not replace label RH/temp limits.

Delta-T	Approximate spray suitability
2 to 8 C (about 3.6 to 14 F)	Preferred band for many boom applications
8 to 10 C (about 14 to 18 F)	Marginal: coarser droplets, drift-reduction nozzles, caution on volatile products
> 10 C (about > 18 F)	High evaporative risk: fine droplets shrink fast; often a no-go for sensitive applications
Near 0 to 2 C	

Delta-T	Approximate spray suitability
	Can signal high humidity / inversion risk; watch wind and vertical mixing closely

Compute delta-T from a field weather station, a psychrometric chart, or a station dashboard that reports wet-bulb. Recheck mid-job if the day is heating fast.

1.3 Droplet size and nozzle selection

Droplet spectrum is classified under **ASABE S572** (very fine through ultra coarse). Smaller droplets improve coverage on some targets; larger droplets reduce drift. **The label states the required or allowed droplet size.** Typical patterns (always confirm):

Product class (general)	Common droplet preference	Drift risk if too fine
Systemic herbicides (many)	Medium to coarse or coarser	Off-target crop injury
Contact herbicides / many insecticides	Medium (coverage-driven)	Reduced efficacy if too coarse; drift if too fine
Fungicides needing dense canopy coverage	Fine to medium (label-driven)	Drift into sensitive areas
Dicamba / 2,4-D and other restricted systems	Often very coarse to ultra coarse plus system-specific nozzles	High liability; follow the full system label

Working setup rules:

1. Match nozzle type, orifice, and pressure to the **label droplet category**, not to “what we used last year.”
2. Pressure changes droplet size. Raising pressure to fix rate often makes droplets finer and more driftable.
3. PWM / pulse-width systems still need correct tip selection; duty cycle is not a free pass on spectrum.
4. Replace worn tips. A 10% flow increase over new-tip rating is a common replace threshold; check with a calibration jug.

1.4 Buffer zones and sensitive sites

Label buffer distances are **minimums under labeled conditions**. They assume correct nozzles, wind, boom height, and application parameters. When conditions are less ideal, increase buffers or stop.

Before the first pass, walk or drive the perimeter:

- Neighbor crops (especially specialty, organic, vineyards, orchards, gardens).
- Homes, schools, playgrounds, open windows, laundry lines.

- Surface water, wells, ditches, and mapped drain inlets.
- Beehives and blooming forage (managed or wild).
- Public roads and parking areas where fine droplets can travel.

Operational habit: treat the label buffer as the floor. If wind is toward a sensitive site, increase buffer or wait for a favorable wind direction. If wind is from the sensitive site toward the field, still respect setbacks and avoid treatments that volatilize later.

1.5 Rainfastness and re-entry

- **Rainfast interval:** time after application before rainfall will not critically reduce efficacy (label value). Do not start a tank if the forecast rain window is inside rainfast plus a safety margin (often +1 hour in changeable weather).
- **REI (Restricted Entry Interval):** time workers must stay out of treated areas without required PPE (label). Post signs where required; log end-of-application time so REI start is unambiguous.
- **PHI (Pre-Harvest Interval):** minimum days between last application and harvest (label). Count calendar days carefully on pick-your-own and multi-pick crops.

1.6 Pre-application decision tree

Walk this tree in order. Any “no” stops the job.

1. **Label and scouting:** Target present at action threshold? Crop stage allowed? Rate, PHI, REI, buffers, and nozzle/droplet requirements clear?
2. **Weather now:** Wind, temp, RH/delta-T, and inversion status inside label and your farm policy at boom height?
3. **Weather next few hours:** Rainfast window clear? Wind forecast not swinging into a bad direction mid-job?
4. **Setup:** Sprayer calibrated recently? Correct tips and pressure? PPE, spill kit, clean water for triple rinse, and mix water quality acceptable?
5. **People and site:** Buffer clear? Bees/bloom addressed? Neighbors notified if that is your standard? REI signage ready?
6. **Records ready:** Application log open before the pump starts.

1.7 Spray records (what to write down)

Keep records even when your state minimum is lighter than this list. Good records win audits, insurance questions, and neighbor disputes.

Field	Example content
Date / start-end times	2026-06-12, 06:40 to 08:15
Field / block / acres	North 12, 8.4 ac

Field	Example content
Crop and growth stage	Sweet corn, V6
Target pest / purpose	Common lambsquarters
Product(s), EPA Reg. No., rate	Product name, reg no., 1.0 pt/ac
Adjuvants and rates	NIS 0.25% v/v
Carrier volume (GPA)	15 GPA
Nozzle, pressure, ground speed	XR11004 @ 40 psi, 8 mph
Droplet category used	Medium
Wind speed/dir at start and mid	5 mph SW; 6 mph SW
Temp / RH or delta-T	68 F, 62% RH
Applicator name / license no.	As required by state
REI / PHI notes	REI 12 h; PHI 30 d
Disposal / rinsate notes	Triple rinse, applied to labeled site

Retain records for the period your state and insurance require (often multi-year). Photograph the label page for the batch you used if formulations change mid-season.

1.8 Quick reference - spray go / no-go

Signal	Action
Wind 3 to 10 mph, no inversion, delta-T in preferred band, label satisfied	Proceed with monitoring
Wind < ~3 mph + inversion flags	No spray
Wind above label max or strong gusts	No spray
Delta-T > ~10 C / 18 F	Usually no spray for fine/medium sensitive work
Rain inside rainfast + margin	Defer
Sensitive site downwind inside buffer	Defer, reorient, or change product/method

Chapter 2: Irrigation Timing and Thresholds

Irrigation timing is a water-budget problem, not a calendar habit. The crop removes water through **evapotranspiration (ET)**; the soil stores a limited amount of **plant-available water (PAW)**; your job is to refill before stress costs yield or quality, without waterlogging roots or violating your water right.

2.1 Soil moisture: field capacity, MAD, and stress

Key concepts:

- **Field capacity (FC):** water held after free drainage (roughly 1/3 bar for many mineral soils).
- **Permanent wilting point (PWP):** water held so tightly plants cannot extract it (often ~15 bar).
- **Plant-available water (PAW):** water between FC and PWP in the managed root zone.
- **Management Allowed Depletion (MAD):** the fraction of PAW you allow the crop to use before irrigating. Many agronomic crops are managed near **50% MAD** in peak demand; sensitive stages (establishment, flowering, fruit fill) often use **30 to 40% MAD**. Drought-tolerant stages or deficit strategies may go higher. Confirm for your crop with Extension or a crop consultant.

Soil texture (general)	Approx. PAW (in water / in soil)	Notes
Coarse sand	~0.04 to 0.08	Irrigate often, light sets
Sandy loam	~0.10 to 0.15	Fast response sensors help
Loam	~0.15 to 0.20	Common vegetable baseline
Silt loam	~0.17 to 0.23	Good storage if structure is intact
Clay loam / clay	~0.15 to 0.22	High total water but slower intake; avoid saturation

Root zone depth (planning defaults - verify by crop and soil):

Crop type	Typical managed root depth
Shallow vegetables, strawberries	6 to 12 in
Many vegetables, potatoes	12 to 18 in
Corn, small grains, many forages	18 to 36 in
Tree fruit / deep perennials	24 to 48 in (often multi-depth sensors)

Example refill math (method, not a universal recipe):

Root zone 18 in of loam at ~0.18 in/in PAW → PAW ≈ 3.2 in. At 50% MAD, refill when ~1.6 in is used. If crop ET is 0.25 in/day, theoretical interval ≈ 6 days in that weather. Real soils and weather vary; use sensors or ET accounting to adjust.

2.2 Measurement tools and start thresholds

Pick one primary method and stick with it long enough to learn it.

Method	What it reads	Common start-irrigation ranges (verify for crop/soil)
Feel / appearance	Relative wetness	Useful for small plots; dig to root depth, not just the surface
Tensiometer	Soil water tension (cb / kPa)	Many vegetables start near 30 to 60 cb depending on soil and stage; sandy soils often lower numbers
Capacitance / VWC probe	Volumetric water content %	Set FC and PWP from your soil; irrigate at MAD line (e.g. midway between FC and stress for 50% MAD)
Granular matrix sensors	Relative tension / moisture	Calibrate against a known method first season
ET checkbook	Inches of depletion	Irrigate when cumulative ET - rain - irrigation $\geq$ MAD volume

Three-threshold system (operational):

Threshold	Meaning	Example use
Watch	Approaching depletion target	Stage equipment; check 7-day rain forecast
Go	At MAD / start tension or VWC	Irrigate within the next operational cycle (often same day or within 24 h in heat)
Stop / full	At or above FC; risk of saturation	Do not apply more water; fix drainage or set length

Write your Watch / Go / Stop numbers on the pump house wall in the units your sensors report.

2.3 ET-based scheduling

Reference ET (ET_0) is the demand of a reference surface (usually short grass) from weather data.

Crop ET (ET_c) = $K_c \times ET_0$, where **K_c** is the crop coefficient for growth stage.

Working process:

1. Pull daily ET_0 from a regional network (AgriMet, CIMIS, CoAgMet, FAWN, Mesonet, etc.) or estimate from a quality on-farm weather station.
2. Apply the current **K_c** for your crop stage (tables from FAO-56 style guides and state Extension crop guides). K_c is low at establishment, peaks in mid-season canopy, and declines toward late season for many annuals.

3. Keep a **soil water balance**:

$$\text{Depletion_today} = \text{Depletion_yesterday} + \text{ETc} - \text{Rain_effective} - \text{Irrigation_net}$$

Cap depletion at 0 after a full refill; never let bookkeeping go negative without a physical reason.

4. Irrigate when depletion reaches your MAD volume (inches), then apply enough water to refill to FC (plus a small efficiency factor for system losses - not a license to flood).

Growth phase (generic annual)	Kc behavior	Irrigation implication
Establishment	Low to rising Kc	Light, frequent sets; shallow root zone
Rapid vegetative	Rising Kc	Increase set length as roots deepen
Mid-season / canopy full	Peak Kc	Highest daily demand; protect against heat stress
Late season / maturity	Falling Kc (many crops)	Taper if quality goals allow; some crops need dry-down

Always use local Kc tables for your crop and region. Generic textbooks are starting points only.

2.4 Crop water use by stage (planning ranges)

Daily ETc varies widely by climate. Peak mid-summer ETc for full-canopy crops in hot, dry areas can exceed **0.30 to 0.40+ in/day**; humid or cooler coastal climates often run lower. Use local $ET_0 \times Kc$ rather than memorizing a single number.

Crop group	Critical stages for water stress	Typical management note
Sweet corn / field corn	Tassel, silk, early grain fill	Stress here cuts kernels and yield hard
Tomatoes / peppers	Flowering and fruit set through sizing	Uneven water → blossom end rot risk and cracking
Leafy greens	Whole cycle; bolting risk in heat	Keep MAD tight; short cycles
Potatoes	Tuber initiation and bulking	Avoid swings that crack or misshape tubers
Small grains	Boot through grain fill	Early stress may tiller less; late stress cuts test weight
Tree fruit	Cell division after bloom; final swell	Stage-specific; fruit size and bitter pit / disorders interact with water and calcium
Pasture / hay		

Crop group	Critical stages for water stress	Typical management note
	After each cutting and during peak summer	Refill profile post-harvest; watch livestock traffic on wet soil

2.5 Deficit irrigation (when and how)

Deficit irrigation deliberately allows more depletion than full MAD to save water or steer quality (e.g. some wine grapes, processing tomatoes, late-season forages). It is a strategy, not neglect.

Rules for small operations:

1. Deficit only on crops and stages where yield/quality response is known and acceptable.
2. Do not deficit during establishment or published critical periods unless a specialist plan says otherwise.
3. Track soil moisture - deficit without sensors becomes accidental drought.
4. Watch salt accumulation in arid irrigated soils; leaching fractions may still be required.
5. Surface water users: deficit does not expand your legal water right; it only changes how you use what you have.

Strategy	What you do	Risk
Full ET replacement	Refill at standard MAD	Highest yield potential, more water
Regulated deficit (selected stages)	Lower MAD or skip non-critical sets	Yield/quality tradeoffs if mistimed
Sustained mild deficit	Slightly higher MAD all season	Cumulative stress; needs monitoring
Cutoff / dry-down	Stop irrigation before harvest	Crop-specific; wrong timing ruins quality

2.6 Set timing and application efficiency

System	Timing preference	Efficiency notes
Drip / micro	Any time; night can cut evaporation	Match run time to deficit; flush lines on a schedule
Solid-set / hand-line sprinkler	Morning preferred in disease-prone crops	Avoid long leaf wetness into cool nights when fungal pressure is high
Center pivot / linear	Anytime with good nozzle package	Watch wheel-track compaction and end-gun overspray
Furrow / flood	Often night in hot climates to cut evaporation	Requires leveled grades and known intake rates

Net irrigation requirement $\approx$ gross applied $\times$ application efficiency. Typical small-farm planning efficiencies (order-of-magnitude; measure your system): drip often ~85 to 95% if designed well; well-managed sprinklers often ~70 to 85%; furrow varies widely.

2.7 Quick reference - irrigation

Item	Working default	Verify against
Default MAD many agronomic crops	~50% of PAW	Crop stage, Extension
Sensitive stages	~30 to 40% MAD	Crop guide
Tensiometer veg start (broad)	~30 to 60 cb	Soil texture
Freeze protection (orchard overhead)	Start near 34 F wet-bulb , continuous until ice free	Local orchard specialist; rate often ~0.10 to 0.15+ in/hr when used
Weekly habit	Recalculate next irrigation Monday from sensors + ET	Forecast rain

Chapter 3: Weather-Station Integration

A personal weather station does not change the weather. It gives you **on-farm truth**, tighter spray and irrigation decisions, and a record you can defend. The National Weather Service grid is excellent and free; it still misses your frost pocket, your ridge wind, and your 7 a.m. inversion.

3.1 Siting (where accuracy is won or lost)

Bad siting produces confident wrong numbers. Follow as much of the meteorological standard as your property allows, and document compromises.

Sensor	Preferred siting	Common failure mode
Temperature / humidity	Aspirated or well-shielded radiation shield, ~1.5 to 2 m (5 to 6.5 ft) above open ground, over short grass if possible	Mounted on south wall or metal roof → reads hot
Wind speed / direction	Open exposure; WMO reference is 10 m (33 ft) ; many farm installs use ~3 m / 10 ft as a practical compromise	Roof peak, next to grain bin, or under tree → turbulence and bias
Rain gauge	Level, open sky, away from drip lines; height often ~1 m class for many farm gauges	Tilted gauge, gutter splash, tree drip
Solar radiation (if equipped)	True level, no shade any season	Mast shadow at low sun angles

Sensor	Preferred siting	Common failure mode
Soil moisture / temp	Representative soil of the management zone; install with good soil contact at decision depths	Air gaps, only one depth in deep-rooted crops

Clearance rule of thumb: keep horizontal distance from large obstacles on the order of **several times obstacle height** when possible (strict met standards are stricter than most farm installs). If you cannot, log the bias (e.g. “wind reads low from SW because of barn”).

Do not mount the primary array on a barn wall “for convenience.” Radiation, turbulence, and snow shed corrupt the record.

3.2 Key metrics for field decisions

Metric	Spray use	Irrigation use	Livestock / frost use
Wind speed / gust / direction	Go/no-go, buffer side	—	Windchill / ventilation
Temperature	Label band, volatility	ET estimate	Heat and frost
RH / dew point / wet-bulb	Delta-T, inversion risk	—	THI, frost risk
Rain (event + rate)	Rainfast decisions	Effective rain in water balance	Mud / animal welfare
Solar radiation	—	ET quality	Heat load
Leaf wetness (if equipped)	Disease spray timing	—	—
Soil moisture / temp	—	Primary irrigate trigger	—
Pressure trend	Storm arrival / abort spray	—	—

3.3 Reading forecasts with on-farm data

Use both public forecasts and local sensors:

1. **Yesterday verification:** Compare NWS (or app) forecast wind/temp/rain to your station. If the grid always under-reads your afternoon wind by 3 to 5 mph, apply that bias when you plan tomorrow’s spray.
2. **Nowcast over forecast for the next hour:** Before spraying, believe the anemometer in your hand and the station at the field edge.
3. **Probability is not timing:** “40% chance of rain after 4 p.m.” means you may get wet at 3:30. Protect rainfast margins.
4. **Valley and slope effects:** Afternoon draws, night drainage winds, and cold-air pooling are local. Stations in the right micro-site beat a perfect regional model.

3.4 Frost action thresholds

Frost risk is about **wet-bulb / dew point and radiational cooling**, not only the airport low.

Condition	Typical action band (orchard / sensitive crops - adapt locally)
Clear, calm night after bud swell	Elevate alert status; check wet-bulb and forecast low
Wet-bulb approaching ~34 F	Prepare freeze protection systems if you use them
Wet-bulb near 32 F and falling	Active protection decisions (wind machines, overhead irrigation, heaters - only systems you are trained and equipped to run)
Wind rising / cloud cover increasing	Risk often eases; confirm with station trend

Critical freeze-protection rule for overhead irrigation: once ice protection is started, **stopping early can be worse than never starting** - evaporative cooling can drive tissue colder. Capacity and uniformity matter; rates are crop- and system-specific. Get local training before relying on this method.

3.5 Heat action thresholds

For people and livestock, temperature alone is not enough. Relative humidity drives heat stress indices.

Temperature-Humidity Index (THI) is widely used for cattle. Formulas vary slightly by source; many dairy references treat rising stress risk as THI moves through the upper 60s into the 70s and higher, with severe risk well into the 80s depending on the scale and duration. **Use a published chart for your species and confirm with your veterinarian or Extension livestock specialist.**

Practical farm actions by escalating heat:

Level	Field actions
Elevated heat	Extra water, shade access, avoid moving livestock mid-afternoon, shift heavy labor earlier
High heat	Cancel nonessential handling, increase water flow, monitor vulnerable animals
Extreme / emergency	Cooling measures you have practiced, continuous water, veterinary readiness; stop risky machinery work for people

For crops, heat interacts with water stress: high ET days raise irrigation priority even if the calendar says “not yet.”

3.6 Station maintenance and calibration

Task	Interval	Pass criteria (practical)
Clean rain gauge funnel / tipping bucket	Monthly in leaf season; after storms	Debris free; level
Compare rain to manual gauge	Seasonally	Within about 5 to 10% on known pour tests
Check radiation shield / fan (if any)	Seasonally	Free airflow; no wasp nests
Temperature check vs quality thermometer	Annually	Drift beyond ~1 F → investigate
RH check vs sling psychrometer or salt kit	Annually	Large drift → replace sensor
Anemometer spin / bearing check	Seasonally	Sticky cups or ultrasonic faults → service
Soil probe re-seat / compare	Annually or after freeze	Agreement with second method

Export weekly CSV archives. Cloud services fail; your farm record should not.

3.7 Quick reference - weather station

Item	Working target
Temp/RH height	~1.5 to 2 m, shielded, open
Wind height	10 m ideal; ~3 m / 10 ft common farm compromise
Spray delta-T prefer	~2 to 8 C
Inversion caution	Calm + clear + stratified smoke/fog
Frost prep cue	Wet-bulb near mid-30s F with clear calm setup
Data habit	Phone alerts + weekly export

Chapter 4: Tank Mixing and Product Handling

Tank mixing is where chemistry, water quality, and human error meet. A failed mix can plug screens, burn crops, or produce sludge that no nozzle will pass. **The label and SDS are the controlling documents.** Compatibility charts and “rules of thumb” are helpers only.

4.1 Before anything hits the tank

1. Read **each** product label for tank-mix permissions, order, water volume, pH windows, and adjuvant requirements.
2. Confirm all products are labeled for the **crop, site, and pest**.
3. Check **use rates** and whether total active ingredient across products stays within legal limits.
4. Inspect PPE requirements for the most restrictive product in the mix.
5. Know your **carrier**: clean water volume, hardness, pH, iron, and organic matter. Hard water can antagonize weak-acid herbicides (glyphosate class is the classic teaching case - ammonium sulfate or water conditioners are often used per label).
6. Calculate batch size from calibrated GPA × acres, not from a guess.

4.2 Mixing order (general sequence)

Exact order can be product-specific. A widely taught general sequence for tank mixing is a variant of:

1. Fill tank ½ to ¾ with carrier water; start agitation.
2. Add **water conditioners / AMS / compatibility agents** (if used).
3. Add **dry formulations**: wettable powders (WP), water-dispersible granules (WDG/DF), soluble granules - slurry pre-mix if label says.
4. Add **liquid flowables / suspension concentrates** (F, SC, SE).
5. Add **emulsifiable concentrates** (EC).
6. Add **solutions / soluble liquids** (SL, SP liquids).
7. Add **adjuvants** last (NIS, COC, MSO, drift retardants, stickers) unless label says otherwise.
8. Top off water; maintain agitation.

Mnemonics (WALES, APPLES, etc.) exist in training materials and **disagree in details**. Treat any mnemonic as a memory aid, not law. When labels conflict on order, follow the **most restrictive label language** or mix products separately.

4.3 Compatibility jar test

Run a jar test **before** a new combination goes into a full tank - especially new generics, fertilizers + pesticides, or hard water.

Quart-jar method (field scale):

1. Wear appropriate PPE.
2. Use the **same water** you will spray.
3. Scale rates to jar volume carefully (use label-specified jar-test ratios when provided; otherwise calculate proportionally from field rate and carrier volume).
4. Add ingredients in the planned mix order, mixing gently between additions.
5. Let stand **10 to 15 minutes** (some guides use up to 30 minutes for slow reactions).
6. Inspect for:

Failure sign	Meaning
Precipitate, sludge, gel	Physical incompatibility
Oil separation / layers that will not re-emulsify	Emulsion failure
Extreme heat or gas	Chemical reaction - do not use
Flakes / grit that will not resuspend	Screen and nozzle plug risk
Color change alone	May be OK - still check physical stability

Pass criteria: mixture stays uniform or resuspends easily with mild agitation, no heat/gas, no sludge.

If the jar fails, do not “hope the tank will be fine.” Change order only if labels allow, add approved compatibility agents, or apply products in separate applications.

4.4 Agitation, foam, and fertilizer carriers

- Keep agitation running from first product to last pass. Dead spots settle wettable powders.
- Excessive foam: check induction rate, fill height, and anti-foam options listed as compatible.
- Liquid fertilizer carriers: only when labels allow; jar test every new fertilizer lot if quality varies.
- Never leave a mixed tank sitting overnight unless labels and product chemistry explicitly allow it.

4.5 Rate calibration (boom sprayer)

Calibration answers: **am I applying the gallons per acre and product rate I think I am?**

1/128th acre nozzle method (common boom method):

1. Measure nozzle spacing (inches).
2. From a 1/128 acre chart (or calculate), mark the travel distance that equals 1/128 acre for that spacing (classic: for 20 in spacing, catch time is often based on 204 ft of travel - confirm the chart you use).
3. Drive at field speed in field gear; time the run.
4. Catch output from one nozzle for that same time; fluid ounces collected $\approx$ gallons per acre for that tip if method is followed correctly.
5. Repeat across several nozzles; replace outliers.

Tank / course method:

1. Fill to a mark; spray a measured area (e.g. 1/4 acre) at field speed and pressure.
2. Refill to the mark measuring water used; compute GPA = gallons used $\div$ acres sprayed.
3. Adjust speed, pressure, or tips to hit target GPA. Recheck.

Product rate check:

- $\text{Product per acre} = (\text{batch product amount}) \div \text{acres treated}$
- Compare to label rate. A 5% error band is a common internal target for small operations; some high-value or regulated applications need tighter control.

Variable	Effect if wrong
Ground speed high	Rate low
Pressure high	Rate high; droplets often finer
Worn nozzle	Rate high; pattern distorted
Wrong orifice	Rate and spectrum wrong
Boom height wrong	Overlap gaps or excess overlap; drift risk

Calibrate:

- Start of season.
- After nozzle change.
- When switching major rate/volume targets.
- If patterns look striped or weeds strip-survive.

4.6 Handling, storage, and cleanup

1. Store pesticides in original labeled containers, locked, dry, temperature-stable per label, separate from feed and seed.
2. Keep spill kit (absorbent, shovel, bags, water, PPE) at the mix site.
3. Measure with dedicated tools; never use food containers.
4. **Triple rinse** empty jugs (or pressure rinse) and apply rinsate to a labeled site, or follow state container rules.
5. End-of-day: flush tank, lines, and boom; clean screens; wash PPE separately.
6. Dispose of unwanted product through legal collection programs - do not dump.

4.7 Quick reference - mix and calibrate

Step	Checkpoint
Labels read	All products, crop, rate, order, PPE
Water quality	Hardness/pH addressed if required
Jar test	New mixes only go to tank after pass
Mix order	Conditioner → dry → flowable → EC → solutions → adjuvants (unless label differs)

Step	Checkpoint
Agitation	On for entire mix and application
Calibration	GPA within target before adding product
Records	Products, rates, batch, field, weather, applicator

Section A closing note

Field operations core is a discipline stack: **label first, measure on site, decide with thresholds, write it down.** Spray windows collapse; irrigation demands spike; stations drift; mixes fail. The operators who stay out of trouble are not luckier - they have written go/no-go numbers, calibrated iron, and the willingness to park a job when the data says stop.

For local legal and agronomic specifics, use:

- Product labels and SDS
- State department of agriculture pesticide program
- Cooperative Extension and crop specialists
- Your water district / water master for diversion rules
- Licensed pesticide applicator training materials for your state

This section does not certify you to apply restricted-use pesticides. Get licensed where required, and keep that license current.

Part II - Crops and Soil

This section is a field guide, not a prescription. Soil texture, rainfall, frost dates, crop insurance requirements, equipment, markets, and weed pressure change the right call. Use local Extension and NRCS guidance to turn these operating ranges into a farm-specific plan. Follow every seed, fertilizer, preservative, pesticide, and grazing label. Pesticide applications must comply with the product label and applicable EPA and state requirements.

Cover Crop Selection and Termination

A cover crop works when it solves a defined problem and fits the next operation. Start with the next cash crop, its planting date, and your termination method. Then choose the simplest species or two-species mix that can meet the goal. A complex mix does not make up for a late planting date, poor seed-to-soil contact, or no termination plan.

Select by goal, growing window, and winter survival

Primary goal	Practical first choice	Why it fits	Watch-outs
Hold soil and scavenge residual nitrate after a late harvest	Winter cereal rye	Establishes relatively late, survives winter in many temperate regions, and grows early in spring	Must be terminated; high biomass can cool the seed zone and tie up available nitrogen early, especially before corn
Quick fall cover that will usually winter-kill in cold regions	Oats	Fast fall growth and simple spring seedbed after winterkill	Little spring protection where it winter-kills; drought can leave a thin stand
Break up a compacted surface or shallow traffic layer	Radish or turnip, often with a grass	Taproot plus scavenging; residue decomposes quickly after winterkill	Needs early enough planting to build a root; do not use Brassicas immediately before a Brassica cash crop where disease or insect rotation is a concern
Add biologically fixed nitrogen over a long enough window	Clover or hairy vetch	Legumes can contribute nitrogen when well established and nodulated	Nitrogen credit is not guaranteed. Inoculation, stand, termination stage, weather, and residue management matter;

Primary goal	Practical first choice	Why it fits	Watch-outs
			vetch can be hard to terminate
Warm-season biomass, weed suppression, and deep rooting	Sorghum-sudangrass or sudangrass	Rapid summer growth and substantial root system	Requires heat and moisture; manage height and regrowth. Check forage safety and grazing restrictions for the specific crop and conditions
Fast summer gap cover and pollinator-friendly flowering window	Buckwheat	Establishes quickly in warm soil and is easy to fit between short crops	Short season and can set viable seed quickly if not terminated on time
High-residue mulch for no-till soybeans	Cereal rye	Produces durable surface residue and can suppress early weeds when biomass is high	Rolling alone is unreliable before anthesis; planting and termination timing are narrow

Zone and climate checks before buying seed

- In cold-winter regions, oats, radish, buckwheat, and many summer annuals normally winter-kill. Treat that as likely, not guaranteed. Protected areas, snow cover, and a mild winter can leave survivors.
- In warmer winter zones, verify winter survival for the exact cultivar and county. A crop called “winter-killed” in the Upper Midwest may be persistent farther south.
- In dryland systems, reserve water for the cash crop. A growing cover can reduce erosion and improve infiltration, but it also uses water. Set a soil-moisture or forecast-based termination trigger before spring.
- In irrigated fields, manage the cover as a crop. It needs establishment water in dry fall conditions and may need irrigation scheduling changes before the cash crop is planted.
- Keep crop families visible on the rotation map. Do not use a Brassica cover as a casual substitute in a Brassica vegetable rotation. The same caution applies to legumes and disease-prone legume cash crops.

Seeding-rate operating ranges

The rates below are single-species **drilled** ranges drawn from Upper Midwest Extension guidance. They are useful planning ranges, not universal prescriptions. Broadcast or aerial seeding generally needs a higher rate because seed-to-soil contact is less reliable. Adjust a mix by the fraction of each species in the full single-species rate, then confirm the final blend, purity, germination, inoculant, planting depth, and local date with the seed supplier or Extension office.

Species	Drilled planning rate	Best-use window	Establishment note
Winter cereal rye	55 to 100 lb/ac	Late summer through fall, including later windows than most covers	Earlier planting allows the low end; late planting and weed-suppression goals push rates upward
Oats	30 to 50 lb/ac	Late summer to early fall in cold-winter regions	A reliable first cover where winterkill is desired
Annual ryegrass	15 to 20 lb/ac	Mid- to late summer into early fall	Can overwinter unpredictably; have a spring termination plan
Triticale or wheat	50 to 90 lb/ac	Late summer through fall	Verify winter hardiness and forage or grain intent for the variety
Sorghum-sudangrass	25 to 30 lb/ac	Late spring through midsummer, after soils warm	Use only where there is enough growing season to justify it
Radish	8 to 15 lb/ac	Late July to mid-September in the Upper Midwest	Earlier planting is more important than extra seed for large roots
Crimson clover	10 to 15 lb/ac	Late July to early September	Inoculate if required by the seed and species; check winter survival locally
Red clover	8 to 12 lb/ac	Late July to mid-August	Useful in longer rotations and interseeding systems, but establishment is not automatic
Hairy vetch	15 to 25 lb/ac	Late July to mid-August	Winter survival and termination are site-specific; plan ahead
Field or winter pea	30 to 90 lb/ac	Late July to late September	Rate depends strongly on seed size and mix design

Establishment checklist

1. **Set the objective and endpoint.** Write down the goal, next crop, latest acceptable termination date, and termination method before drilling.

2. **Choose the earliest realistic seeding pass.** Earlier fall establishment almost always buys more roots and biomass than simply raising the rate.
3. **Calibrate by seed lot.** Check drill settings with the actual blend. Seed size and density change metering. Do not rely on a prior crop's setting.
4. **Protect seed-to-soil contact.** Drilling at the intended depth into firm soil is more consistent than surface broadcasting. If broadcasting, follow with a method that improves contact when field conditions and equipment allow.
5. **Map strips.** Leave a marked check strip without the cover or use a simple replicated strip if you are changing species, rate, or termination timing. Measure stand, spring biomass, planting conditions, and cash-crop outcome.
6. **Inspect before winter and before termination.** Confirm species composition, density, weeds, volunteer cash crop, and any escaped perennial weeds. A failed stand is a planning signal, not a reason to carry it into spring unseen.

Termination playbook

Termination is an operation, not a calendar date. Assess growth stage, active growth, weather, soil moisture, and the next crop. Walk representative areas before and after the pass. Recheck in 7 to 14 days for regrowth or misses, subject to the product label and your crop schedule.

Method	Best fit	Timing and operating point
Winterkill	Oats, radish, buckwheat, warm-season annuals in climates cold enough to kill them	Verify survival after winter, including protected patches
Herbicide termination	Winter-hardy grass or mixed stands where an approved product fits the rotation	Small, actively growing covers are generally easier to control. A common Extension guideline is about 4 to 8 inches tall
Tillage	Systems already using tillage and fields where residue incorporation is desired	A field cultivator working about 3 to 4 inches deep can sever roots and bury plants more effectively than a shallow vertical pass
Mowing	Small acreage, vegetables, and covers at a susceptible reproductive stage	Works better at flowering or heading than on young vigorous plants
Roller-crimper	High-biomass no-till systems, commonly cereal rye before soybean	Rye is most reliably crimped around anthesis, when pollen is shedding

For herbicide termination, use only an EPA-registered product labeled for the crop, use pattern, and site. Read the entire label before mixing or spraying, including PPE, buffer, weather, resistance-

management, grazing, forage, plant-back, and recordkeeping requirements. Local restrictions and crop-insurance or program termination requirements may be more specific than a general field guide.

Planting green without gambling the stand

Planting green means placing the cash crop into a living cover, then terminating the cover at or near planting. It can buy biomass, trafficability, and moisture removal on wet ground. It can also create competition for water and nitrogen, cool the seed zone, increase insect or disease risk, and expose weak planter setup.

Use it first in a low-risk field, preferably with a crop and cover combination proven locally. No-till soybean into cereal rye is generally a more forgiving starting point than corn following cereal rye.

Preflight before planting green

- Confirm that your crop-insurance policy, NRCS contract, and any program requirements permit the planned termination date. Do this before planting, not after emergence.
- Dig the intended planting depth. Do not judge field readiness from the cab. Check moisture, temperature, sidewall condition, and residue hairpinning risk.
- Check opener wear, downforce, closing wheels, seed depth, and seed-to-soil contact in the heaviest residue and in the lightest area of the field.
- Start with a termination date that prevents the cover from competing with the cash crop for light, nutrients, or water. In dry conditions, terminate earlier.
- Scout the green bridge. Look for slugs, armyworm, cutworm, and other locally relevant pests, and inspect emerging crop rows promptly after planting.
- Do not adopt a yield-preserving nutrient plan by guesswork. In cereal-rye-before-corn systems, use local nitrogen guidance and consider the greater early-season nitrogen demand and seedling-disease risk.

Tillage and Rotation Playbooks

The question is not whether tillage is good or bad. The better question is: what job must be done in this field, what is the least-disturbing tool that will do it under fit soil conditions, and what will that choice cost in residue, water, labor, and weed pressure?

Match the tool to the job

System or tool	What it does well	Main tradeoff	Field rule
No-till	Preserves surface cover, reduces passes, protects aggregates and infiltration	Requires disciplined planter setup, weed program, and residue management	Start with fields that drain well and have manageable perennial weeds

System or tool	What it does well	Main tradeoff	Field rule
Strip-till	Clears and warms a narrow seed zone while retaining between-row residue	Demands accurate guidance and a consistent planter match	Useful where cool, wet spring soils make full-width residue difficult
Vertical tillage	Sizes and redistributes residue, smooths surface	Often does not reliably terminate living covers because it has little horizontal root-cutting action	Do not call a single vertical pass a termination plan without checking live plants
Field cultivator or shallow full-width tillage	Creates a seedbed and can terminate covers when roots are cut and plants buried	Reduces cover and can require repeat passes	A 3- to 4-inch working depth is more effective for cover termination than a superficial pass
Chisel or deeper primary tillage	Addresses selected compaction or heavy residue situations	Higher disturbance, fuel, erosion exposure, and risk of creating a tillage layer if repeated at one depth	Use after diagnosing a real restriction, not because the calendar says so
Moldboard plow or aggressive inversion	Buries residue and resets a difficult seedbed	Highest disturbance and low residue cover	Reserve for a specific, documented reason and rebuild cover afterward

Soil-fit decision: stop before compaction starts

Tillage on wet soil can do more lasting harm than the short-term seedbed benefit is worth. Before entering the field:

- Take soil from operating depth, not just the surface. Squeeze and break it apart. If it smears, ribbons, or forms a shiny compressed face rather than crumbling, wait.
- Check the wheel track, headlands, and low areas separately. A field is not uniformly fit because one high spot is fit.
- Limit axle load and repeated traffic where possible. Controlled traffic lanes are easier to manage than random compaction across the whole field.
- If a penetrometer, shovel, or root observation shows a compacted layer, identify the depth and cause first. Deep tillage is temporary if traffic, wet operations, or the same implement depth recreates the restriction.
- Record the pass, depth, soil condition, and outcome. The record reveals whether a pass is solving a recurring system problem or creating one.

Rotation planning that survives the season

A workable rotation is a sequence of cash crops, cover crops, manure or compost applications, and field operations. Build it by constraints first, then opportunities.

1. **List non-negotiables for every field.** Crop contracts, herbicide carryover and plant-back restrictions, disease history, manure timing, irrigation capacity, equipment availability, livestock needs, and slope belong on the field card.
2. **Separate crop families.** Avoid repeating related crops where shared diseases, insects, or herbicide-resistant weeds are a concern. A diverse rotation changes planting dates, crop canopy, root architecture, and weed-control timing.
3. **Place high-residue crops before crops that can handle them.** Corn residue decomposes slowly; soybean and wheat generally tolerate a broader range of residue than corn. Plan the next crop before the combine leaves the field.
4. **Use harvest timing as a rotation asset.** Small grains, silage corn, early vegetables, and early-maturity cash crops can create a real cover-crop window. A late harvest does not magically create one.
5. **Plan nitrogen around residue quality.** Mature cereal residue is carbon-rich and can temporarily immobilize nitrogen during decomposition. Legume residue generally decomposes faster, but do not convert a cover stand into a fertilizer credit without a locally calibrated recommendation.
6. **Build a weed-resistance rotation.** Rotate crop competitiveness, planting dates, effective herbicide sites of action, cultivation where appropriate, and cover-crop tactics. Do not rely on one chemistry or one tillage pass.

Residue management at harvest and planting

Uneven residue creates uneven planter performance. Correct it at harvest, when the combine can spread chaff and stalk material across its full cut width, rather than trying to repair heavy strips in spring.

Observation	Likely operational response
Heavy bands behind the combine	Inspect chopper and spreader pattern; correct distribution before the next field
Hairpinning or open seed trench	Check opener sharpness, downforce, speed, residue managers, and soil moisture; do not only add downforce
Cold, wet residue in corn row	Consider a strip system, row cleaners set to move rather than gouge, or a crop sequence that gives more warming time
Thin residue after soybean or residue removal	Reduce disturbance and add a cover crop where the growing window supports it

Observation	Likely operational response
Thick living cover at planting	Calibrate planter in the actual field, carry a termination contingency, and inspect emergence rather than assuming a clean pass equals a good stand

Leave residue on slopes and erosion-prone ground whenever the system permits. Conservation tillage is commonly defined as leaving at least 30% residue cover after planting, but erosion protection needs are site-specific. Slope length, soil type, rainfall intensity, and drainage outlets matter more than a single universal percentage.

Hay and Forage Moisture

Hay quality is largely decided between cutting and storage. The crop must cure enough to store safely, but every extra day exposed to rain, leaf shatter, bleaching, and respiration costs feed value. Use a moisture tester and field judgment. Bale moisture is not something to estimate from a weather app or the feel of a windrow.

Cut and cure deliberately

1. **Cut at the quality stage your market or livestock requires.** Maturity affects fiber and energy more than a late-afternoon weather decision. Keep cutting stage, field, and lot separate in the record.
2. **Use the forecast as a risk screen, not a promise.** Start with a credible drying window, then watch actual humidity, dew, wind, cloud, and soil moisture.
3. **Condition only as much as the crop needs.** Stemmy forage often benefits from conditioning to equalize stem and leaf drying. Over-conditioning can increase leaf loss in legumes.
4. **Manage the swath for the day.** A wide swath can speed early drying when weather supports it. Rake when forage is tough enough to retain leaves, not when brittle leaves will shatter.
5. **Sample the bale, not just the windrow.** Test representative material, then test individual bales as baling begins, after field changes, and when a weather change is moving through. Moisture can vary sharply within a field and between outer and inner windrow material.
6. **Keep wet bales out of the barn.** If moisture is questionable, stage them separately on a noncombustible, well-ventilated area and monitor rather than burying the risk in a stack.

Bale moisture targets

These are practical dry-hay storage targets. Exact acceptable moisture changes with bale density, size, preservative system, crop, ventilation, and storage duration. A conservative target is safer than a single maximum. Penn State Extension identifies roughly 14% to 18% as ideal for large-bale storage; many operators target the lower end as bale size and density rise.

Bale type	Conservative dry-hay target	Operating caution
Small conventional square	About 18% or lower	Small bales shed heat more readily, but hot spots still occur. Test the stem moisture and watch dense, leafy forage
Large square	About 15% or lower	Higher density holds heat. Treat 16% to 18% as a caution zone unless the preservative system and storage plan explicitly support it
Large round	About 15% or lower	Dense cores dry slowly and retain moisture. Test more than one location and do not rely on surface feel

If a bale tests above the farm's dry-hay threshold, do not solve the problem by hoping it will cool in storage. Continue curing, use an approved preservative exactly as labeled where it fits, or divert to a managed baleage/haylage system designed for higher moisture. Baleage is a different storage system: it needs adequate moisture, rapid wrapping, oxygen exclusion, and management for the forage, livestock class, and local conditions.

Preservatives: a management aid, not permission to bale wet hay

Most dry-hay preservatives are organic-acid products, commonly propionic-acid based or buffered formulations. They can suppress mold growth and extend the baling window within the manufacturer-approved moisture range. They do not remove water, fix a rain-damaged crop, or make a wet bale safe indefinitely.

Question	Field answer
When does a preservative fit?	When hay is near but above the normal dry-hay target, the product is labeled for that bale type and moisture range, and the applicator can deliver the required rate uniformly
What must be checked first?	Product label, crop and bale-type fit, measured moisture, applicator calibration, corrosion/PPE instructions, livestock and market restrictions, and storage plan
What is a hard stop?	Do not bale above the product's labeled maximum. A preservative does not make excessively wet hay safe
Why can rates differ?	Application rate rises with moisture and often differs for small/round versus large square bales. Use the current

Question	Field answer
	product label or manufacturer table, not a remembered rate

Calibrate the applicator with the actual product, baler, and bale rate. Confirm output at the nozzles, maintain filters, and document moisture, product rate, field, and lot. Acid products can be corrosive. Use the specified PPE and maintenance practices.

Heat and fire monitoring

Most hay heating problems appear in the first several weeks after baling. Check new lots frequently, especially bales made near the moisture limit or stored inside.

- Smell for a sharp, musty, or caramelized odor; inspect for steam, condensation, mold, and a hot surface. These are warnings, not diagnoses.
- Use a long probe thermometer to measure the bale interior or stack. Do not climb on unstable stacks or enter a confined, smoky, or hot storage area.
- At roughly **130°F to 140°F**, microbial heating can intensify and the lot needs close attention. At about **150°F**, increase monitoring and prepare to move the lot only if doing so is safe. Around **175°F or above**, or if smoke is present, treat it as a fire emergency: call the fire department before disturbing bales. Introducing air to a hot mass can trigger ignition.
- Keep a log of bale date, field, moisture, preservative, storage location, and temperature checks. This turns a recurring problem into a traceable one.

Local fire authorities and Extension guidance should control the response plan for a heating hay stack. Do not enter a barn or attempt to pull apart a smoking stack alone.

Soil Sampling and Sensor Placement

Good decisions need samples that represent the management decision. A perfect lab analysis cannot repair a poor composite sample, a mixed soil zone, or a sensor installed with an air gap.

Grid versus zone sampling

Grid and zone sampling answer different questions. Choose one because it matches field variability, not because the software makes it easy.

Approach	Best use	Collection logic	Failure mode to avoid
Composite sample for a uniform management area	Small, visibly uniform fields or a baseline test	Take many cores across one consistent area and mix thoroughly	Combining knolls, depressions, old feedlots, different soils, or different manure histories into one “average”

Approach	Best use	Collection logic	Failure mode to avoid
Grid sampling	Variability is not obvious, or pH and relatively immobile nutrients need a systematic map	Divide the field into equal, georeferenced cells and collect a composite within each cell	Sampling too coarsely to detect meaningful change, then treating interpolation as fact
Zone sampling	Stable zones can be identified from soil survey, elevation, EC, yield history, imagery, drainage, or management history	Define zones first, then randomly collect and bulk cores within each zone	Drawing zones only from a colorful map without ground-truthing soil and management history

For a first field test, start with a defensible management-area map and consistent sampling method. Grid sampling can reveal hidden variation but costs more. Zone sampling can be efficient when zones reflect real, stable causes of variation. Review yield maps for multiple years, not one drought or flood year, and verify a few boundaries with a shovel.

Sampling procedure

1. **Define the purpose.** Routine pH, phosphorus, potassium, organic matter, nitrate, salinity, micronutrients, and nematode tests do not all use the same depth, timing, handling, or lab method.
2. **Use the lab's instructions first.** Ask the receiving lab for the required depth, number of cores, container, handling, and turnaround. Recommendations are calibrated to the lab method and local university system.
3. **Keep depth consistent.** For routine surface fertility testing, many labs use a 6- to 8-inch depth, but follow the local recommendation. In no-till or banded-fertilizer systems, surface stratification and row position matter.
4. **Take enough cores.** A composite should contain numerous cores distributed through the defined area. For example, Extension guidance for one nitrate approach calls for at least 12 cores from no more than 10 acres. Follow the lab and local nutrient-program protocol for your test.
5. **Avoid nonrepresentative locations.** Skip headlands, fence lines, fertilizer bands unless deliberately sampling them, manure piles, livestock congregation areas, old buildings, waterways, and unusual spills.
6. **Separate management histories.** Different soil types, crop histories, manure histories, irrigation zones, and yield zones deserve separate samples.
7. **Label and preserve immediately.** Record field, zone or grid ID, GPS point, date, crop, depth, and test requested. For nitrate samples, rapid handling is critical because biological activity changes the sample; refrigerate, deliver promptly, or dry only as the lab directs.

Timing and depths

Test or decision	Timing principle	Depth and handling principle
Routine pH, P, K, and organic matter	Sample at roughly the same time in the rotation each cycle so trends are comparable	Use the local lab's standard depth, often 6 to 8 inches for surface samples; keep depth consistent year to year
Pre-sidedress nitrate or other in-season nitrogen test	Sample close to the fertilizer decision, not months ahead	Use the local protocol exactly. Depth, handling, and interpretation are region- and test-specific
Deep residual nitrate profile	Use only where a local recommendation is calibrated for it	Minnesota's nitrate guidance, for example, is calibrated to a two-foot sample; do not transfer that depth to another state or test without local confirmation
Problem diagnosis	Sample affected and unaffected plants or zones separately, with notes and photos	Add tissue testing or other diagnostics when the problem is not clearly a soil-fertility issue

Do not collect routine samples immediately after a fertilizer, manure, lime, or compost application if the goal is a representative baseline. Record application history instead, then follow local waiting guidance. The goal is repeatability: same depth, similar timing, similar zones, and documented method.

Soil-moisture sensor siting and depth

A sensor tells you about the soil touching the sensor, not the whole field. Install it in representative crop and soil conditions, then use more locations when the field contains meaningful texture, elevation, irrigation, or management differences.

Placement decision	Practical rule
Number of locations	Begin with at least two representative locations per management area when possible; add locations for materially different soil textures or irrigation zones
Depth	A practical starting layout is sensors at about one-third and two-thirds of the active crop root-zone depth. Add a deeper sensor when you need to observe water moving below the main root zone
In-row position	For stationary systems, place sensors between plants within the crop row at the chosen depth, unless the manufacturer or crop system specifies otherwise
Avoid	

Placement decision	Practical rule
	Pivot wheel tracks, end rows, field edges, unusual depressions or knolls, compacted traffic lanes, leaks, and spots unrepresentative of the irrigation zone
Installation	Match the manufacturer's method, maintain firm soil contact, and avoid an oversized hole or air gap. An air gap creates misleading readings
Protection	Flag and map the location, protect cables and telemetry hardware, and train equipment operators before fieldwork begins

Commissioning sequence

1. Map the sensor site, depth, soil type, irrigation zone, crop, and installation date.
2. Verify the sensor is at the intended depth and has firm soil contact. Do not backfill with loose clods.
3. Compare the first readings against a hand probe, nearby soil feel, irrigation event, and rainfall record. Investigate an implausible flat line or sudden jump before acting on it.
4. Read or transmit data often enough to see irrigation and rainfall response. A common operating interval is every two to three days, with more attention during rapid crop water use or heat.
5. Review the shallow and deep sensors together. A shallow sensor may dry first; persistent wetness at depth may indicate over-application, slow drainage, or a sensor problem.

Sensors improve irrigation scheduling when they are paired with a water-balance method, crop stage, weather, irrigation-system output, and field observation. They do not replace checking application uniformity, emitter function, root depth, or plant stress.

Sources to keep with the farm binder

- University of Minnesota Extension, *Getting started with cover crops* and *Spring management of cover crops*.
- University of Minnesota Extension, *Tillage implements: purpose and ideal use* and *Soil moisture sensors for irrigation scheduling*.
- USDA NRCS, state-specific Cover Crop Practice Standard 340 materials and termination guidance.
- Your state Extension nutrient-management guide and the analytical lab's current sampling instructions.
- Penn State Extension, hay storage, baler-preservative, and fire-safety guidance.

Part III - Equipment, Calendars, and Records

Chapter 1: Yield Monitor Calibration

Modern yield monitoring systems depend on sensor inputs to calculate instant crop mass flow and moisture content as grain moves through the combine harvester. Achieving reliable yield map data requires methodical, multi-load calibration. A single-point calibration will only measure accuracy at one flow rate; when crop density, ground speed, or grain moisture fluctuates across a field, uncalibrated monitors produce yield map errors exceeding 15 percent.

Core Principles of Yield Sensor Operation

1. **Mass Flow Load Cells:** Positioned at the top of the clean grain elevator, an impact plate measures the force exerted by grain striking the plate. The load cell converts this mechanical force into an electrical voltage signal. Alternative volumetric optical sensors measure elevator paddle fill levels, but impact plate load cells remain the industry standard for grain combines.
2. **Moisture Sensor Calibration:** Dielectric capacitance sensors located in the clean grain elevator bypass tube measure the electrical permittivity of the grain. Moisture readings directly affect dry-bushel calculations. Because grain temperature alters electrical conductivity, moisture sensors incorporate an integrated thermistor.
3. **Vibration & Slope Compensation:** Mechanical vibrations from the thresher cylinder and uneven field slopes alter grain impact trajectory. Accelerometers or dual-load-cell differential circuits filter out machine vibration and chassis tilt up to 15 degrees.

Multi-Load Calibration Steps

Single-load calibration assumes a linear relationship between grain flow and load cell voltage. In reality, crop flow dynamics are non-linear. Multi-load calibration establishes a calibration curve across 4 to 6 distinct flow rate tiers.

Step 1: Pre-Calibration Preparation

- Inspect the clean grain elevator chain for proper tension (typically 1/4 inch to 1/2 inch side-to-side deflection at the mid-point inspection door).
- Clean the impact plate and remove accumulated crop residue, dust, or sap.
- Verify moisture sensor bypass auger operation and clear any grain build-up.
- Set combine tire pressures to manufacturer spec to maintain level operating geometry.
- Zero the elevator speed sensor and calibrate the header height sensor on flat ground.

Step 2: Establish Calibration Loads

- Select a field section with uniform crop yield and moisture.
- Plan 4 to 6 calibration runs at varying flow rates. Vary flow rates by changing combine ground speed (e.g., 2.5 mph, 3.5 mph, 4.5 mph, 5.5 mph) or by taking partial header widths at full speed.
- Each calibration load must weigh between 3,000 lbs and 10,000 lbs (or one full combine grain tank / weigh wagon load). Small loads under 2,000 lbs introduce scale rounding errors.

Step 3: Harvesting and Scale Weighing

- Clear the grain tank completely before starting each calibration load.
- Harvest the planned strip at a constant speed and full header width.
- Dump the grain directly into a certified weigh wagon or grain cart equipped with calibrated load cells, or transport the grain immediately to a certified elevator scale.
- Record the exact scale weight and moisture reading for each individual load.

Step 4: Input Scale Values and Moisture Offsets

- Enter the actual scale weight into the yield monitor console for each corresponding load number.
- Take 3 representative grain samples per load using a calibrated hand-held moisture tester (such as a DICKEY-john GAC2500 or equivalent benchtop meter).
- Calculate the average sample moisture and enter the offset into the yield monitor console.

Step 5: Verify Calibration Error Thresholds

- Compare the monitor's estimated weight against actual scale weight for each load.
- Target calibration error must be within +/- 1.0% to 2.0%.
- Re-calibrate if grain moisture shifts by more than 3% to 5%, if crop test weight changes significantly (e.g., switching from 56 lb/bu corn to 52 lb/bu corn), or when changing crop varieties with vastly different kernel sizes.

Sensor System	Operating Threshold / Target Range	Recalibration Trigger
Load Cell Mass Flow	+/- 1.0% to 2.0% error vs certified scale	Moisture shift > 3 - 5%, test weight change > 2 lb/bu
Moisture Sensor	+/- 0.5% moisture content vs handheld meter	Temp change > 20 deg F, switching crop varieties
Header Height Sensor	0% flow cutoff at non-harvest height	Changing header attachments or tire sizes

Sensor System	Operating Threshold / Target Range	Recalibration Trigger
Elevator Speed Sensor	+/- 1 RPM of actual shaft speed	Chain tension adjustment or belt replacement

Chapter 2: Telematics and Equipment Setup

In modern precision agriculture, seamless data flow between tractors, implements, and cloud platforms relies on standardized telematics protocols and CAN-bus architectures. Proper setup prevents data loss, misapplied inputs, and guidance line drift.

Fleet Telematics Integration

1. **Standardized Telematics Interfaces:** Modern fleets communicate using ISO 15143-3 (AEMP 2.0) telematics data standards and AEF (Agricultural Electronics Foundation) guidelines. This enables cross-brand fleet tracking (e.g., John Deere JDLink, Case IH AFS Connect, AGCO Telemetry) within a single farm management software (FMIS) platform.
2. **Data Transfer Protocols & Frequencies:** Machine performance telemetry (fuel rate, engine load, DEF consumption, hydraulic oil temperature) streams via cellular modems (LTE Cat-4 / Cat-M1) at 1 Hz (1 sample per second). High-density spatial agronomic data (as-applied rate maps, coverage maps) buffer locally on display hardware and sync to cloud servers every 30 to 60 seconds.
3. **Data Storage & Dead-Zone Buffering:** Hardware consoles must maintain internal solid-state storage buffers capable of logging up to 30 days of offline task data. When cellular signal is lost, files queue automatically in ISO 11783-10 Task Data XML (TASKDATA.XML) or Shapefile format (.shp, .dbf, .shx) and push immediately upon re-establishing network connection.

ISOBUS Architecture & Setup (ISO 11783)

ISOBUS provides plug-and-play compatibility between tractors and implements regardless of manufacturer.

Functional Classes

- **UT (Universal Terminal):** Allows the implement user interface to render on any ISOBUS-compliant cab display.
- **TC-BAS (Task Controller Basic):** Logs total values (total acres worked, total product applied, average application rate).
- **TC-GEO (Task Controller Geo-Referenced):** Handles spatial data logging and variable-rate application based on prescription maps.
- **TC-SC (Task Controller Section Control):** Switches implement sections (planter rows, sprayer boom sections) on and off automatically based on GPS boundaries and overlap maps.

Physical Bus Diagnostics

- **ISOBUS In-Cab & Break-Away Connectors:** 9-pin ISO 11783 diagnostic connectors located in the cab and at the rear hitch (IBBC - In-Cab Breakaway Connector).
- **Bus Resistance Standards:** Unpowered ISOBUS CAN-bus networks must measure 60 ohms total resistance across CAN-High (CAN-H) and CAN-Low (CAN-L). This is provided by two 120-ohm termination resistors located at opposite ends of the tractor harness.
- **Diagnostic Voltage Ranges:** With key ON, measure DC voltage to ground:
 - CAN-H: 2.5 V to 3.5 V (typically ~2.8 V nominal).
 - CAN-L: 1.5 V to 2.5 V (typically ~2.2 V nominal).
 - Differential Voltage (CAN-H minus CAN-L): 1.0 V to 2.0 V active dominant state; ~0 V recessive state.

Diagnostic Parameter	Normal Operating Spec	Fault Indication	Troubleshooting Action
Bus Resistance (Power OFF)	60 Ohms across CAN-H & CAN-L	120 Ohms (missing 1 resistor) / 0 Ohms (short circuit)	Inspect termination plugs at harness ends; test harness continuity
CAN-H Voltage (Key ON)	2.5 V to 3.5 V DC	< 1.0 V or > 4.5 V	Check for short to ground or short to 12V battery power
CAN-L Voltage (Key ON)	1.5 V to 2.5 V DC	< 0.5 V or > 3.5 V	Check for chafed wires or damaged pin connectors
ECU Power Supply	12.0 V to 14.4 V DC	< 10.5 V	Check ISOBUS main battery fuse (typically 30A or 50A Maxi fuse)

Auto-Guidance & RTK Setup

Spatial accuracy depends directly on correction signal tier and precise machine geometry measurements.

Correction Signal Tiers

- **SBAS (WAAS / EGNOS):** Free satellite-based correction. Pass-to-pass accuracy: +/- 6 to 9 inches (15 to 23 cm). Year-to-year repeatability: None. Suitable for broadacre tillage, spraying, and fertilizer spreading where drift is acceptable.
- **DGPS / High-Accuracy Satellite (RTX / SF3):** Subscription satellite correction. Pass-to-pass accuracy: +/- 1.5 to 3 inches (3.8 to 7.6 cm). Year-to-year repeatability: Moderate (+/- 2 inches). Suitable for secondary tillage, grain drilling, and haying.
- **RTK (Real-Time Kinematic - Cellular NTRIP or 900 MHz / 450 MHz Radio):** Local base station or CORS network correction. Pass-to-pass accuracy: +/- 0.8 to 1.0 inch (2.0 to 2.5 cm).

Year-to-year repeatability: Absolute (< 1 inch). Mandatory for strip-till, planting, row-crop cultivation, and drip tape installation.

Base Station & Distance Limits

- Dual-frequency RTK receiver distance from local base station must not exceed 6 to 8 miles (10 to 12 km). Baseline distances exceeding 8 miles introduce ionospheric signal degradation, increasing initialization times and degrading vertical accuracy.

Machine Geometry & TCM Calibration

Accurate guidance requires entering exact physical measurements into the display console: 1.

Antenna Height: Distance from ground to top center of GPS receiver dome. 2. **Centerline Offset (X-Offset):** Distance left or right of the machine axle center line (target: 0.0 inches). 3. **Axle Offset (Z-Offset):** Distance forward or backward from rear axle center line to receiver dome. 4. **Hitch-to-Axle Distance:** Distance from rear axle to drawbar pin or 3-point hitch pivot point. 5. **Implement**

Application Point Offset: Distance from implement hitch point to active row units or spray nozzles. 6.

Terrain Compensation Module (TCM) Calibration: Calibrate roll, pitch, and yaw on a flat, level

concrete surface. Drive tractor forward onto marked spot, calibrate TCM, turn tractor 180 degrees,

park on exact same spot, and complete zero-point offset calibration.

Chapter 3: Monthly Farm Operations Calendars

A structured operational calendar keeps equipment maintenance, crop inputs, livestock management, and administrative tasks on schedule. The following month-by-month checklist covers a mixed farming operation combining row crops, forage production, market garden production, and livestock management.

January: Winter Overhaul & Planning

- **Machinery:** Complete major engine overhauls; replace worn planter disc openers and seed tubes; overhaul hydraulic pumps; test display console software updates on bench.
- **Crops & Soil:** Review previous year soil test results; finalize crop rotation plans; place orders for seed, fertilizer, and crop protection products to secure early-pay discounts.
- **Livestock:** Inspect winter housing ventilation and bedding; audit hay inventory against herd requirements for remaining winter months; prepare calving/lambing kits.
- **Administrative:** Compile year-end financial ledgers; finalize tax filings; review crop insurance coverage options with agent prior to sales closing deadlines.

February: Shop Operations & Early Prep

- **Machinery:** Calibrate planter seed meters on test bench (verify singulation > 98%); replace worn tillage sweeps and disc blades; rebuild sprayer pump seals.

- **Crops & Greenhouse:** Start early cool-season brassica and Solanaceous crop seeds in greenhouse; check grain storage bins for hot spots or crusting (run aeration fans on clear dry days).
- **Livestock:** Begin early calving/lambing observation; maintain clean, dry nursery pens; monitor water trough heaters and supply lines during hard freezes.
- **Administrative:** Renew private pesticide applicator licenses; update farm safety data sheets (SDS) binder in shop; file annual EPA water discharge reports if applicable.

March: Pre-Season Field Preparation

- **Machinery:** De-winterize field tractors; change engine oil and filters; perform flow meter calibration on chemical applicators; inspect tire pressures and dual setups.
- **Crops & Soil:** Frost-seed legumes (red clover) into dormant pasture or winter wheat stands; take early spring nitrogen soil samples as field conditions permit.
- **Livestock:** Transition livestock feed rations as calving/lambing progresses; administer pre-turnout vaccinations per veterinary protocol.
- **Administrative:** Receive early spring fertilizer and pesticide deliveries; verify EPA registration numbers and batch labels against delivery manifests; set up field activity logbooks.

April: Planting & Spring Application

- **Machinery:** Set planter frame level and downforce settings; check double-disc opener contact (should touch for 1.5 to 2.0 inches at bottom of blade); calibrate liquid starter fertilizer pumps.
- **Crops & Soil:** Apply pre-plant burndown herbicides per label directions; begin planting early corn and spring small grains as soil temperatures reach 50 deg F at 2-inch depth.
- **Livestock:** Begin pasture rotation once forage growth reaches 8 to 10 inches height; establish rotational grazing paddock boundaries.
- **Administrative:** Post Worker Protection Standard (WPS) safety signs at field entry points prior to chemical applications; log all spray events within 24 hours.

May: Main Planting & Pasture Management

- **Machinery:** Monitor planter depth control and seed monitor seed spacing performance; grease implement drivelines every 10 to 50 hours per operator manual.
- **Crops & Soil:** Complete soybean planting and warm-season vegetable transplanting; perform post-emergence weed scouting 10 to 14 days after crop emergence.
- **Livestock:** Monitor turnout pastures for bloat risks when grazing lush legumes; manage bull/ram breeding soundness exams prior to turnout.
- **Administrative:** Complete USDA Farm Service Agency (FSA) crop acreage reporting (Form FSA-578); update organic or GAP compliance record files.

June: Crop Protection & First Hay Harvest

- **Machinery:** Inspect and sharpen hay mower/conditioner knives; service round baler net wrap and tension systems; adjust side-dress nitrogen applicator coulters.
- **Crops & Soil:** Execute first cutting of cool-season grass hay at boot to early-bloom stage; apply side-dress post-emergence nitrogen to corn at V4 to V8 growth stage.
- **Livestock:** Provide shade, clean water, and fly control mineral feeders in pastures; rotate paddocks every 3 to 5 days to maintain 4-inch residual forage height.
- **Administrative:** Audit pesticide inventory; maintain restricted use pesticide (RUP) logs; verify field re-entry intervals (REI) before sending field crews.

July: Mid-Season Monitoring & Second Hay Cut

- **Machinery:** Perform mid-season maintenance on crop sprayers (flush boom lines, clean nozzle strainers); begin pre-harvest combine inspection and belt replacement.
- **Crops & Soil:** Scout fields for corn rootworm, soybean aphids, and foliar fungal diseases (grey leaf spot, northern corn leaf blight); execute second cutting hay harvest.
- **Livestock:** Monitor livestock heat stress indices; ensure continuous water flow (minimum 15 to 20 gallons per head per day for lactating beef cattle in high heat).
- **Administrative:** Review mid-year budget performance against financial projections; order fall cover crop seed mixes.

August: Pre-Harvest Prep & Cover Crops

- **Machinery:** Complete full combine inspection (cylinder rasp bars, concaves, elevator chains, sieve adjustments); calibrate grain tank yield monitor hardware.
- **Crops & Soil:** Clean out and sanitize grain storage bins; sweep floors and apply EPA-approved bin wall residual insecticide treatment; seed fall cover crops into standing crops or bare ground.
- **Livestock:** Wean early spring calves/lambs; move livestock off summer paddocks during dry spells to prevent overgrazing down to root crowns.
- **Administrative:** Finalize grain marketing contracts and hedge positions; confirm commercial elevator drop-off schedules and moisture discount schedules.

September: Fall Harvest Kickoff & Seeding

- **Machinery:** Calibrate combine yield monitor load cells using first 4 to 6 harvested loads; monitor combine header loss (target < 1 grain/sq ft = ~1 bu/ac loss).
- **Crops & Soil:** Begin corn silage and high-moisture shell corn harvest; harvest early soybeans as seed moisture drops below 15%; seed winter wheat and fall cover crops.
- **Livestock:** Transition livestock onto fall stockpiled pastures or crop residue fields as harvest completes; check fencing around corn stalk fields.

- **Administrative:** Track daily grain moisture and drying fuel costs (propane/electric); record all field yield data into farm management software.

October: Peak Harvest & Fall Tillage

- **Machinery:** Grease combine fittings daily; clear chaff and trash build-up from engine compartment and exhaust manifolds every shift to prevent fire hazards.
- **Crops & Soil:** Complete main grain and soybean harvest; execute fall primary tillage or deep ripping on compacted headlands where necessary.
- **Livestock:** Administer fall weaning vaccinations and parasite treatments; group livestock by nutritional requirements for winter feeding.
- **Administrative:** Submit harvest yield logs to crop insurance agent for multi-peril policy compliance; perform fall grid soil sampling (1.0 to 2.5 acre grids).

November: Winterization & Post-Harvest Field Work

- **Machinery:** De-winterize liquid systems; flush crop sprayers with clean water followed by non-toxic RV antifreeze; drain engine cooling systems or verify anti-freeze freeze points (-30 deg F).
- **Crops & Soil:** Apply fall variable-rate dry fertilizer (P, K) and agricultural lime based on recent soil tests; check field drainage tiles and clear outlets.
- **Livestock:** Move herd onto dedicated winter feeding areas; inspect windbreaks and shelter buildings.
- **Administrative:** Complete equipment asset valuation updates for farm insurance policy renewal; reconcile final harvest tally against grain bin storage volumes.

December: Financial Closing & Strategic Planning

- **Machinery:** Wash all field equipment; apply rust inhibitor coating to bare metal tillage surfaces; store tractors and implements in shed out of weather.
- **Crops & Soil:** Analyze yield map data against soil maps, fertilizer prescription maps, and hybrid trial plots to evaluate return on investment.
- **Livestock:** Perform winter herd inventory count; monitor body condition scores (target BCS 5.0 to 6.0 for brood cows entering mid-winter).
- **Administrative:** Close out annual financial books; meet with farm accountant for end-of-year tax planning; establish operational goals and capital expenditure budget for coming year.

Chapter 4: Record-Keeping Templates

Farming operations require accurate, structured documentation to satisfy regulatory mandates, ensure worker safety, track equipment lifetime costs, and evaluate field profitability.

Record Tiers & Regulatory Obligations

1. **Restricted Use Pesticide (RUP) Logs:** Federal law (40 CFR Part 171) and state Departments of Agriculture mandate that certified applicators maintain records of all RUP applications for a minimum of 2 years (3 years in select state jurisdictions). Logs must be completed within 14 days of application.
2. **Worker Protection Standard (WPS):** Under 40 CFR Part 170, employers must display safety data sheets (SDS) and application records at a central location before spraying occurs and retain records for 2 years.
3. **Food Safety (GAP / USDA Organic):** Operations certified under Good Agricultural Practices or USDA National Organic Program (7 CFR Part 205) must retain field activity logs, compost/manure application records, and harvest cleanliness logs for 5 years.

Template 1: Pesticide & Spray Application Log

Always follow specific product label instructions and state/federal regulations. Verify application parameters against the EPA product label before applying any chemical.

Field ID & Location	Date & Time	Target Crop & Acres	Product Name & EPA Reg No	Active Ingredient & Rate/Ac	Total Product Used	Target Pest	Wind & Weather (Speed, Dir, Temp, RH)	Carrier & Pressure (Gal/Ac, PSI)	Nozzle Type & Size	
F-02 (North 40)	2026-05-12 08:30	Corn (40.0 Ac)	Harness Xtra 5.6L (EPA #524-512)	Acetochlor + Atrazine @ 2.0 pt/ac	10.0 gal	Grasses & Broadleaves	4-6 mph NW, 62 deg F, 55% RH	15 GPA @ 40 PSI	AIXR 11004 (Air Induction)	
F-05 (River Bottom)	2026-06-04 14:00	Soybeans (65.5 Ac)	Roundup PowerMAX 3 (EPA #524-659)	Glyphosate @ 30 oz/ac	15.35 gal	Post-emergence Weeds	3-5 mph W, 74 deg F, 48% RH	12 GPA @ 35 PSI	TTJ60 11003 (Turbo Twin)	
F-01 (Home 80)	2026-07-15 07:00	Corn (78.0 Ac)	Headline AMP (EPA #7969-291)	Pyraclostrobin + Metconazole @ 10 oz/ac	6.09 gal	Grey Leaf Spot	2-4 mph S, 68 deg F, 70% RH	20 GPA @ 45 PSI	AirMix 11003 (Low Drift)	
[Blank Entry]	YYYY-MM-DD HH:MM									

Template 2: Equipment Maintenance & Service Log

Equipment ID / Unit	VIN / Serial Number	Date of Service	Machine Hours / Odometer	Service Type (PM / Repair / Cal)	Fluids & Filters Changed (Type & Volume)	Parts Replaced & Part Numbers	Labor Hours	Technician / Shop	Total Cost (\$ Parts + Labor)
Tractor #1 (JD 7230R)	1RW7230R... 4892	2026-03-10	2,450 Hrs	250-Hr Scheduled PM	Engine Oil 15W-40 (26 Qts), Oil Filter, Fuel Filter	RE509672 (Fuel Filter), RE539279 (Oil Filter)	2.5 Hrs	In-House Shop	\$345.00
Sprayer #1 (Apache AS1020)	9140291... 3019	2026-04-18	1,120 Hrs	Emergency Repair	Hydraulic Fluid (5 Gal)	Boom Folding Cylinder Seal Kit (#SK-402)	4.0 Hrs	Valley Ag Repair	\$780.00
Combine #1 (CIH 7250)	YJG02491... 8812	2026-08-25	1,890 Hrs	Pre- Harvest Inspection	Trans Fluid, Main Hydraulic Filter	Elevator Chain (#8429102), Rasp Bars (#700192)	8.0 Hrs	In-House Shop	\$2,150.00
[Blank Entry]		YYYY-MM- DD							

Template 3: Field Activity & Yield Log

Field ID & Name	Total Acres	Crop Variety / Hybrid	Planting Date & Seeding Rate	Starter Fertilizer & Nitrogen Applied	Tillage Passes	Harvest Date	Avg Grain Moisture (%)	Harvested Gross Weight (Lbs)	Dry Bushels / Total Yield	Avg Yield (Bu/ Ac or Tons/ Ac)
F-01 (Home 80)	78.0 Ac	Pioneer P0589AM	2026-04-28 @ 34,000 seeds/ac	10 gal/ac 10-34-0 at plant; 140 lb N side- dress	Vertical Tillage (1 pass spring)	2026-10-12	16.5%	948,000 Lbs	16,320 Bu	209.2 Bu/ Ac
	40.0 Ac	Asgrow AG26XF3		None at plant; 100 lb	No-Till	2026-09-28	13.0%	158,400 Lbs	2,640 Bu	

Field ID & Name	Total Acres	Crop Variety / Hybrid	Planting Date & Seeding Rate	Starter Fertilizer & Nitrogen Applied	Tillage Passes	Harvest Date	Avg Grain Moisture (%)	Harvested Gross Weight (Lbs)	Dry Bushels / Total Yield	Avg Yield (Bu/ Ac or Tons/ Ac)
F-02 (North 40)			2026-05-08 @ 140,000 seeds/ac	K2O fall applied						66.0 Bu/ Ac
F-05 (River Bottom)	65.5 Ac	DeKalb DKC62-08	2026-05-02 @ 35,500 seeds/ac	12 gal/ac 7-21-7 at plant; 160 lb N side- dress	Chisel Plow (fall), Field Cultivator (spring)	2026-10-18	17.2%	838,400 Lbs	14,310 Bu	218.5 Bu/ Ac
[Blank Entry]			YYYY-MM-DD			YYYY-MM-DD				

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