# The 3-Sensor Garden

**Read Your Plants Before You Reach for a Bottle**

Introduction

## Why Farmers Read the Plant First

Walk into any commercial growing operation and ask the head grower what their most important tool is. They won't say a fertilizer program or an irrigation timer. They will say their eyes, hands, and sense of time, three sensors that cost nothing and miss almost nothing.

Home growers tend to do the opposite. Something looks off, so they reach for a bottle. Yellow leaves trigger a nitrogen spray. Brown tips trigger more water. Wilting triggers panic. Half the time the intervention makes things worse because the diagnosis was wrong.

This toolkit teaches you to slow down, use your three built-in sensors, and read what the plant is actually telling you before you do anything. That's how farmers work. That's how we're going to work.

**CROSS-REFERENCE:** Before diagnosing a nutrient problem, make sure your soil is right. See Toolkit No. 1: How to Make Great Soil for full soil recipes and amendment guidance.

🌴 **WARM CLIMATE NOTE:** In Florida and warm climates, heat stress mimics many deficiency symptoms. Before diagnosing nutrition, rule out temperature stress, especially for tomatoes above 90°F and leafy greens in full summer sun.

SECTION 1

## Meet Your Three Sensors

You already carry the three most important diagnostic tools in any garden. No equipment purchase required.

### The Three Sensors

| SENSOR | WHAT IT READS | WHAT YOU'RE LOOKING FOR |
|---|---|---|
| Sensor 1 — Your Eyes | Leaf color, pattern, texture, growth shape | Yellow, brown, purple, spotted, curled, stunted, distorted |
| Sensor 2 — Your Hands | Soil moisture, leaf firmness, stem strength | Dry vs. wet soil, wilted vs. turgid leaves, brittle vs. flexible stems |
| Sensor 3 — Your Calendar | Time elapsed since planting, feeding, watering | Whether the plant is on pace, ahead, or behind its natural schedule |

### The Diagnosis Order — Always Follow This Sequence

Most misdiagnoses happen because growers skip straight to nutrition. The right order is:

| STEP | CHECK THIS FIRST | BECAUSE |
|---|---|---|
| 1 | Water status | Drought and overwatering both cause yellowing and wilt, they look identical. Water kills more plants than any deficiency. |
| 2 | Light availability | Low light causes yellowing that looks exactly like nitrogen deficiency. No amount of fertilizer fixes a shade problem. |
| 3 | Root zone health | Compacted, waterlogged, or root-bound plants can't take up nutrients even if they're present in the soil. |
| 4 | Nutrient status | Only after ruling out water, light, and roots should you look at the leaf as a nutrition symptom. |

**COMMON MISTAKE:** Yellow leaves + fertilizer = often more damage. If the plant is overwatered, adding fertilizer salts to a wet, stressed root zone burns roots further. Always check water first.

SECTION 2

## Sensor 1 — Water: The First Thing to Rule Out

Water is the most mismanaged variable in home gardens. Both too much and too little kill plants. Before you call anything a 'problem,' you need to know the water status of your soil.

### The Finger Test

Push your index finger into the soil up to the second knuckle, roughly 2 inches deep. This is where most vegetable root action happens.

| WHAT YOU FEEL | WHAT IT MEANS | WHAT TO DO |
|---|---|---|
| Dry, crumbly, pulls away from pot or bed edge | Underwatered — plant is drawing water from deeper reserves | Water deeply and slowly. Check mulch cover to slow evaporation. |
| Cool, damp, like a wrung-out sponge | Good moisture level — where you want to be | Check again in 1–2 days depending on heat and plant size. |
| Wet, heavy, maybe smelly or mushy | Overwatered — low oxygen in root zone, possible root rot | Stop watering. Improve drainage. Check if pot or bed is draining. |

### The Weight Test (Containers Only)

Lift the pot. A dry pot is surprisingly light. A wet pot is heavy. Over two or three days, lift your containers each morning and you'll quickly develop a feel for when they need water without ever putting a finger in the soil. This is one of the fastest skills a container grower can build.

### Reading Wilt — Not All Wilt Is Drought

| WILT TYPE | WHAT IT LOOKS LIKE | WHAT IT MEANS |
|---|---|---|
| Midday wilt | Leaves droop in afternoon heat, recover by morning | Normal heat response — not a watering problem. Don't water extra. |
| Morning wilt | Leaves still drooped at 7 AM after cool night | True drought stress — water needed |
| Wilt in wet soil | Plant is drooped but soil is wet | Root rot or root damage — more water will kill it. Stop watering. |

🌴 **WARM CLIMATE NOTE:** In South Florida and the Gulf Coast during summer, midday wilt is almost universal. Check your plants before 8 AM. If they've recovered overnight, the plant is fine. If they haven't, you have a real water deficit.



*Learn this difference and you'll never overwater again*




SECTION 3

## Sensor 2 — Light: The Most Under-Diagnosed Problem

Growers underestimate how much light vegetables need. Most fruiting crops, tomatoes, peppers, squash, cucumbers, need 6 to 8 hours of direct sun to thrive. Leafy greens can do 4 to 6. Below those thresholds, plants start showing symptoms that look exactly like nutrient deficiencies.

### Mapping Your Light Hours

Take one day in the first week of a new growing season and map your space properly:

- Set a timer and check your growing area every hour from 7 AM to 7 PM.
- Mark each hour as: Full Sun (direct overhead or angled sun hitting leaves), Partial (some direct sun), or Shade (no direct sun).
- Count the full-sun hours. That number tells you what you can grow.
- Repeat this mapping seasonally, sun angles shift significantly between summer and winter, and trees leaf out and change the picture.

| DAILY DIRECT SUN | WHAT YOU CAN GROW | WHAT TO EXPECT |
|---|---|---|
| 6-8+ hours | Tomatoes, peppers, squash, cucumbers, beans, corn, melons | Full production potential |
| 4-6 hours | Lettuce, spinach, kale, herbs, radishes, beets | Good leafy production; fruiting crops will underperform |
| 2-4 hours | Some herbs (mint, parsley), shade-tolerant greens | Limited production — work with your reality |
| Under 2 hours | Very few edibles succeed | Consider grow lights, or prioritize container growing near a window |

### Light vs. Nutrition: Telling Them Apart

This is where many home growers waste money. The symptoms overlap significantly.

| SYMPTOM | LIGHT DEFICIENCY CLUE | NUTRIENT DEFICIENCY CLUE |
|---|---|---|
| Yellowing leaves | Even yellowing across the whole plant; leggy, reaching growth | Patterned yellowing (specific location on leaf or plant) |
| Slow growth | Small leaves, thin stems, pale green throughout | Specific crop behind others in same light; some leaves look normal |
| Poor fruiting | Flowers but drops them; fruit doesn't set | Leaves show obvious discoloration before fruit fails |
| Leggy seedlings | Plants stretch strongly toward light source | Seedlings are compact but off-color |

**FARMER RULE:** If the plant is reaching, stretching stems toward light, one-sided growth, long internodes, it's a light problem. No fertilizer in the world fixes a shade problem. Move the plant or move the shade.




*The stretch is not growth — it's a distress signal*

SECTION 4

## Sensor 3 — Nutrition: Read the Leaf as a Map

Once you've ruled out water and light problems, you can start reading the plant's leaves as a nutrient map. Plants are organized systems, when they run short of something, they move available resources from old leaves to new leaves (mobile nutrients) or show the problem first in new growth (immobile nutrients). That pattern tells you what you're looking at.

### Mobile vs. Immobile Nutrients — The First Sort

| NUTRIENT TYPE | WHERE SYMPTOMS APPEAR FIRST | KEY NUTRIENTS |
|---|---|---|
| Mobile | Older, lower leaves — plant pulls from there to feed new growth | Nitrogen (N), Phosphorus (P), Potassium (K), Magnesium (Mg) |
| Immobile | Newest growth — plant can't move these from old to new | Calcium (Ca), Iron (Fe), Manganese (Mn), Boron (B), Sulfur (S) |

### Deficiency Symptom Quick Reference

| NUTRIENT | SYMBOL | WHERE IT SHOWS | WHAT IT LOOKS LIKE |
|---|---|---|---|
| Nitrogen | N | Old leaves first | Uniform yellowing starting from bottom of plant; leaves may drop |
| Phosphorus | P | Old leaves first | Purple or reddish undersides of leaves; dark green upper surface; stunted roots |
| Potassium | K | Old leaf edges | Yellowing and browning at leaf margins (edges), especially on older leaves |
| Calcium | Ca | New growth & fruit | Tip burn on lettuce; blossom end rot on tomatoes and peppers; curled new leaves |
| Magnesium | Mg | Old leaves | Interveinal chlorosis — yellow between leaf veins, green veins stay green |
| Iron | Fe | New growth first | Interveinal chlorosis on youngest leaves; veins stay green while leaf yellows |
| Manganese | Mn | New leaves | Similar to iron — interveinal yellowing; may have small brown spots |
| Sulfur | S | New growth | Uniform light green to yellow on new leaves; entire leaf affected equally |
| Boron | B | Growing tip | Distorted, thickened, or dead growing tips; hollow stems in brassicas |

### Before You Treat: Confirm the Problem

Don't treat a single symptom. Run this confirmation checklist first:

- Is the symptom isolated to one plant, or do multiple plants show it? (One plant = likely mechanical, root, or disease issue. Multiple = likely environmental or nutrient)
- What does the soil pH test show? Most nutrient uptake problems in established gardens are pH-related, the nutrient is present but locked out. Check your soil pH before adding any amendments. See Toolkit No. 3 for soil testing guidance.
- When did you last amend? Overcorrecting a nutrient that isn't actually deficient can create toxicity and lock out other nutrients.
- Is it spreading up the plant or staying in one place? Spreading deficiencies are progressing, get ahead of them. Static symptoms may resolve on their own as conditions improve.

**OVER-AMENDMENT WARNING:** Adding fertilizer to a plant that doesn't need it is one of the fastest ways to kill it. Salt buildup, pH shift, and nutrient antagonism (too much of one blocks another) are all real risks. When in doubt, do less. Good soil with proper pH feeds most crops without any additional intervention.

🌴 **WARM CLIMATE NOTE:** In Florida, calcium deficiency is extremely common because of fast-draining sandy soils and high summer rainfall. If you're seeing blossom end rot on tomatoes or tip burn on lettuce, add crushed oyster shell or gypsum to your beds before your next planting, not calcium spray mid-season.




SECTION 5

## The Symptom Flowchart: One Question at a Time

When something looks wrong, work through these questions in order. Don't skip ahead. The right answer almost always lives in the first three questions.




### Quick-Reference: Symptom Location to Likely Cause

| SYMPTOM LOCATION | MOST LIKELY CAUSE | NEXT STEP |
|---|---|---|
| Bottom leaves, whole plant yellowing uniformly | Nitrogen deficiency or overwatering | Check soil moisture first; if dry, N deficiency likely |
| Leaf edges brown or yellow (older leaves) | Potassium deficiency or salt buildup | Test soil; flush container or check soil EC |
| Between-vein yellowing, new leaves | Magnesium deficiency | Epsom salt foliar spray (1 tbsp/gallon) as test dose |
| Between-vein yellowing, new leaves | Iron or manganese deficiency | Check pH — likely too high (above 7.0) for iron uptake |
| Growing tip dead or distorted | Calcium or boron deficiency | Improve watering consistency; add calcium source to soil |
| Purple undersides on leaves | Phosphorus deficiency (or cold stress) | Check temperature; if above 50°F, test and amend phosphorus |
| Whole plant pale green, reaching toward light | Light deficiency | Count sun hours; relocate plant or remove shade |
| Irregular spots, rings, mosaic pattern | Viral or fungal disease — not a nutrient issue | Remove affected leaves; research the specific crop disease |

SECTION 6

## The 24-Hour vs. 2-Week Action Table

Not everything needs action right now. Part of using your three sensors is knowing what to act on immediately and what to monitor and reassess. Reacting too quickly to every symptom creates new problems.

| ACT IN THE NEXT 24 HOURS | MONITOR FOR 2 WEEKS FIRST |
|---|---|
| Wilted plant in dry soil — water now | Single yellow leaf on an otherwise healthy plant |
| Wilted plant in wet soil — stop watering, check drainage | Slightly slower growth than expected |
| Blossom end rot appearing on fruit — improve watering consistency | One or two spots on outer leaves |
| Seedlings stretching hard toward light — add light or relocate | Pale color in a plant that was recently transplanted |
| Roots coming out of drainage holes — repot immediately | Light interveinal yellowing on a couple of older leaves |
| Growing tip dying or distorting — assess calcium and watering | Leaves slightly smaller than usual in first two weeks after transplant |
| Entire plant collapsing — check for root rot or crown damage | Occasional brown tip on an outer leaf |
| Pest damage spreading fast (holes multiplying, colonies visible) | A single leaf with discoloration while rest of plant looks healthy |
| Soil completely hydrophobic (water beading off or running through instantly) | Color that seems slightly off but plant is still producing |
| Fruit cracking on tomatoes or peppers — regulate watering schedule | Very slow germination relative to seed packet estimate |
| Signs of disease spreading between plants — remove affected tissue | A slightly leggy seedling that just arrived from the nursery |
| Container plants in full summer sun wilting daily before noon | Leaves that show one symptom but have been the same for two weeks |

**FARMER TIMING RULE:** A symptom that appeared today and is changing fast is an emergency. A symptom that has been the same for two weeks probably won't kill the plant this week. Prioritize moving problems over static ones.

SECTION 7

## When to Pull the Crop and Move On

This is the section most home growers skip. Nobody wants to pull a plant they've invested weeks in, but one declining plant can hold back an entire bed, harbor disease, attract pests, and delay your next more productive planting. Farmers know when to cut losses. You need to develop that instinct too.

### The Math on Pulling

A tomato plant that peaked three weeks ago and is now declining is not going to recover to peak production. Every week it stays in the bed is a week of prime growing space, water, and nutrients spent on diminishing returns. A fresh transplant of the same variety would be producing well within 6–8 weeks. Do that math before you decide to nurse a sick plant through another month.

**SUNK COST WARNING:** The time and money you've already spent on a plant are gone whether you pull it or not. The only question is: what will this space produce if I pull now vs. if I hold on? Make that calculation forward, not backward.

### Pull the Crop When You See These Signs

| SIGN | WHAT IT MEANS | WHAT TO DO NEXT |
|---|---|---|
| More than 50% of leaves showing severe symptoms | Plant energy budget is compromised — recovery unlikely | Pull, add compost to bed, replant or allow rest period |
| Viral symptoms (mosaic, ring spots, distortion) | No cure for virus in the field — and it can spread | Pull and bag immediately — don't compost infected material |
| Root rot confirmed (mushy, dark roots at crown) | Root system cannot recover in place | Pull, let bed dry, amend with perlite or coarse material before replanting |
| Plant past its productive window for your climate | Natural end-of-life for that crop in your conditions | Pull at first sign of decline rather than nursing through heat or cold |
| Pest pressure that isn't responding to management | Colony is established — individual plant is sacrificed to protect others | Pull infested plant, inspect surrounding plants carefully |

### After You Pull — What to Do Right

- Remove as much root material as you can, especially if disease was involved.
- If the plant was diseased or pest-infested: bag it and trash it. Do not compost.
- If it was healthy but simply done: chop and drop the biomass into the bed or compost pile.
- Amend the bed before replanting, add compost, check moisture, let it settle for a day if you amended with anything that needs time to integrate.
- Record what happened in your garden log,I season, crop, symptom, outcome. That data is gold the next time you grow that crop.

🌴 **WARM CLIMATE NOTE:** In Florida's year-round growing climate, pulling an exhausted crop in March sets you up for a much stronger warm-season succession. Most growers hold on too long trying to push through the heat. Pull tomatoes when daytime temps consistently exceed 90°F and the plant has stopped setting fruit, succession with heat-tolerant crops like sweet potatoes, yard-long beans, or Malabar spinach.




*Pulling on time is how you keep the garden moving forward.*

SECTION 8

## The Neighborhood Garden Mentor — Building Your Help Circle

Even the most experienced growers get stumped. That's not a failure of the three-sensor system, it's a sign you've reached the edge of what this toolkit can cover. The next step is human expertise, and it's more available than most home growers know.

### Your Local Expertise Network

- Your county cooperative extension office: Free plant clinics, soil testing, and master gardener programs exist in every Florida county and most states. This is taxpayer-funded expertise — use it.
- Local nursery staff: The staff at a good independent nursery have seen every local problem. Bring a sample or a good photo.
- Neighboring growers: If you're growing in a community garden or neighborhood with active growers, someone nearby has probably seen your exact problem before. Ask.

### How to Ask for Help Effectively

A photo and a diagnosis attempt is worth ten times more than 'my plant looks bad.' When you reach out:

- Bring your three-sensor assessment: 'Soil moisture is good, light is 6+ hours, symptom is on older leaves only.'
- Describe when the symptom appeared and how fast it's progressing.
- Note your soil type and any recent amendments or changes.
- Photo the whole plant and a close-up of the affected leaf, both views matter.

### Diagnosis Visit Checklist

If someone comes to look at your garden, or if you're visiting a neighbor's, walk through this:

| WHAT TO CHECK | WHAT TO LOOK FOR |
|---|---|
| Soil moisture at 2-inch depth | Dry, moist, or wet? |
| Sun hours at this location | Full sun, partial, or shade? |
| Symptom location on plant | Old leaves, new growth, growing tip, or all over? |
| Symptom pattern on leaf | Uniform, edges, between veins, spots, or tip? |
| Other plants nearby showing same symptoms? | One plant or multiple — and which varieties? |
| Root inspection (pull or slide from pot) | White and firm (healthy) or dark, mushy, smelly (root rot)? |
| Recent changes: amendments, products, weather events | Anything new in the past 2-3 weeks? |
| Underside of leaves | Pest eggs, whiteflies, spider mite webbing, aphids? |

Tracker

## My Garden Diagnosis Log

Use this log to track problems and outcomes over time. Your own records are the best reference you'll ever build.

| DATE | CROP & BED | SYMPTOM OBSERVED | THREE-SENSOR ASSESSMENT | OUTCOME / WHAT WORKED |
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Checklist

## The Three-Sensor Daily Check

A 2-minute walk-through each morning prevents 90% of garden emergencies:

**SENSOR 1 — EYES: What do I see?**

- ☐ Overall plant posture — upright and turgid, or drooping?
- ☐ New growth — healthy and deep green, or pale, distorted, or stunted?
- ☐ Older leaves — any yellowing, browning, or spots progressing?
- ☐ Undersides of leaves — any pests, webbing, or damage?

**SENSOR 2 — HANDS: What do I feel?**

- ☐ Soil at 2-inch depth — dry, moist, or wet?
- ☐ Container weight (if applicable) — light (needs water) or heavy (hold off)?
- ☐ Stem firmness — solid and upright, or soft and rubbery?

**SENSOR 3 — CALENDAR: What does time tell me?**

- ☐ How many days since transplant or germination? Is growth on pace?
- ☐ How many days since last watering? Is the soil drying at the expected rate?
- ☐ How many days since last amendment or feed? Is it time to reassess?
- ☐ Where are we in the season? Is this crop approaching its natural end?

**TOOLKIT SERIES:** The 3-Sensor Garden is part of the NFUSA Home Grower Toolkit Series. Visit neighborhoodfarmsusa.org/knowledge-hub/toolkits-for-growers/ for all available guides, including the Supply Guide for recommended tools and materials referenced throughout this series.