ProfitProAG

More from Every Acre, Animal & Gallon of Manure

Foundational Crop Production Information

The Advantage of Farming the Controllables is to create...

Healthier Soil

Water Quality

Healthier Plants → **Healthier Livestock** ← **Healthier Environment**

Healthier PROFIT$

Be an Environmental Steward

ProfitPro®AG

Achieve More from Every Acre, Animal & Gallon of Manure

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More from Every Acre, Animal & Gallon of Manure

Why is so much corn prematurely dying?

Stalk rots trigger almost all premature death in corn—and they're probably lurking in your field.

When a crop runs short of energy to fully complete its life cycle, it prematurely dies. This reduces yield and quality. Growing to full maturity requires high-yielding crops to "stay green" and die from a killing frost or the combine.

Healthy Corn with a Mature and Dry Ear at Harvest

- High test weight & nutrient density
- Free of mycotoxins

Premature Death of Corn

- Low test weight & nutrient density
- Loaded of mycotoxins

Ask about ProfitProAG's *Farming the Controllables* and your **"Recipe for Success"** to achieve stay green crops.

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FORMULA for 400 bu/A Corn
Produces 38,840,000 kernels/A

Ingredient	Amount (Seed and Stover)
Carbon (air is 0.03% CO_2)	18,000 lbs (45 lbs/bu)
Glucose	40,000 lbs (100 lbs/bu) (Glucose is 45% carbon)
Water	2,000,000 gal (5,000 gal/bu)
Nutrients in Seed and Stover	• 600 lbs (1.5 lbs/bu) Nitrogen (33% left in stover) • 240 lbs (0.6 lb/bu) Phosphorus (42% left in stover) • 520 lbs (1.3 lbs/bu) Potassium (80% left in stover) • 84 lbs (0.21 lb/bu) Calcium (90% left in stover) • 64 lbs (0.16 lb/bu) Sulfur (56% left in stover) 1,508 Total Pounds

Components of Corn Yield

- Ears per acre
- Rows per ear
- Kernels per row
- Kernel weight

FORMULA for 100 bu/A Soybean
Produces 15 million seeds/A

Ingredient	Amount (Seed and Stover)
Carbon (air is 0.03% CO_2)	13,545 lbs (135.5 lbs/bu)
Glucose	301,080 lbs (301 lbs/bu) (Glucose is 45% carbon)
Water	1,350,000 gal (13,500 gal/bu)
Nutrients in Seed and Stover	• 550 lbs (5.5 lbs/bu) Nitrogen (24% left in stover) • 120 lbs (1.2 lb/bu) Phosphorus (29% left in stover) • 240 lbs (2.4 lbs/bu) Potassium (41% left in stover) • 170 lbs (1.7 lb/bu) Calcium (88% left in stover) • 45 lbs (0.45 lb/bu) Sulfur (56% left in stover) 1,125 Total Pounds

Components of soybean Yield

- Plants per acre
- Nodes per plant
- Seed weight
- Pods per node
- Seeds per pod

Big crop yields start with a "Recipe for Success"

Farming the Controllables

"Recipe for Success"

Phase I Residue Management–"Second Harvest"

Phase II At-Plant–"Jump Start Yield"

Phase III In-Season–"Stay Green"

For your Customized "Recipe for Success," call ProfitProAG at 507-373-2550 or visit profitproag.com

Farming the Controllables

"Recipe for Success"

Photos taken September 8th, 2021

2021 Photos/Terry Kucera

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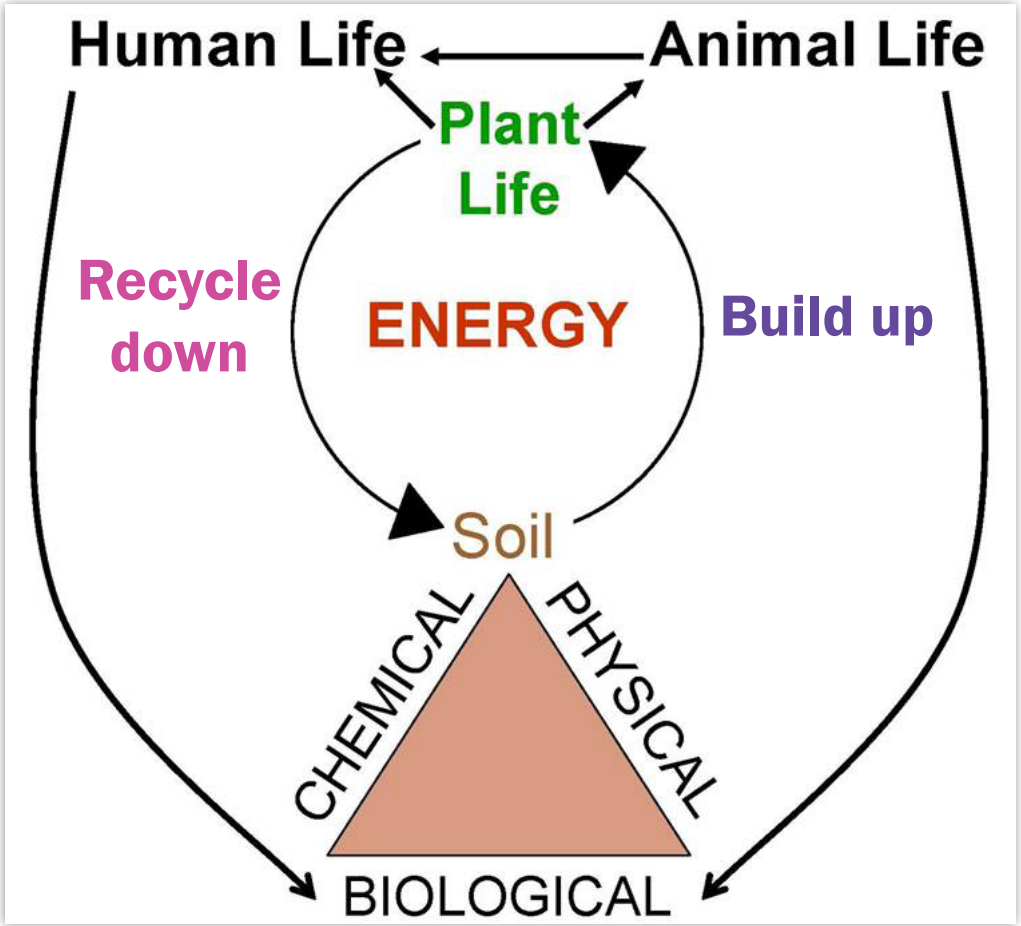
More from Every Acre, Animal & Gallon of Manure

Microbiology is the Foundation to a Healthy Production System

"Nature's" Life Cycle



Farm the Controllables "Recipe for Success"

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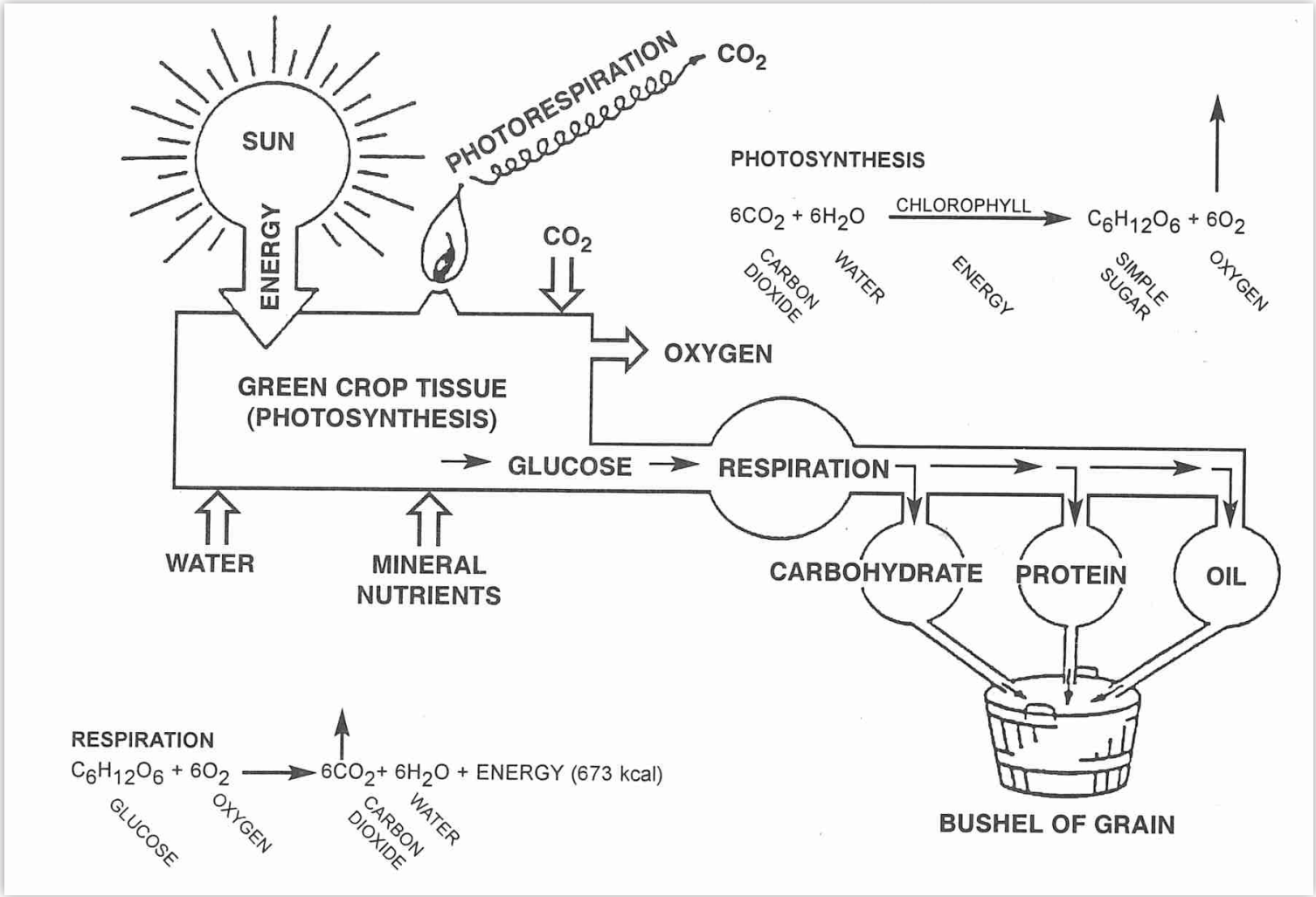
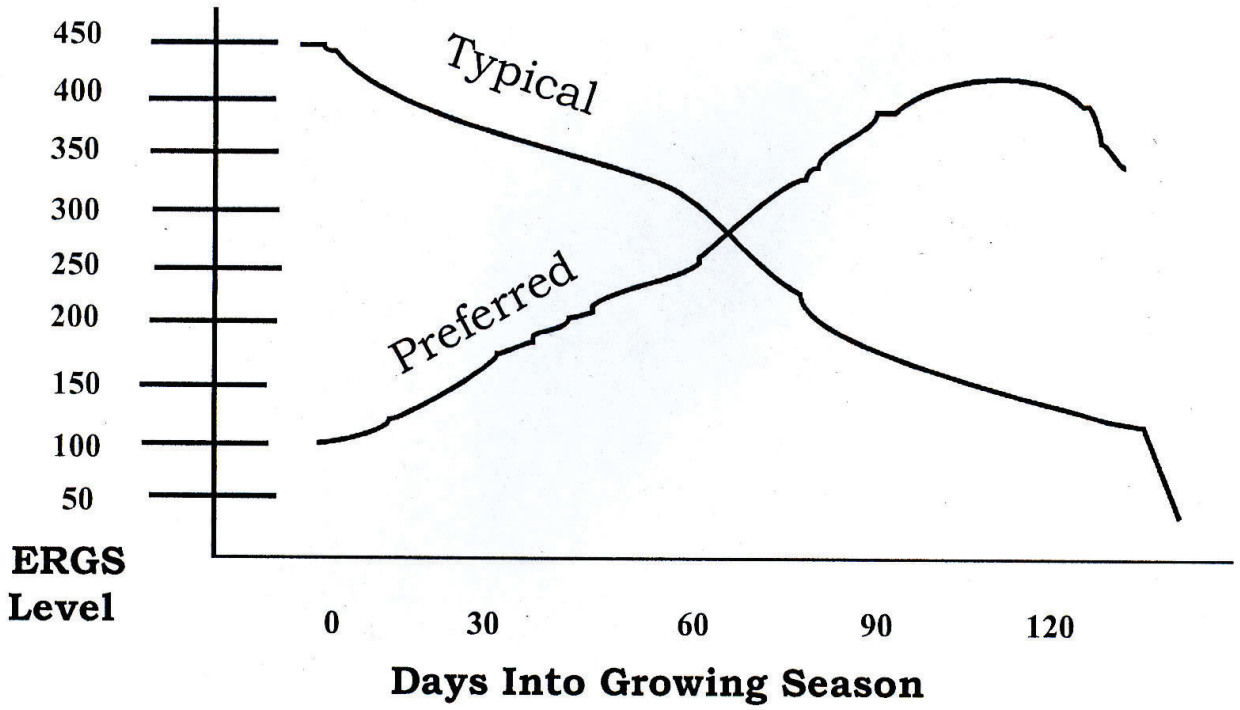
More from Every Acre, Animal & Gallon of Manure

The Story of Crop Productivity



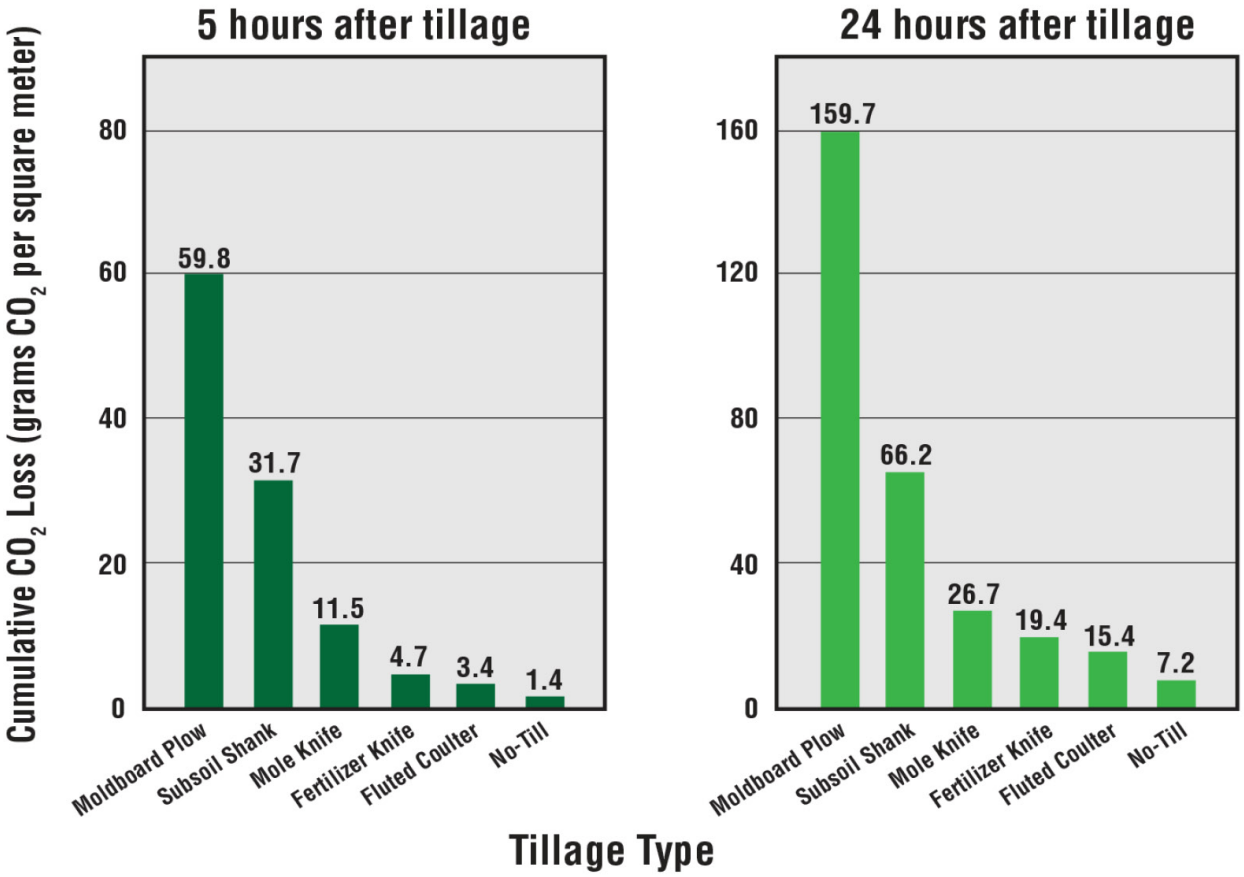
Source: Adapted from Johnson, Richard R. 1980. How high can yield go? August-September, p. 11. Crop and Soils Magazine

Energy for Kernel Development



- ERGS is a unit of conductance equaling the amount of energy given off per gram of soil per second.

Measuring Carbon & Energy Losses



Microbes function in the Soil in these important ways

- They decompose the plant and animal residues added to the soil
- Liberate the Nitrogen and Minerals necessary for plant growth
- Oxidize and transform fertilizer into forms available to plants
- Produce organic plant foods from organic residues in the soil
- Have a very favorable effect upon seed germination
- Produce substances that have a direct beneficial effect upon plant growth
- Build and improve soil structure

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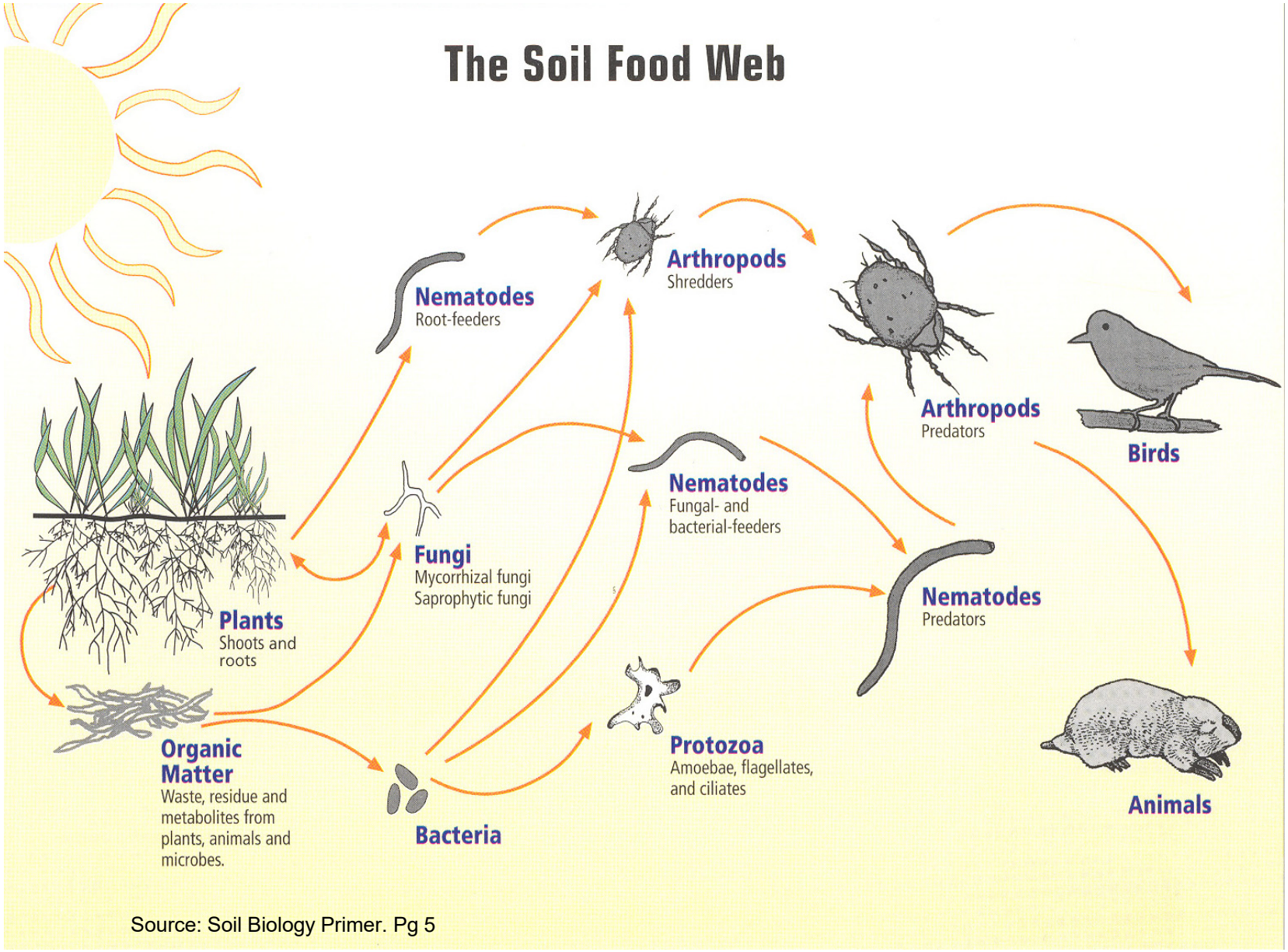

Source: Soil Biology Primer. Pg 5

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Microbe Nutrient Cycling

Bacteria	**5:1**	**C/N, C/P, C/K, C/Ca, C/Mg, C/S, C/Mn, C/Fe**
Fungi	**20:1**	**C/N, C/P, C/K, C/Ca, C/Mg, C/S, C/Mn, C/Fe**
Protozoa	**30:1**	**C/N, C/P, C/K, C/Ca, C/Mg, C/S, C/Mn, C/Fe**
Nematodes	**100:1**	**C/N, C/P, C/K, C/Ca, C/Mg, C/S, C/Mn, C/Fe**

EATS

Bacteria		**Protozoa**
5:1		**30:1**
	6 Bacteria	**30:6**
	X 5:1	**- 5 N – NH_4 – Soil**
	30:6	

EATS

Fungi		**Nematodes**
20:1		**100:1**
	5 Fungi	**100:5**
	X 20:1	**- 4 N – NH_4 – Soil**
	100:5	

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Importance of Microbial Activity in Soil

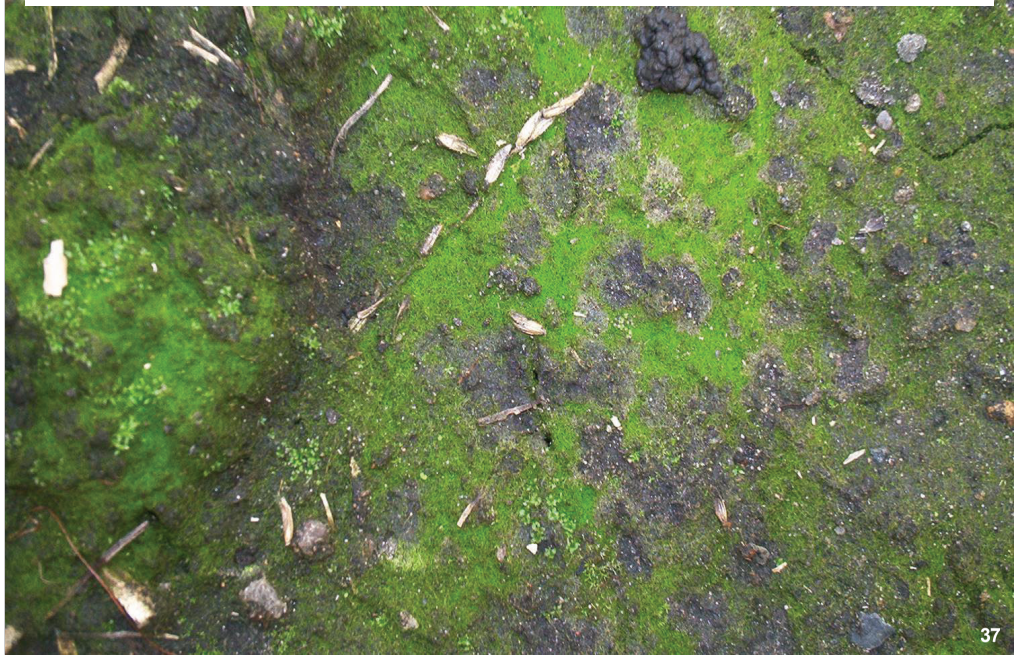
USDA experiments have shown that in some areas earthworms convert 700 pounds of soil per acre, per day, into earthworm castings. These castings are generally mixed with the upper few inches of the native soil causing a build-up of topsoil.

Chemical analysis of parent soil without microorganisms and earthworms, and of the same soil after it is worked by earthworms and microorganisms showed the following increase in the table below.

Nutrient	Percent Increase
Nitrate Increase	500
Available Phosphorus	700
Exchangeable Potassium	1,200
Exchangeable Calcium	150
Organic Carbon	200
Available Magnesium	200

- Microorganism activity in one acre of soil uses about the same amount of energy in soil preparation as 10,000 people would burn for the same work, for the same period of time.
- Microorganisms must be protected, nourished and further stimulated when required.

Nitrogen fixing microorganisms (cyno-bacteria) & earthworm castings



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Earthworm Residue Mound

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Roots following earthworm channels

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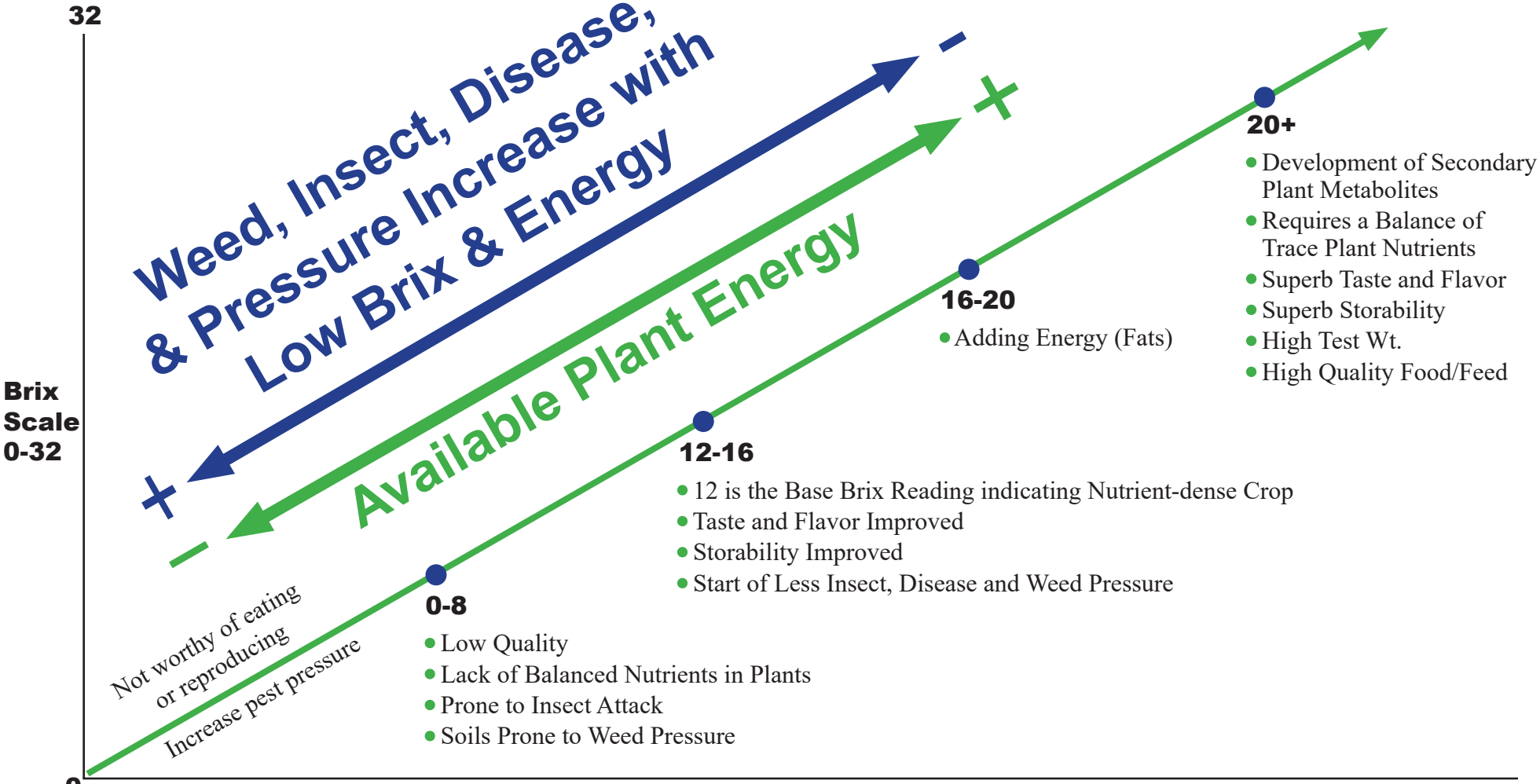
Why is so much corn prematurely dying?

Stalk rots trigger almost all premature death in corn—and they're probably lurking in your field.

When a crop runs short of energy to fully complete its life cycle, it prematurely dies. This reduces yield and quality. Growing to full maturity requires high-yielding crops to "stay green" and die from a killing frost or the combine.

Stalk rots cause damage and yield loss in many corn fields across North America each year. Depending on location, stalk rot organisms may include Anthracnose, Gibberella, Diplodia or Fusarium, all of which survive in corn residue and are spread to the next crop by wind and/or rain. Stalk rots can reduce corn yield by killing the plant before physiological maturity. They can also cause plant lodging, increasing harvest losses and impeding harvest progress. When plants become infected with a stalk rot they are more susceptible to ear rot which can lead to grain quality issues and mycotoxins.

Growing High Brix, Nutrient-dense Crops is Dependent on Soil & Plant Health



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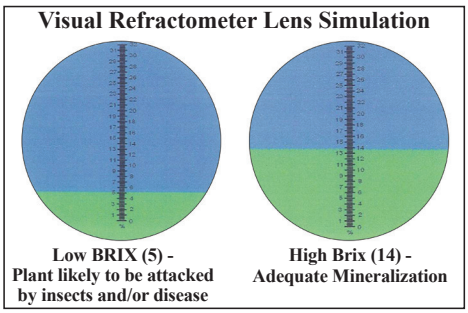
Producing Quality and Value-added Food and Feed

by Dr. Jim Ladlie, ProfitProAG Owner

Measuring BRIX is one of the simplest ways to evaluate crop health and productivity.

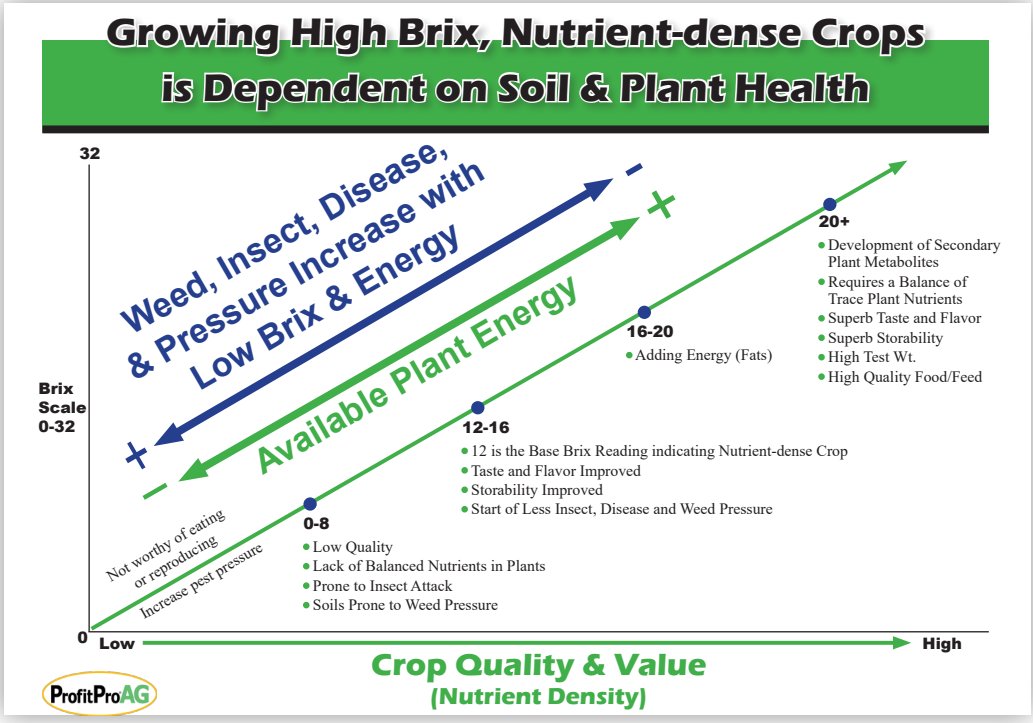
Brix is measured with a refractometer that measures (scale 0 to 32) total dissolved solids in plant sap (Brix) and provides information about photosynthesis, proteins and sugars. Low Brix levels (<12) can indicate a lack of balanced nutrients within the plant and/or the effect of environmental stress factors due to poor growing conditions (wet soils, cloudy weather, etc.) or low fertility. Low BRIX (<12) plants are more likely to be attacked by insects and/or disease. Brix readings of >12 indicate good plant health.

Visual Refractometer



Refractometer Readings

Within a given species of plant, the crop with the higher refractive index will have higher sugar, mineral and protein content, as well as a greater specific gravity or density. This adds up to a sweeter tasting, more minerally nutritious food with a lower nitrate and water content and better storage characteristics. It produces more alcohol from fermented sugars, is more resistant to insects and results in a decreased insecticide usage. Crops with high sugar content have a lower freezing point and, therefore, are less prone to frost damage. Soil fertility needs may also be ascertained from this reading.



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Mineral Percent of Dry Weight Plant Matter

Structural Components

MACRO NUTRIENTS

	Symbol	Atomic Weight	Plant Dry Weight %
Hydrogen	H	1	6
Carbon	C	12	45
Nitrogen	N	14	1.5
Oxygen	O	16	45
Magnesium	Mg	24	0.2
Potassium	K	39	1
Calcium	Ca	40	0.5
Phosphorous	P	31	0.2
Sulfur	S	32	0.1
		Total	**99.50%**

Cofactor Enzyme Activators

MICROS AND TRACE NUTRIENTS

	Symbol	Atomic Weight	Plant Dry Weight %
Boron	B	11	0.002
Chlorine	Cl	35	0.01
Manganese	Mn	55	0.005
Iron	Fe	56	0.01
Copper	Cu	64	0.006
Zinc	Zn	65	0.002
Molybdenum	Mo	96	0.00001
		Sub Total	0.03501
		All others	0.46499
		Total	**0.50%**

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Building Test Weight, Nutrient Density and Brix Level

Percentage of Plant Weight			
45%	45%	6%	1.5%
C	O	H	N
Atomic Weight			
12	16	1	14

Test Weight Building Nutrients

Minerals	Atomic Wt.
P	31
K	39
S	32
Ca	40
Mn	55
Fe	55
Cu	63
Zn	65
Mo	95
etc.	

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What does Mineral and Microbial Balance do?

Reduces	Improves
Compaction	Drainage/Aeration
Disease	Microbial activity
Insects	Soil organic content
Weeds	Recycling of nutrients
Inputs	Mineral balance and availability
Toxins	Crop residue digestion
Salts	Water utilization and efficiency
Mineral tie-up	Optimize the plants genetic potential
Plant stress	Improves feed/food quality

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Corn Test Weights

Bu/Acre	200.00	200.00
lbs/Acre	**56.00** 15.5% moisture	**61.00** 15.5% moisture
Lbs/Acre	11,200.00	12,200.00
Bu Price	4.50	$4.50
C.W.T	112.00	122.00
C.W.T Price	$8.04	$8.04
Proceeds/Acre	$900.48	$980.88
$$ Difference/Acre	**$80.40** ($16.08/A/lb/twt)	

Ingredients & Components Necessary to

ACHIEVE HIGHER YIELD

Components of Corn Yield

The components that make bushels of corn are:

- **Ears per acre**
- **Rows per ear**
- **Kernels per row**
- **Kernel weight**

Approximately 36,000,000 kernels must be produced per acre to achieve 400 bu/A corn.

INGREDIENTS OF CORN YIELD

Ingredient	Amount (Seed and Stover)
Carbon (air is 0.03% CO_2)	18,000 lbs (45 lbs/bu)
Glucose	40,000 lbs (100 lbs/bu) (glucose is 45% carbon)
Water	2,000,000 gal (5,000 gal/bu)
Nutrients in Seed and Stover	• 600 lbs (1.5 lbs/bu) Nitrogen (33% left in stover) • 240 lbs (0.6 lb/bu) Phosphorus (42% left in stover) • 520 lbs (1.3 lbs/bu) Potassium (80% left in stover) • 84 lbs (0.21 lb/bu) Calcium (90% left in stover) • 64 lbs (0.16 lb/bu) Sulfur (56% left in stover) **1,508 Total Pounds**

Source ProfitPro, LLC. 2003

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Achieve Higher Corn Yields with the "Recipe for Success"

Components of Corn Yield

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- **Ears per acre**
- **Rows per ear**
- **Kernels per row**
- **Kernel weight**

Approximately 36,000,000 kernels must be produced per acre to achieve 400 bu/A corn.

Based on average kernels per bushel

Components of Corn Yield:

1. **Ears per Acre established at V3**
   * 36,000,000 ÷ 1000 kernels/ear = **36,000 ears/A** (36,000,000 kernels ÷ 90,000 kernels/bu = **400 bu**)
   * 34,000 ears/A ÷ 1000 kernels/ear = **34,000,000 kernels/A** (34,000,000 kernels ÷ 90,000 kernels/bu= **378 bu)**
   * Kernel density & test weight plays a factor
2. **Rows per ear determined at V4 to V5**
   * 32,000 x 16 x 35 = 17,920,000 kernels ÷ 90,000 kernels/bu = **199 bu/A**
   * 32,000 x 18 x 35 = 20,160,000 kernels ÷ 90,000 kernels/bu = **224 bu/A**
   * *By adding two rows of kernels around per ear (always think in two's), you gain* **25 bu/A**
3. **Kernels per Row determined at V12 to V14**
   * 32,000 ears x 18 x 35 = 17,920,000 kernels ÷ 90,000 kernels/bu = **224 bu/A**
   * 32,000 ears x 18 x 50 = 28,800,000 kernels ÷ 90,000 kernels/bu = **320 bu/A**
   * *By adding 15 kernels per row, you gain* **96 bu/A**
4. **Test Weight determined at R2 to R6** (weight & density of each kernel)
   * 300 bu x 56 lbs/bu (at 15.5% moisture) = **16,800 lbs = 300 bu**
   * 300 bu x 61 lbs/bu (at 15.5% moisture) = 18,300 lbs ÷ 56 lb/bu (market stand per bushel) = **327 bu/A** *or* plus **27 bu/A more corn**

Big crop yields start with a "Recipe for Success"

Farming the Controllables

Phase I **Residue Management–"Second Harvest"**

Phase II **At-Plant–"Jump Start Yield"**

Phase III **In-Season–"Stay Green"**

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Critical Success Factors in Corn Production

The importance of each of the corn growth stages to final ear weight is shown in Table 1.

Table 1
Chronological Development of the Corn Ear

Approximate Plant Growth Stage	Approximate Days After Planting (Days after Emergence)	Growth Event	Importance to Final Ear Weight
V3	16 to 19 (9 to 12)	• Ear shoot initiated	• Ear established
V4 to V5	21 to 30 (14 to 21)	• Leaf and ear shoot initiation complete • Tassel initiated in stem apex tip • Stem apex is just under or at soil surface • Tillers are forming • Above ground height is 8 inches (20 cm)	• Number of rows of kernels determined • In normal corn belt hybrids there are 16, 18 or 20 rows of potential kernels per ear
V12 to V14	49 to 56 (42 to 49)	• Ovule number being determined (potential kernels) • Brace roots beginning • Late whorl	• Number of kernels per row determined (will not be complete until V17) • Potential is for about 50 kernels per row
R1 Silking	70 (63)	• Silk emerged • Pollen shed begins • Brace root development complete • Root mass reaches maximum size	• Ovule fertilization (most critical period of yield determination) • On a well developed ear, there are about 750 to 1,000 potential ovules
R2 to R6 Physiological Maturity	81 to 130 (74 to 124)	• Black layer formation	• Kernel growth (R2 to R6) • Maximum kernel and ear weight potential under existing growth parameters reached

The final weight of an ear of corn depends on the:

- Number of rows of kernels
- Number of kernels per row
- Weight and density of each kernel
- Rate and length of dry matter accumulation (vegetative growth)
- Size of the root system which supports continued nutrient and moisture uptake for grain fill after R1

Keeping corn plants healthy longer promotes higher yields

Tom J Bechman

Brad Wehr enjoys seeing how much corn he can grow per acre. It's why he participates in the National Corn Growers Association corn yield contest. He took the top prize nationally in 2020 in the strip till/ no-till non-irrigated division, with a recorded yield of 347.4597 bushels per acre.

Perhaps more important than winning is what he's learning, Wehr says. Wehr and his family farm both in Dubois and Pike counties in southwest Indiana.

"We've got some good creek bottom ground where we usually place the contest entry, and it works well with strip till," he says. "We hire someone to make strips and apply fertilizer at the same time, usually near planting. Using RTK guidance, we plant on those strips. Residue is cleared off, and the corn usually gets a good start. We still conventional-till some fields, and no-till our most rolling fields."

In 2020, the contest field wasn't planted until May 25. "It was cool and wet early, and although we planted other corn before then, our later-planted corn

generally yielded better," he adds.

They planted 41,500 seeds per acre with Dekalb 65-95RIB on the contest field. Typically, he plants at 34,000 to 36,000.

Late, healthy corn

Wehr says the biggest thing he's learned is the importance of keeping corn healthy as long as possible. "We combined at around 21% with dry husks, but stalks were still green," he says. "We believe we're picking up extra bushels on all our corn when we keep plants healthy longer.

"The extra yield is coming through more weight in those kernels. Corn needs to be healthy as long as possible to keep filling kernels."

Wehr sometimes sprays fungicides at V10, then again right before or right after tasseling. "If we think there is good yield potential on our best ground, we might spray three times, but normally it's less 9than that. We want plants filling kernels as long as possible."

Bob Nielsen, Purdue University Extension corn specialist, agrees that keeping corn healthy as long as possible is critical for optimum yield.

"The grain-filling period determines kernel weight," Nielsen says. He points to data indicating that more than half of total kernel dry weight is added during the final 30 days before corn reaches black layer. "Basically, that's after early dent stage," he explains. "Some used to say that if you got corn to early dent, you had the crop made. Obviously, that's not the case. The final 30 days is still a key period."

How much difference can kernel weight make on final yield? Nielsen offers this example. Suppose you estimate yield using the traditional method, and find 32,000 plants per acre, with 16 rows of kernels and 35 kernels per row per ear. Which "fudge factor" you choose to represent kernel weight makes a huge difference.

At 90, the yield would be 199 bushels per acre. At 80, more common with today's hybrids, it's 224. If you have very large kernels and use 65, it's 276. If it's a stress year with light kernels, at 100, it's 179.

"You can vary your yield estimate almost 100 bushels per acre simply by changing the factor for kernel weight," Nielsen says. "It's a critical component."

Nielsen outlines other important factors for yield in a three-part video, "High corn yields: Strategies and Philosophies," posted at Purdue's Chat'n Chew Café, *bit.ly/highyieldforcorn.*

Ingredients & Components Necessary to

ACHIEVE HIGHER YIELD

Components of Soybean Yield

The components that make bushels of soybeans are:

Number of:

- **Plants per acre**
- **Nodes per plant**
- **Pods per node**
- **Seeds per pod**
- **Seed weight**

At 2,500 seeds per pound about 15 million seeds must be produced per acre to achieve 100 bu/A soybeans.

INGREDIENTS OF SOYBEAN YIELD

Ingredient	Amount (Seed and Stover)
Carbon (air is 0.03% CO_2)	13,545 lbs (135.5 lbs/bu)
Glucose	301,080 lbs (301 lbs/bu) (glucose is 45% carbon)
Water	1,350,000 gal (13,500 gal/bu)
Nutrients in Seed and Stover	• 550 lbs (5.5 lbs/bu) Nitrogen (24% left in stover) • 120 lbs (1.2 lbs/bu) Phosphorus (29% left in stover) • 240 lbs (2.4 lbs/bu) Potassium (41% left in stover) • 170 lbs (1.7 lbs/bu) Calcium (88% left in stover) • 45 lbs (0.45 lb/bu) Sulfur (56% left in stover) **1,125 Total Pounds**

Source ProfitPro, LLC. 2003

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Higher soybean yields must retain more pods per plant.

Example

Add 1 pod to each main stem node on a plant that has 17 nodes

Each pod contains 3 average size seed (2900 seed per lb)

Final stand of 120,000 plants/A

+35 Bu/A

Big crop yields start with a "Recipe for Success"

Farming the Controllables

Recipe for Success

Phase I Residue Management–"Second Harvest"

Phase II At-Plant–"Jump Start Yield"

Phase III In-Season–"Stay Green"

The soybean "Recipe for Success" results in more pods per plant & enhances yield!

For your Customized "Recipe for Success," call ProfitProAG at 507-373-2550

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Critical Success Factors in Soybean Production

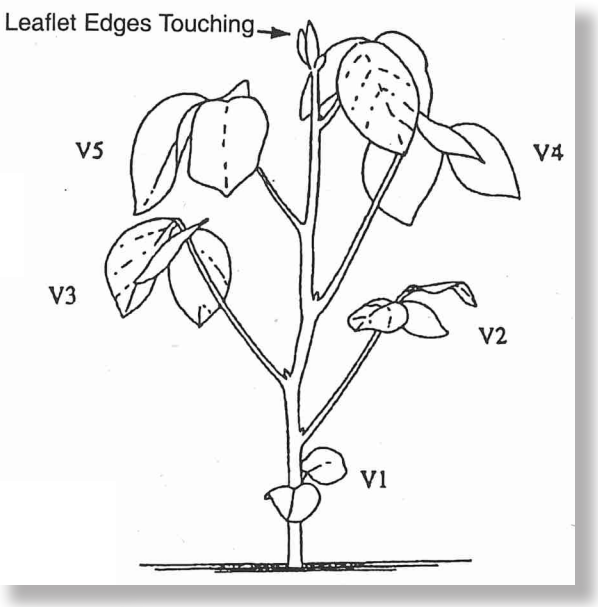
Identifying Stages of Soybean Development

Growers need to know the stages of soybean growth and development. The soybean staging system divides development into:

- Vegetative (V)
- Reproductive (R)

The V stages are designated as V1, V2, V3 through V(n), except for the first two stages, which are designated as VE (emergence stage) and VC (cotyledon stage) (Figure 1). The last V stage is designated as V(n), where (n) represents the number for the last node stage. The subdivision of the R stages are designated by their common names.

There are 8 subdivisions of the R stage, each designated numerically (R1-R8) with common names describing the changing anatomical appearance of the plant (Table 1).



Source: Agri-Growth, Inc

Figure 1: Soybean plant at V5

Table 1
Soybean Vegetative and Reproductive Stages of Development

Vegetative Stages	Reproductive Stages
VE Emergence	R1 Beginning Bloom
VC Cotyledon	R2 Full Bloom
V1 First-node	R3 Beginning Pod
V2 Second-node (1st Trifoliolate)	R4 Full Pod
V3 Third-node	R5 Beginning Seed
	R6 Full Seed
	R7 Beginning maturity
V(n) nth-node	R8 Full maturity