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KKMU- LUD, DOA

World Soybean Production

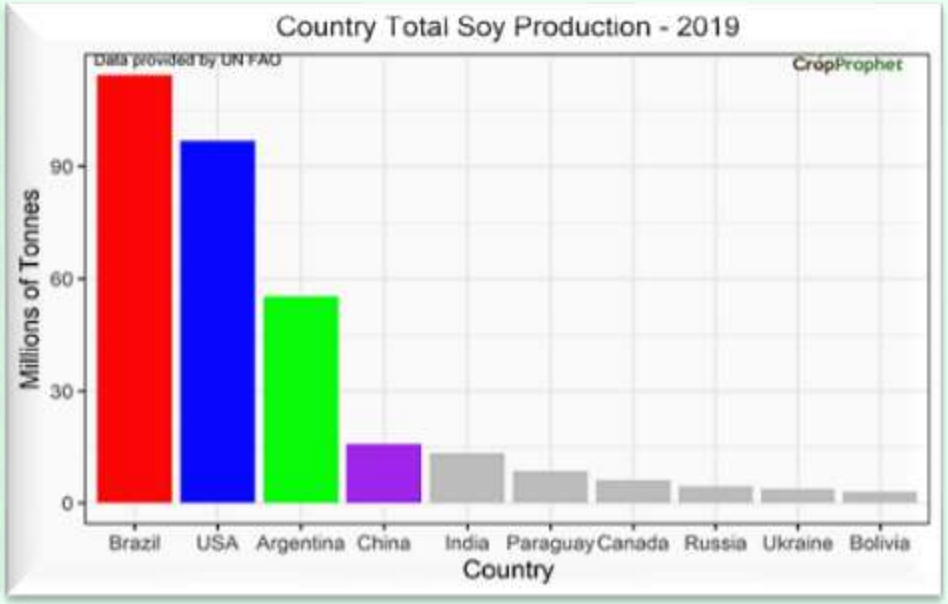
Soybean (Glycine max [L.])

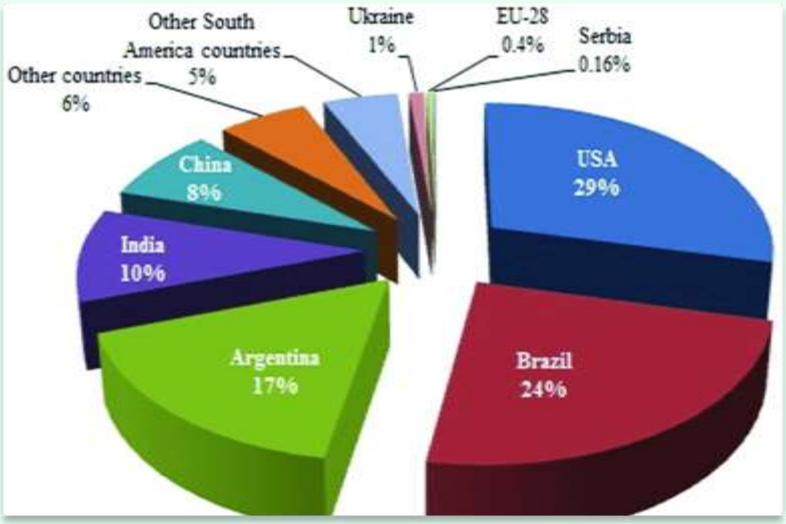
- The total world production for soybeans in 2020 was 353,463,735 metric tones, up 5.1% from 336,329,392 tones in 2019

- Brazil is the largest soybean producer in the world with 114,269,392 tones production per year., accounting for (34%) of world production.

- United States of America comes second with 96,793,180 tones yearly production (32%) of world production.

- Brazil and United States of America produce together more than 60 % of world's total soybean.





Myanmar Soybean Cultivation and Production

- Myanmar is an agricultural country bordering China and part of the Belt and Road Initiative.
- It has the potential to penetrate the large soybean market and enter the global stage.
- This is need to make effective preparation for soybean production.
- Who can divide this into cultivation, industrial processing, and quality aspects.
- Myanmar's soybean shipments are noticeably increasing with each year
- As it rose from just 1,700 tones in 2016 to over 2,000 tones in 2017 and then went above 7,000 tones in the 2018-2019 financial year with a marked increase in foreign market demand as well.
- The biggest challenge to Myanmar's soybean production is the annual decrease in available farmland.

No.	Year	Soybean acres	Difference
1.	2013-2014	383,300	
2.	2014-2015	379,536	-3,764
3.	2015-2016	367,198	-12,338
4.	2016-2017	353,805	-13,393
5.	2017-2018	345,448	-8,357
6.	2018-2019	343,845	-1,603

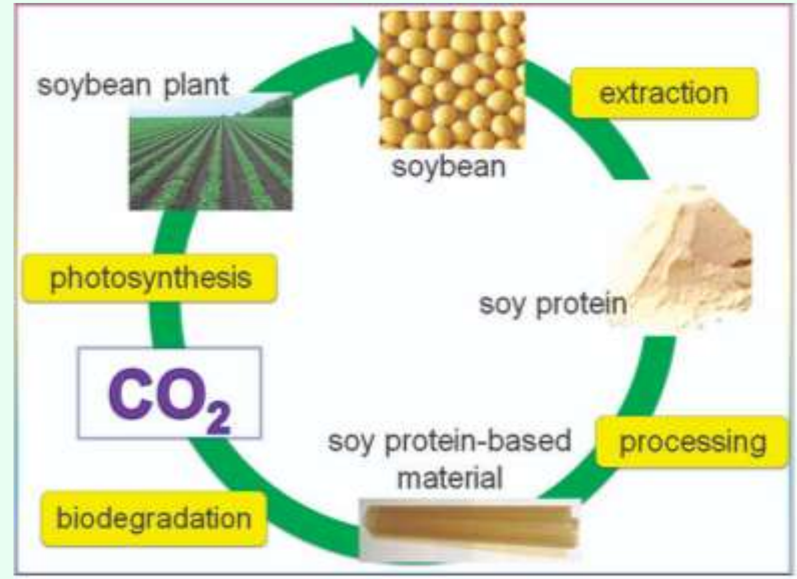
Sources; The Forest Department illustrates the issue

Situation of Myanmar’s Soybean Collaborating, Learning and Adapting

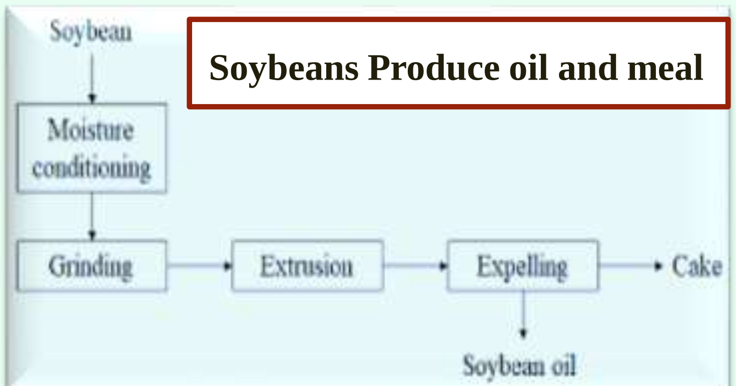
- The origins of soybean can be traced to South China, in an area just north of Myanmar.
- There is a wide genetic diversity of soybean in the country, offering promising opportunities for farmers to adapt to the effects of climate change in Myanmar.
- During the project’s first three seasons (2015-2019), VCRD (USAID’S Value Chains for Rural Development) and farmers learned together about the tremendous genetic diversity of local varieties of soy in Myanmar’s various microclimates through outreach to the Department of Agriculture Research (DAR).
- In a series of meetings with DAR, VCRD and farmers identified several “new” soy varieties (called Yezin 14, Yezin 6 and Yezin 11) well adapted to some of these micro- climates, as well as to market requirements.
- These varieties had until then, remained at DAR, which lacked the resources to conduct extension, outreach or sharing about the varieties outside the Department.
- In 2015, VCRD started organizing stakeholder workshops and facilitating business-to-business exchanges to provide information on these varieties and other information about the soy supply chain to people involved in the sector.
- These events enabled smallholder farmers to meet directly with end-buyers, including processors, often for the first time.
- Given the overwhelmingly positive feedback, VCRD continued to facilitate these events with gradually decreasing financial contributions, finally handing the organization and sponsorship collection to a committed and capable private sector firm called **Sein Lan Wei**.

ပဲပုပ် ထုတ်လုပ်ရေးတွင် တွေ့ကြုံနေရသည့်အဟန့်အတားများ

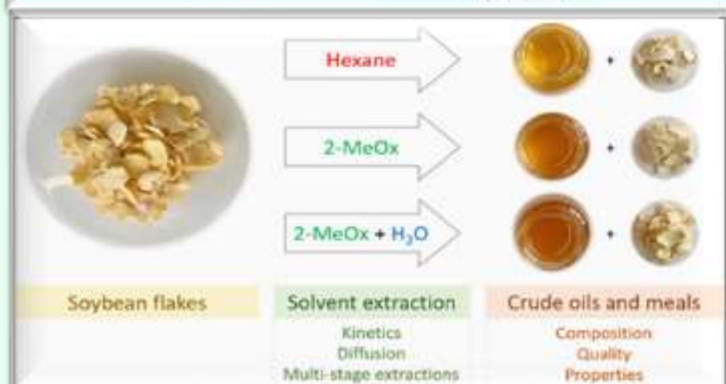
1. Non availability of adequate amount of quality seeds of improved varieties.
2. Most of the area under soybean cultivation is **dependent on rains**.
3. Poor adoption of improved production technology.
4. Soybean seed is least storable and is vulnerable to mechanical storage.
5. Soil moisture stress at critical growth stages, especially seed-filling stage.
6. High temperature stress at critical growth stages.
7. Presence of anti-nutritional factors in soybean



Biodegradable Soy Protein Isolate-Based Materials



Soybeans Produce oil and meal



Production of soybean oil and defatted meal

Anti-nutritional factors (ANFs) are defined as **biological components present in foods that can reduce nutrient utilization or food uptake**. There are several compounds in the foods we eat classified as anti-nutrients. Examples include: Glucosinolates and goitrogens in cruciferous vegetables (broccoli, Brussels sprouts, cabbage, kale)—can prevent the absorption of iodine, which may then interfere with thyroid function and cause goiter

Soybeans and soybean meal storage

Factors affecting the soybean storage

- The three major factors affecting the storage of soybean and soybean meal are **moisture content, temperature, and storage duration**. The general condition of the product and amount of foreign materials also affect their storage. By focusing on these three elements we can insure the perfect storage of soya meal.
- **Moisture content.** Depending on the moisture percentage, the storage period may change. At harvest time, soybeans moisture content ranges from 12% to 15%. Above 13%, grains should be dried to reduce the risk of deterioration due to seed respiration, mold attack, spontaneous heating and reduced germination.

- The table shows the recommended storage period for soybeans depending on the moisture content levels;

Moisture content % wet basis	Safe storage period	
	Market stock	Seed stock
10-11	4 years	1 years
10-12.5	1-3 years	6 months
13-14	6-9 months	poor germination
14-15	6 months	poor germination

Sources; SILOS CORDOBA, Soybeans and soybean meal storage Recommendations for the storage of soy (2020)

- **Temperature** is very important factor influencing in soybean storage. Growth of fungi and chemical changes such as oxidation are increased with temperature. It is really important to consider the climate in the different regions of the world.
- Experience indicates that under hot and humid tropical conditions, grains stored in metal bins exhibit sweating.
- This problem arises with extreme high temperatures reached on the inner surface of the metal silo on a hot day, then, at night, the rapid cooling of the metal results in moisture condensation as the dew point is reached.

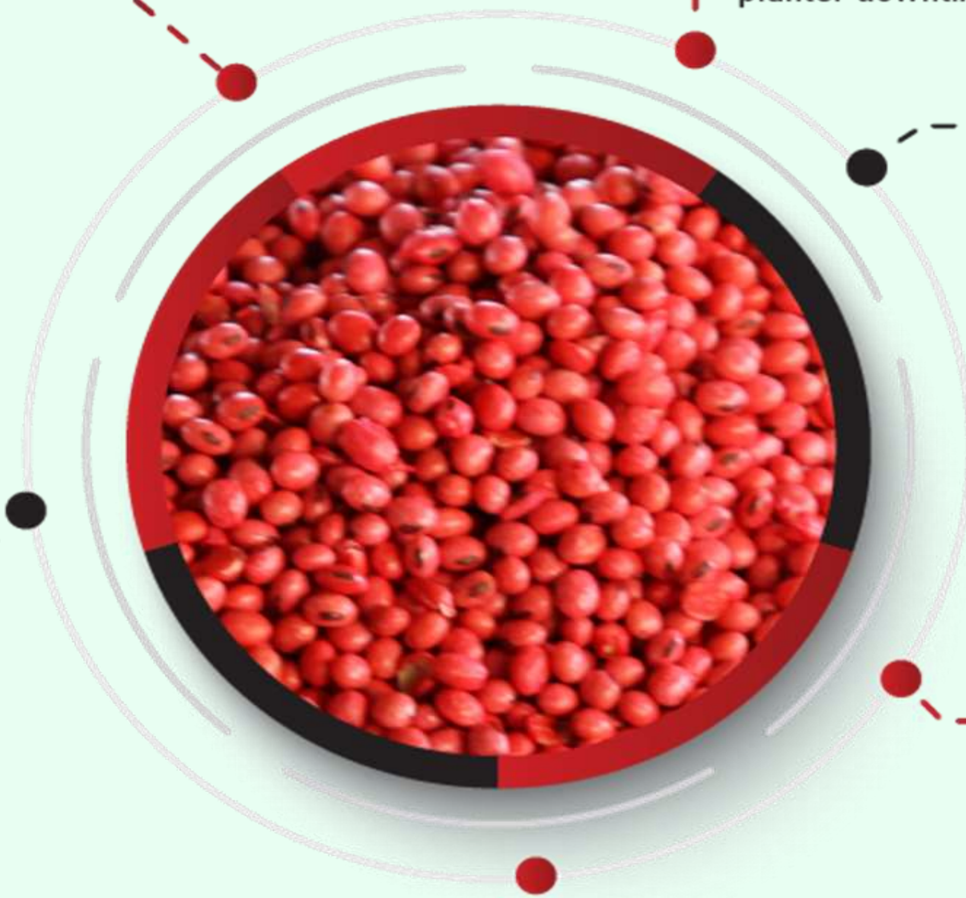
Soybean Quality Seeds Treatment

POLYMER

Smooth flowability through seed tenders, trucks, and your planter leads to better and more even stands, all while reducing your planter downtime.

NUTRI-CYCLE ST

Nutri-Cycle ST accounts for over 25 active, beneficial strains of bacteria and fungi. This alone has shown an average gain of 3.75 bushels/acre in our research. The bacteria and fungi begin working in the soil right away to make the most vital nutrients readily available for the young soybean. Increased cold, salt, and drought tolerance, more developed root systems, and improved nutrient uptake are other benefits we have seen from Nutri-Cycle.



HEAT SHIELD

The six fungal strains in Heat Shield have shown increased tolerance to cold and salty soils, drought, and heat, along with general plant health enhancements. In normal conditions, Heat Shield has demonstrated a 2-6% yield advantage in many of our trials, but in fields under severe stress, we have seen huge gains.

FUNGICIDES

Four systemic fungicides equip the seed for long-lasting protection. Using multiple fungicide modes of action means your seedlings are protected well past emergence and into the season.

INSECTICIDE

A broad-spectrum, early-season insecticide protects against bean leaf beetles, cutworms, grasshoppers, soybean aphids and other insects for as long as 2 -3 months, giving your plants a healthy habitat during the most critical growth stages.

INOCULANT + EXTENDER

Including both ROOTastic inoculant and extender in Hefty Complete gives your treated seed the best opportunity to increase nodulation and nitrogen uptake, even when planting is delayed.

Growth, development and yield of Soybeans field

- A result of a variety's genetic potential are interacting with environmental and farming practices.
- **Minimizing environmental stress will optimize seed yield**.
- Management practices that may influence crop growth include - seedbed preparation,
  variety selection,
  planting rate,
  planting depth,
  row width,
  pest management (diseases, insects and weeds),
  plant nutrition and
  harvesting.

- **Seed rate**

  The recommended seed rate for soybean is **100kg/ha**. However, as a safety measure against low germination, a slightly high seed rate is normally recommended i.e. farmers can use a rate of 110kg/ha. The ideal planting depth should be between **2.5 and 3 cm**. It is recommended that soybean is planted in rows by drilling.
- **Yield (produce)**

  Soya beans matures at 90 – 100 days. At this time, it's ready to be pulled out of the field. With good management you can get a yield of **4 tonnes/ha**. On average most farmers are getting **2 tons/ha**.

Benefits of Improved Soy Quality and Producer-buyer Relationships

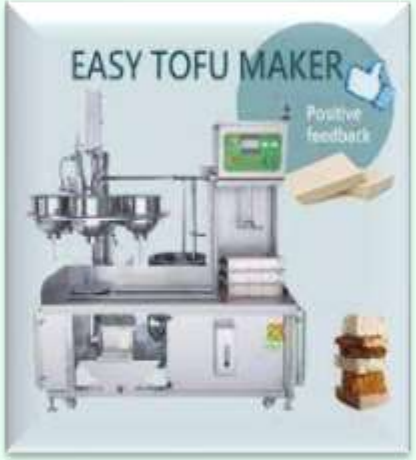
The benefits increase profits irrespective of market price fluctuations:

For farmers

- ➢ Price premiums for higher quality
- ➢ More resilient, healthy seed
- ➢ Lower sales transaction fees
- ➢ Greater market transparency
- ➢ Offers a profitable alternative to less resilient crops, such as black gram
- ➢ Soy is nitrogen-fixing and improves soil fertility

For tofu processers

- ➢ Supply chain management: access to larger quantities of higher quality soybean, enabling higher quality soy products
- ➢ No soil, dust, or sand that could damage equipment, enabling processors to invest in better equipment



Sources; FROM SEED TO FORK: Triggering Systemic Changes In Myanmar's Soybean Sector, USAID'S VALUE CHAINS FOR RURAL DEVELOPMENT FROM SEED TO FORK (2019)





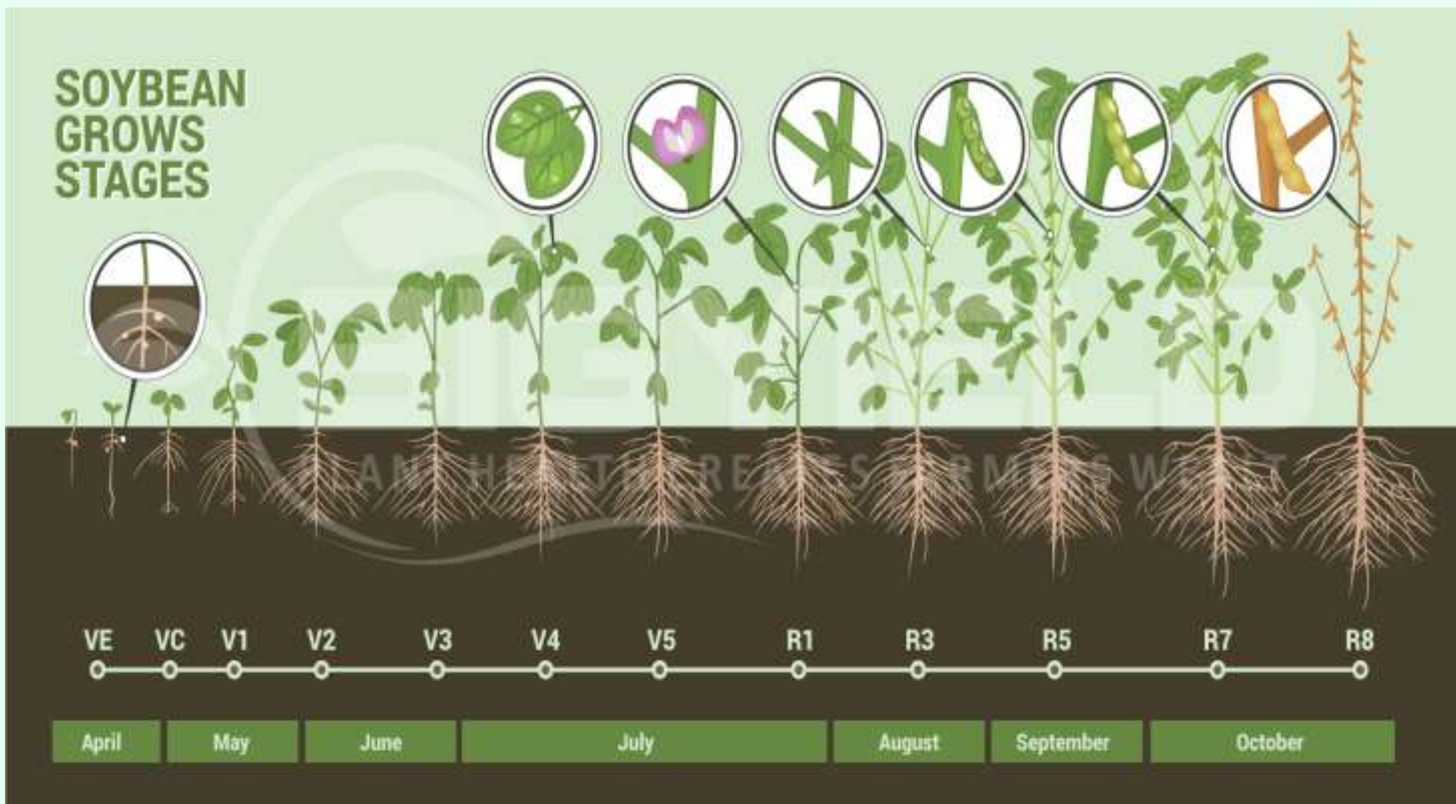
KKMU- LUD, DOA

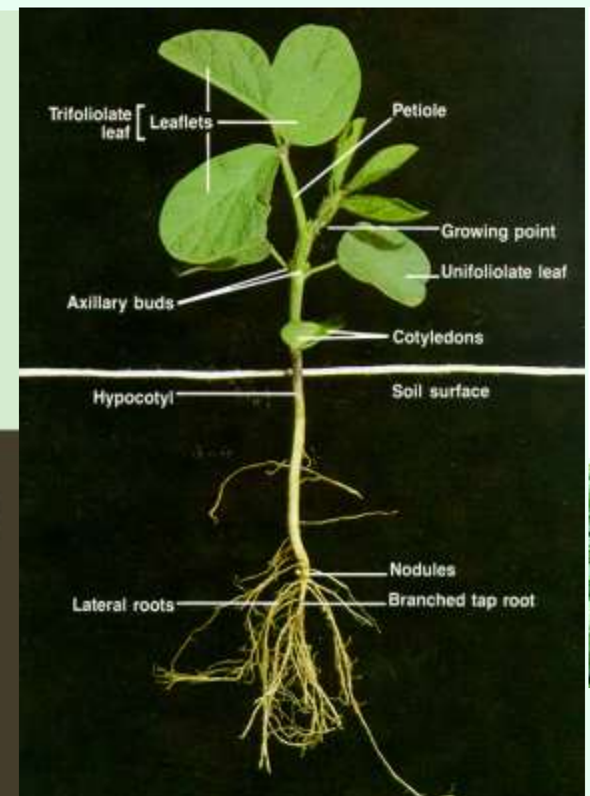
Is urea fertilizer good for soyabeans?

In leguminous plants, the root microorganisms that fix and assimilate free nitrogen, **urea has no effect on their production**. However, applications of N during the pod or seed stages of soybean development can increase yield.

Do you need to add fertilizer with soybeans?

Soybean crop yields will decrease when it lacks essential nutrients. Therefore, it's important to develop a profitable fertilizer program to maximize crop yields.





What is the best fertilizer for soybeans?

- ❖ Use a **high potassium fertilizer** for Soybeans, with a maximum of 20 parts potassium in its mixture.
- ❖ Soybean seeds are relatively high in K and the removal of K by Soybeans is higher on a per bushel
- ❖ basis than other crops when only grains are extracted.
- ❖ Like P, a soil test is the best indicator of K requirements.

Brazil

What is a good starter fertilizer for soybeans?

- ❖ Both phosphorus and potassium should be included in a soybean starter fertilizer.
- ❖ Phosphorus promotes early root growth and potassium has been shown to increase soybean root nodulation and biological nitrogen fixation.
- ❖ Phosphorus and potassium nutrients are important for high-yielding Soybeans. (May 23, 2022)

Preferred nutrient forms

- ❖ All fertilizers applied should provide easily plant-available forms. On soils which are highly leachable and low in organic matter, K_2O should be applied preferably in the sulphate form (eg. K_2SO_4).
- ❖ 20kg/ha K_2O for each ton of grain expected. A corrective application of up to 100kg/ha K_2O is recommended for soils low in K. Where CEC is < 4meq/100cm^3, half of the K may be applied at sowing and half 30 days after plant emergence.

Identifying Soybean Growth Stages- Vegetative Stages

Vegetative growth stages of soybean the primary consideration is the number of fully developed leaves on the main stem. A fully developed leaf is one that has all leaflets open (Figure 4), while an undeveloped leaf has leaflet edges that are still touching (figures 2 and 3).

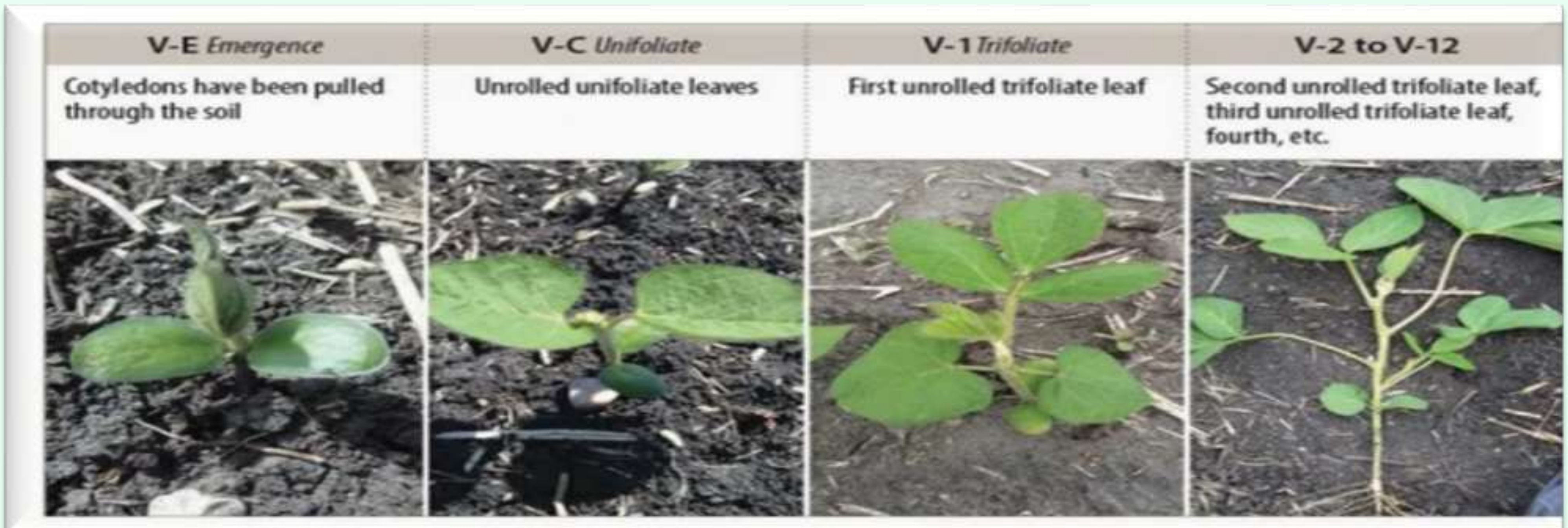
When classifying a field of soybean as a specific growth stage, at least 50 percent of the plants in the field must be at or beyond that growth stage.

For example, a soybean field that has 10 percent of the plants with two fully developed trifoliate leaves (V2),

60 percent of the plants with three fully developed trifoliate leaves (V3), and

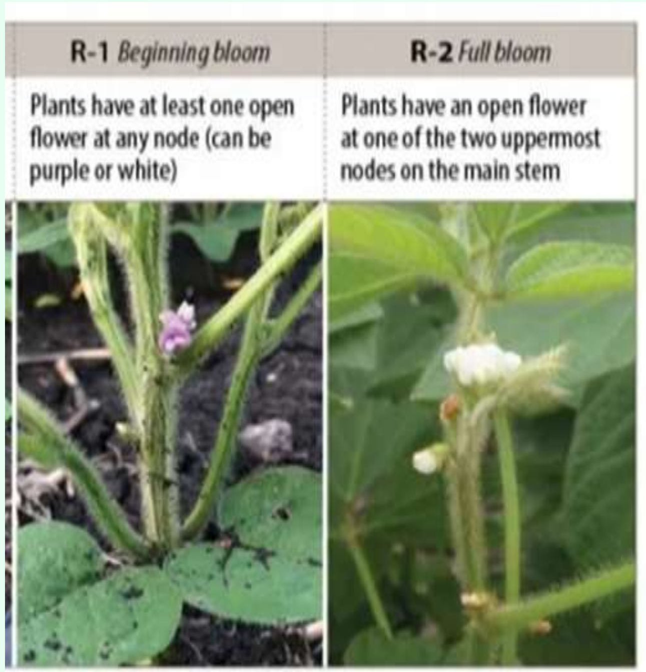
30 percent of the plants with four fully developed trifoliate leaves (V4) will be the V3 growth stage.

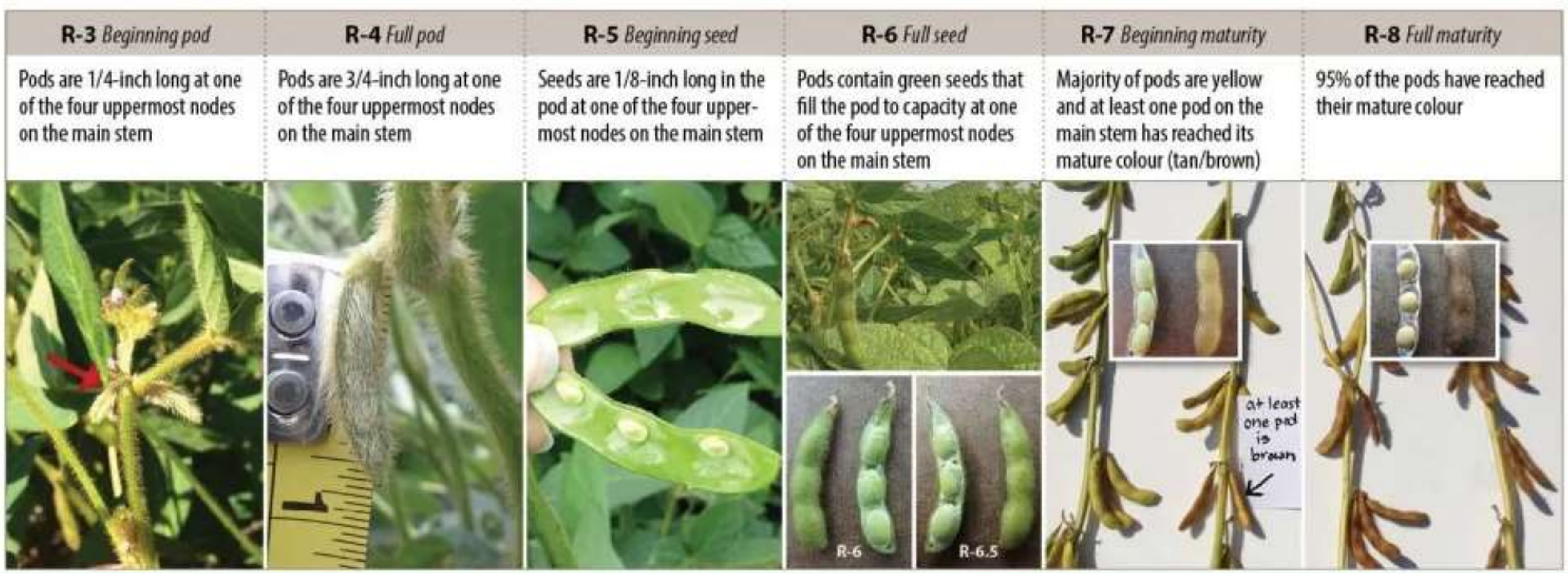
This is because 70 percent of the field is or has already been the V3 growth stage.



Identifying Soybean Growth Stages- Reproductive stages

Reproductive growth stages (figures 6 to 13) are identified by specific flower, pod, and seed characteristics.





9 steps to higher soybean yields

1. Spend time on variety selection
2. Know your fields and consider your cropping system
3. Maintain your fertility foundation
4. Plant early and consider prescription planting and variable variety placement.
5. Use of seed treatments and inoculants.
6. Use a pre-emergence herbicide.
7. Manage residue in no-till soybeans.
8. Manage white mold.
9. Don’t overlook harvest loss.

(Source: Scott Nelson, 9 steps to higher soybean yields (2021))

Growth habited of Soybean (Glycine max [L.])

- ♠ Annual. Harvested part: seeds.
- ♠ Sown February-August (Northern hemisphere)
- ♠ Flowers (1-3 months) after sowing.
- ♠ Harvested (3-5 months) after sowing.
- ♠ The crop is adapted to a wide range of climatic conditions.
- ♠ It is most susceptible to drought damage during flowering and grain filling.
- ♠ It is not generally irrigated.

Plant density			
Planting date	**Row width**		
	Wide > 75 cm	**Medium 30-75 cm**	**Narrow < 30 cm**
	‘000 plants/ha		
Early spring	150-300	200-450	250-700
Spring	150-300	200-450	250-600
Summer	150-200	150-300	200-450
Autumn	200-300	200-450	250-700

soil pH

- ♠ Availability of essential nutrients is influenced by soil pH through its effects on Al saturation percentage and on nutrient fixation and release mechanisms.
- ♠ Highest soybean yields are usually produced when soil pH is between 6.2 and 7.0.
- ♠ In this range, adequate Ca and Mg are normally available.
- ♠ Soybeans grown on naturally acid oxisols and ultisols will generally produce to their potential at soil pH between 5.5 and 6.5.
- ♠ However, liming of these soils should also reflect the importance of exchangeable aluminum.
- ♠ Soils with low exchangeable Al with no Al in the soil solution generally will not benefit from lime application.
- ♠ This usually occurs at a soil pH of 5.5 or above.

Nutrient demand/uptake/removal – Macronutrients

Part	kg/t grain						
	Source	N	P_2O_5	K_2O	MgO	CaO	S
Grain only	(1)	65	14	23	5	4	2
Grain only	(2)	100	16	21	21	4	4
Grain only	(3)	65	11	20	4	4	2
Total		81	14	33	18	24	3
Grain only	(4)	64	11	20	4	4	2
Total		77	14	39	7	18	8
Grain only	(5)	38	8	16	19	9	n.a

(1) Adapted from “ The Fertilizer Handbook”, TFI,1982
(2) Bataglia et al., 1977
(3) Bataglia & Mascarenhas, 1978
(4) Cordeo et al., 1979
(5) Guo Qinyuan, 1991 (personal communication)

Nutrient demand/uptake/removal -Micronutrients

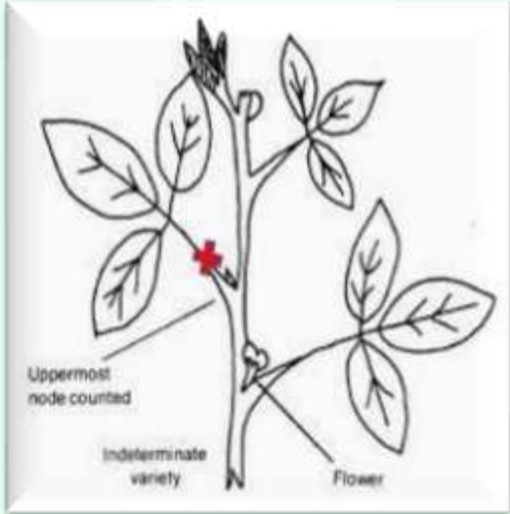
Part	Source	g/t grain					
		Fe	Mn	Zn	Cu	B	Mo
Grain only	(1)	n.a	20	17	16	n.a	n,a
Grain only	(2)	110	33	43	16	16	6
Total		366	90	61	25	39	7
Grain only	(3)	n.a	n.a	24	n.a	n.a	n.a

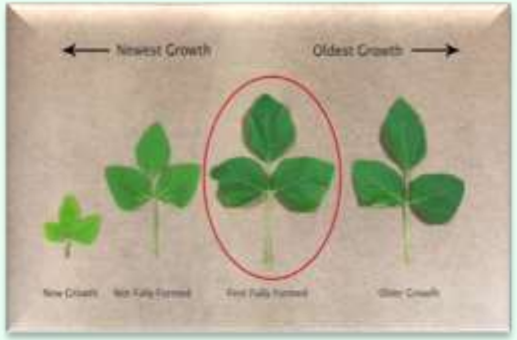
(1) Adapted from “ The Fertilizer Handbook”, TFI,1982
(2) Bataglia & Mascarenhas, 1978
(3) Guo Qinyuan, 1991 (personal communication)

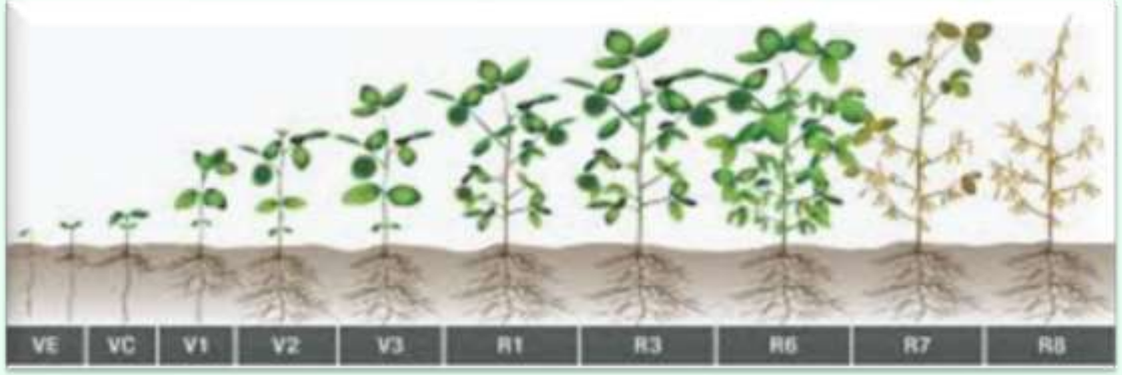
Soybean Tissue Sampling as a Diagnostic Tool

For an accurate diagnosis, the correct plant parts must be collected for testing. Collecting the correct plant part is dependent on the growth stage of the soybean plant. Sample the entire aboveground portion of the soybean plant if sampling plants in the seedling to early vegetative stage of growth. Collect twenty-five to thirty plants in the area to be sampled. Collect the most recent, matured trifoliate leaves (not including the petiole) from one of the top three or four nodes of the plant if sampling during the late vegetative stages (V3) to early reproductive stages (R1 or R2). The sampling should be performed on twenty to twenty-five plants that are exhibiting a problem.

soil samples should also be taken next to the same plants. The soil samples will help determine fertility status in the field and the ultimate cause of the nutritional problem. As with the tissue samples, the soil samples should be labeled appropriately to correspond with the tissue samples taken from the field.







Plant Analysis Data

Sufficiency range for upper fully developed leaf at initial flowering stage- Macronutrients				
% of dry matter				
N	**P**	**K**	**Mg**	**Ca**
4.62 - 5.50	0.26 - 0.50	1.71 - 2.50	0.26 - 1.00	0.36 - 2.00
Source: Small & Ohlrogge, 1978.				

Sufficiency range for upper fully developed leaf at initial flowering stage- Micronutrients					
ppm dry matter					
Fe	**Mn**	**Cu**	**Zn**	**B**	**Mo**
51-350	21-100	10-30	21-50	21-55	1-5
Source:Small & Ohlrogge, 1978.					

Table (1) Suggested macronutrient sufficiency ranges (%) for **early growth (V-V3) of soybeans**

Macronutrients

N	P	K	Ca	Mg	S
3.5%–5.5%	0.30%–0.60%	1.7%–2.5%	1.1%–2.2%	0.30%–0.60%	–

Table (2) Suggested macronutrient sufficiency ranges (%) for **flowering stages (R1-R2) of soybeans** based on samples from fully expanded trifoliate leaves from the top three or four nodes.

Macronutrients

N	P	K	Ca	Mg	S
3.25%–5.0%	0.30%–0.6%	1.5%–2.25%	0.8%–1.4%	0.25%–0.7%	0.25%–0.60%

Table (3) Suggested micronutrient sufficiency ranges (%) for **flowering stages (R1-R2) of soybeans** based on samples from fully expanded trifoliate leaves from the top three or four nodes.3

Micronutrients

Fe	Mn	Zn	Cu	B
25%–300%	17%–100%	21%–80%	4%–30%	20%–60%

Fertilizer for soybeans

Soybeans require 14 mineral nutrients for growth: nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), magnesium (Mg), copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), boron (B), chloride (Cl), molybdenum (Mo) and nickel (Ni) to grow successfully.

Fertilizer recommendations

Available organic manures should be applied and incorporated well before primary tillage.

If necessary with soil pH corrections should be made prior to doing primary tillage.

Mineral fertilizers may be split into two or more applications on highly leachable soils or soils which fix large amounts of nutrients.

Most non-sandy soils are soils in which fixation is low: usually one application of fertilizer is satisfactory.

On soils low in nutrients it is often more efficient to apply fertilizers in a band near the row at seeding.

Nitrogen Deficiency in Soybean

- Soybean is a legume, and, if properly inoculated, can use the nitrogen gas (N_2) in the atmosphere for plant growth via fixation in the nodules.
- The fix adequate atmospheric N is to produce yields 3000-4000 kg/ha, if well nodulated.
- The amount of fixation that takes place is related to the amount of nitrate-nitrogen (NO_3-N) in the soil.
- The amount of N fixed increases as the amount of NO_3-N in the soil decreases. When soil NO_3-N is high, the amount of N fixed in the nodules is small.
- If soil NO_3-N is low, N fixation quickly increases to meet the greater N demand.

- **N deficiency results** in reduced chlorophyll development and a pale-green leaf color. Growth, development and yield are reduced.
- Symptoms appear first or are more severe on older and/or fully expanded leaves.
- Symptoms are uniform across leaves.
- Because soybeans are high in protein, they need a lot of nitrogen in the early seed development stage.
- When there's a nitrogen deficiency, it has a negative impact on root nodulation and leads to stunted light-green plants.

Photo credit:
University of Nebraska and
Mississippi State University

Phosphorus Deficiency in Soybean

Left: P applied; right: P deficient

Source: Luiz Antonia Zanao Junior (IPNI)

Photo credit: University of Nebraska and Mississippi State University

- P: taken up throughout the growing season. The period of greatest **demand starts just before the pods begin** to form and continues until about 10 days before the seeds are fully developed.
- If you see dark bluish-green leaves, slow overall growth and interveinal chlorosis from the base of the leaf, this points to a **phosphorous deficiency**.
- With a potassium deficiency, the lower leaves will turn yellow and red while the base of the plant stays green. Older leaves will look irregular and growth slows down. (2020)
- Much P used in seed development is taken up early, stored temporarily in leaves, stems and petioles, and then translocate into the seed.
- Stunted growth is usually the only symptom of P deficiency, though some leaf cupping and discoloration are possible.
- Dark green to bluish green leaves, often with interveinal, small lesions; dry bean may have marginal chlorosis.

Potassium Deficiency in Soybean

- K: Relatively large amounts of K are required.
- Hanway & Weber (1971) reported that the rate of uptake is highest during rapid vegetative growth and slows as seed formation begins.
- **Uptake continues until two to three weeks before the seed is mature;** it can be depressed by poor soil condition including compaction, excess moisture and poor aeration.
- Most K taken up moves to the roots by diffusion through moisture films around soil particles.
- As the water content of a soil decreases, moisture films around the soil particles become thinner and the path length of ion movement increases and the movement of K to roots decreases.
- Lawton (1945) reported that K uptake decreases if the oxygen content of the soil is low, therefore poor aeration would require higher available K.
- Could soils reduce the rate and extent of root growth and this can limit uptake.
- When farmers plant earlier or adopt tillage practices that result in lower soil temperatures early in the growing season, such as no-till, higher levels of available K in the soil are likely to be needed for optimum growth.

POTASSIUM DEFICIENCY IS MADE WORSE BY:

- Acidic conditions
- High Calcium and Magnesium

K -Nutrient Deficiencies in Soybean-2

One of the most common Potassium deficiency symptoms is scorching along leaf margins. Since Potassium is mobile in the plant, deficiency symptoms appear on older leaves first. Potassium-deficient plants grow slowly and have poorly developed root systems. Stalks are weak and lodging is common. Plants deficient in Potassium show lower resistance to disease and moisture stress and have poor fruit quality and yield. The leaf margins leading to brown interveinal necrosis in soybean; veins stay green. Symptoms are localized on leaves. With a potassium deficiency, the lower leaves will turn yellow and red while the base of the plant stays green.

Potassium Deficiency: Scorching along leaf margins on older leaves first

ABOUT POTASSIUM

Potassium, unlike other nutrients, does not form compounds in plants but remains free to ‘regulate’ many essential processes. This includes enzyme activation, photosynthesis, water-use efficiency, starch formation, and protein synthesis. Most crops contain about the same amounts of Nitrogen and Potassium, but Potassium content of many high-yielding crops is even higher than that of Nitrogen. Most soils contain large amounts of Potassium, but only a small portion is available to plants over a growing season.

Potassium Deficiency:
Scorching along leaf margins

FUNCTIONS OF POTASSIUM

Necessary for the formation of sugars and starches, Essential for oil production
Enzyme activator, Improves cold weather tolerance

Micronutrients

Deficiencies of micronutrients are more common than on most other field crops. Shortages of Fe, Mn, Mo and Zn have been observed. Deficiencies are limited to rather specific soil situations, viz:

- **Strongly weathered soils**. These soils are old in terms of the extent of chemical and physical changes that have occurred. Many have lost nutrients within the soybean rooting zone through leaching.
- **Coarse-textured soils**. These soils were formed from rock materials low in micronutrients. Furthermore, rainfall penetrates much more rapidly and to a greater depth, thus causing more leaching of nutrients from sandy and gravelly soils than from loams, silt loams, and silty clay loams.
- **Alkaline soils**. The solubility, though not total supply, of several nutrients diminishes as pH rises; it is not feasible, to lower the pH to correct micronutrient deficiencies.

Soil tests have not been nearly as satisfactory for determining micronutrient deficiencies as have plant analyses. Differential responses have been found between varieties to both Fe and Mn.

Where a micronutrient deficiency is acute, the visual response to small, corrective applications may be striking, but often the yield response, if any, is negligible and there is no visible change in plant growth. Carefully controlled research trials are usually needed for precise evaluation. The margin between too little, just enough, and too much of a micronutrient is very often narrow.

Magnesium Deficiency in Soybean

Magnesium-
deficient plants (left) and normal plants (right).

Mg and Ca: In most cases Mg and Ca needs are met when a suitable soil pH is maintained. Acid soils are often deficient in Mg; dolomite is therefore the preferred lime source.

- Pale green plants with interveinal pale yellow mottling of the leaves followed by interveinal necrosis or necrosis along the underside of the main veins in dry bean.
- Symptoms appear first or are more severe on older and/or fully expanded leaves.
- If the edges of older leaves are curling up and you see interveinal chlorosis, then low magnesium is to blame.
- The use of dolomitic lime to neutralize the soil acidity in pH management typically supplies sufficient Mg to avoid deficiency in North Carolina.
- Magnesium deficiency is often associated with low soil pH, especially in coarse-textured soils with low cation exchange capacity (CEC).
- Magnesium deficiency may be induced if calcite lime is used on a regular basis in low CEC soils with low reserves of Mg.
- Deficiency may also be induced by excessively high rates of gypsum application on low CEC soils when gypsum is being used for a soil conditioner.

Sulfur Deficiency in Soybean

- Substantial amounts of S are taken up, but few research trials have shown responses to added sulphur.
- In the past, S was a component of several fertilizers applied as sources of other nutrients; and additional S from emissions from burning of fossil fuels may have been enough to make up the remaining requirements.
- Today, most fertilizers contain little or no S, and emissions from fossil fuels are being reduced, so it may become more limiting in the future.
- Deficiency is most likely to occur during cool, wet weather on highly leachable soils low in organic matter.
- Pale green to yellow leaflets without prominent veins or necrosis.
- Pale green to yellow plants, often with pale brown or bronze necrosis.
- New leaves will be small and light yellowish-green.
- Stems will be thin, hard and long.

Iron Deficiency in Soybean

- If soybeans are planted in rows wider than 50 cm and the planter can apply row fertilizer, then the use of an acid-forming row fertilizer will usually prevent Mn deficiency.
- The alternative method is foliar application of 5-10 kg/ha manganese sulphate when the plants have two or three trifoliate leaves.
- Fe deficiency symptoms are prominent interveinal chlorosis or necrosis; veins are prominent over length of leaf.
- Pale green to yellow plants, often with pale brown or bronze necrosis.
- The first symptom of an iron deficiency is interveinal chlorosis, followed by stunting. The veins can also become chlorotic.

Fe and Mn: Deficiencies of both occur on solis with high pH.

Symptoms are very similar: stunted plants with pale yellow to nearly white leaves, but with green veins, over the whole plant.

Fe deficiency is accentuated by very dry soil conditions.

Mn deficiency is most pronounced in cool wheather.

(photo by UNL staff)

Manganese Deficiency in Soybean

Manganese Deficiency: Interveinal chlorosis while veins remain green

Manganese functions primarily as part of a plant's enzyme system. It has a role in several metabolic reactions including the conversion of Nitrate Nitrogen to a form the plant can use. It plays a direct role in photosynthesis by aiding chlorophyll synthesis. Deficiencies often occur in high organic matter soils with neutral to alkaline pH and on those soils that are naturally low in Manganese.

Pale yellow leaves with mottled interveinal chlorosis leading to dark brown necrosis.

Pale green to yellow plants, often with pale brown or bronze necrosis.

After the plant's leaves turn light green and develop interveinal chlorosis, you'll see delayed growth, necrotic brown spots and premature leaf drop.

Note that the early signs of a manganese deficiency mimic an iron deficiency.

Functions of Manganese

- ➢ Necessary for the formation of sugars and starches
- ➢ Aids in Nitrogen utilization and assimilation
- ➢ Aids in chlorophyll synthesis

Manganese Deficiency is Made Worse by:

- ➢ High pH
- ➢ Organic conditions
- ➢ Prolonged cold periods

Boron Deficiency in Soybeans

- ♠ Boron is immobile in the plant and deficiency symptoms appear as abnormal growth on the youngest leaves, and terminal growth becomes stunted and dies. The roots are often short and stubby.
- ♠ Unlike most nutrient deficiencies that typically exhibit symptoms uniformly across the crop, Boron symptoms can appear randomly within a crop.
- ♠ Results with boron additions where soil tests indicate low supplies have been inconsistent. Conditions conducive to B shortage are: high pH (7.0- 8.0); coarse-textured soil from which nutrients leach readily; low organic matter; and drought. Because susceptibility of soybeans to boron toxicity, growers should consult their agronomist for guidance.
- ♠ Boron is essential for growth and development of new cells for new growth in plants. Seed development, cell wall formation, nodule formation, flowering, and developing fruit all depend on adequate Boron. Organic matter is the most important soil source of Boron.
- ♠ Hot or cold dry weather can often slow decomposition at the soil surface, which reduces the release of Boron to crops. Coarse-textured soils are typically low in minerals that contain Boron and are susceptible to Boron leaching.

FUNCTIONS OF BORON

Pollen tube formation
Important for early growth
Necessary for cell division
Aids in Calcium translocation

BORON DEFICIENCY IS MADE WORSE BY:

•High Nitrogen or Calcium
•High pH media
•Alkaline conditions

Boron Deficiency:
Stunted, abnormal growth

Molybdenum Deficiency in Soybean

Molybdenum deficiency **occurs in highly acidic soils**. Molybdenum deficiency affects N-fixing bacteria, resulting in few or ineffective nodules on roots.
Thus, Mo deficiency will also cause a soybean N deficiency.
Mo: Differs from other micronutrients in that availability increases with rising soil pH.
It is seldom lacking for soybean at pH 6.0 or above. Legumes need Mo for N fixation. The deficiency symptom is pale green or yellow plants indicating a nitrogen shortage in the leaf tissue. Not surprisingly, this usually does not occur on any soil that is high enough in N to make up for the lack of nodule fixation.
Sodium molybdate (30 %Mo) and ammonium molybdate (48 % Mo) are used as seed treatments to supply 30-40 g/ha Mo; soil treatment is 60-120 g/ha Mo, but the first step is always to establish the correct soil pH.

Molybdenum is needed by the plant in the synthesis and activation of nitrate reductase, an enzyme that reduces nitrate to ammonium in the plant. It is also required for symbiotic fixation of Nitrogen within legume root nodules and for the conversion of inorganic Phosphorus to organic forms in the plant. Unlike other micronutrients, Molybdenum availability in the soil increases with higher soil pH. Sandy soils are more likely to be deficient in Molybdenum. Heavy Phosphorus fertilization can increase Molybdenum uptake by plants from the soil, while Sulfur fertilization reduces Molybdenum uptake.

FUNCTIONS OF MOLYBDENUM

- Nitrogen fixation and metabolism
- Iron and Phosphorus metabolism

MOLYBDENUM DEFICIENCY IS MADE WORSE BY:

- Low pH

Molybdenum Deficiency:
Middle leaves are first to become chlorotic

Zinc Deficiency in Soybean

Deficient plants are stunted. The leaves are yellow or light green. The lower leaves may turn brown and drop. Flowers are scarce. The few pods that do set are abnormal and slow-maturing. In mild deficiencies, early growth is stunted and plants are very light green or chlorotic. Symptoms appear first or are more severe on older and/or fully expanded leaves. Symptoms are uniform across leaves.

Zn deficiency is most likely on soils with a high pH, high p and low organic matter. Soybeans on sandy soils are more susceptible than those on finer-textured soils. The deficiency can be caused by heavy P fertilization, especially near the row, or by very high soil test levels for P. Soil tests are available, but plant analysis is usually recommended for additional confirmation.

Zinc sulphate is the most widely applied inorganic source. A single broadcast application is normally adequate for 2-4 years, if soils do not have high pH or high P level.

When chelated zinc is used, manufacturers' directions should be carefully followed. Application of organic manure often corrects Zn deficiency.

Zinc plays a key role in many enzyme systems in plants. It controls the production of important growth regulators that influence new growth and development. One of the first indications of Zinc deficiency is the presence of stunted plants resulting from a shortage of growth regulators.

FUNCTIONS OF ZINC

- Synthesis of protein
- Needed for uniform maturity
- Important for Calcium translocation

ZINC DEFICIENCY IS MADE WORSE BY:

- Organic conditions
- High Phosphorus fertilization
- High pH

Sudden Death Syndrome (SDS)

- ♠ We're including sudden death syndrome in our list of nutrient deficiencies because the symptoms can be very similar.
- ♠ After the R 2 growth stage, leaf chlorosis and necrosis will develop. Leaves will become brown and fall off quickly, and the lower stem's cortex will develop brown and grey streaks.
- ♠ This infection develops during the vegetative growth stage but foliar symptoms generally appear at the blooming and beginning pod stages.
- ♠ Treatment depends on the deficiency. An experienced Programing agronomist can help you find the right solution.

Photo credit: University of Nebraska and Mississippi State University

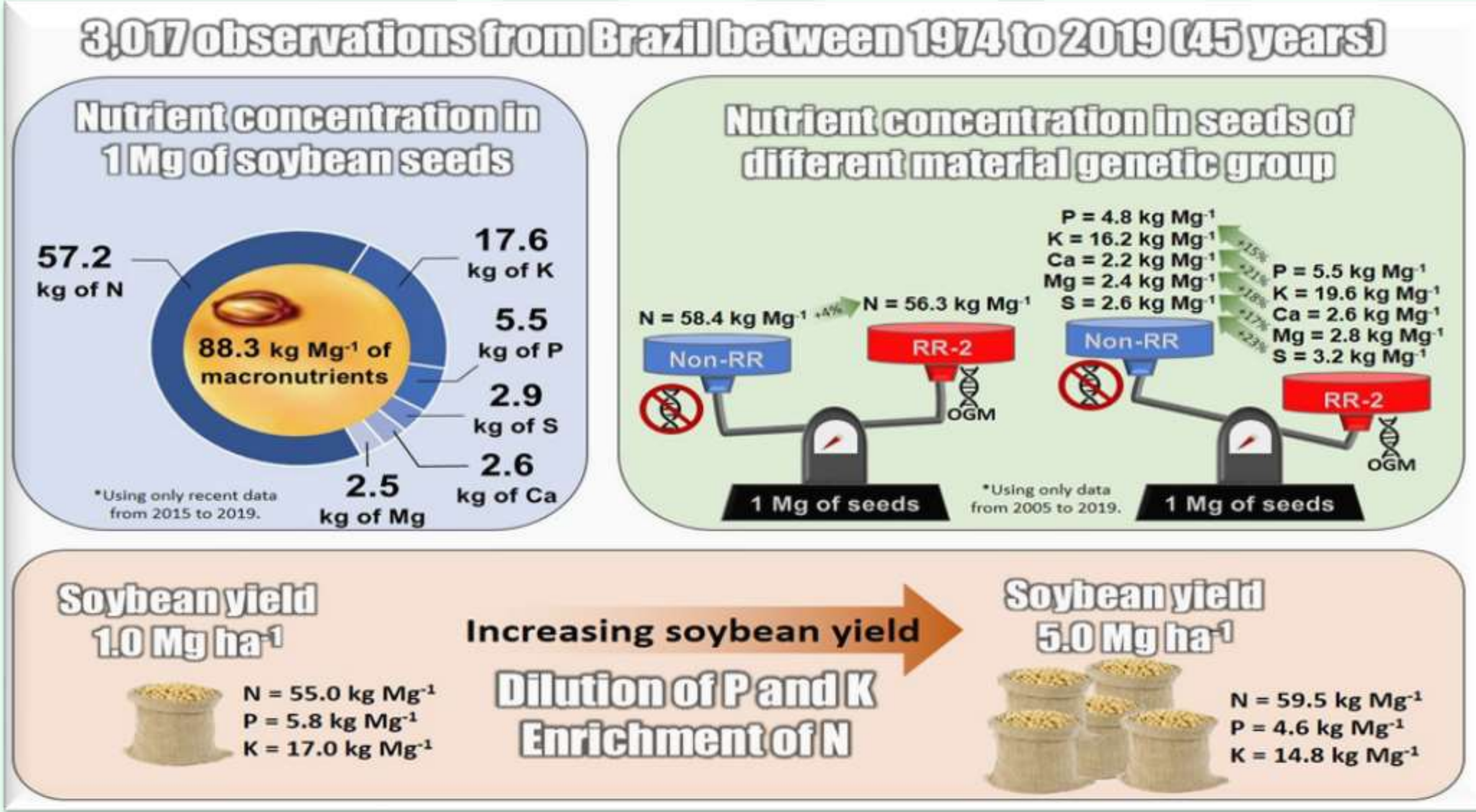
Fertilizers for Soybean in Brazil

Potassium and Sulfur Fertilizers for Soybean in Brazil.

Soybean production in several regions of Brazil is carried out on soils with medium to low sulfur (S) levels, which may be corrected using fertilizer. Several S fertilizers have been examined, some of which contain S in sulphate form and others in its elemental form. Polyhalite, a fertilizer comprised of sulphate, calcium (Ca), magnesium (Mg), and potassium (K), was shown to correct Ca, Mg, and S deficiencies, but could not always fully supply crops' K requirements. PotashpluS®, a new granular blend of polyhalite and potassium chloride (KCl), was evaluated as the sole K and S sources for soybean production and compared to alternative S fertilizers common in Brazil.

The competence of PotashpluS®, a granular blend of polyhalite and KCl, to supply all K and S requirements of soybean crop in a single application was examined in Brazil. PotashpluS®, and MAP+SSP+KCl, both comprising sulphate as their sole S source, showed greater response potential and gave rise to significantly higher yields compared with fertilizers, where the partial or total S supply is in the elemental form. PotashpluS®, broadcast pre-planting, was as efficient as SSP applied in the planting furrow. However, the full promise of PotashpluS®, which also contains considerable amounts of the essential nutrients Ca and Mg, remains unclear in the present study, probably due to serious N deficiency. Further research is needed to verify the potential benefits of PotashpluS® for soybean as well as other crop species.

(Sources; e-ifc No. 59 - Research Findings)



HIGHLIGHTS

Soybean seeds contain 57.2, 17.6, 5.5, 2.9, 2.6, and 2.5 kg Mg^{-1} of N, K, P, S, Ca, and Mg

RR-2 seeds are more concentrated in K, P, Ca, Mg, and S than the non-RR

N concentration in soybean seeds increase with increasing yield

P and K concentration in soybean seeds decrease with increasing yield

Brazilian guidelines of nutrient concentration in soybean seeds need to be updated

Present Fertilizer Practices

Basal fertilizer rates are:

In USA

Soil test level	Fertilizer nutrients recommended (kg/ha)		
	P_2O_5	K_2O	
		Low or normal clay content	High clay content
Low	40-60	100 -150	120-180
Medium	30-40	50 - 100	70-100
Adequate	0-30	0-50	0-70
High	0	0	0
For expected yield of 2500- 2700 kg/ha; for each additional 1000kg add an extra 10-15 kg/ha P_2O_5 and 20-30 kg/ha K_2O.			

Basal fertilizer rates are:

In China

Sowing time	Province	Yield Level t/ha	Basal fertilization (kg/ha)					Remarks
			N	P_2O_5	K_2O	$Zn\ SO_4$	H_2BO_3	
Spring	Heilong jiang	2-2.5	45	45	-	-	-	30-45kg/ha N top-dressed 2mnths after sowing
Spring	Hunan	3	-	45	120	-	6	60 kg/ha N top dressed 2 months after sowing
Summer	Henan	2-2.5	45	60	-	15	-	
		3	60	60	60	15		
Autumn	Hubei, Hunan	2.25	60	45	80	-	-	

*** The basal fertilization is banded in the seed row and incorporated into the upper 15 cm of soil.

Liming : on basis of formula

Liming to pH 6.0 (in Brazil)

$$\mathbf{NC} = \frac{(70 - V1) \times T}{100} \times \mathbf{f}$$

Where NC = Lime requirement

V1 = base saturation, before liming

T = CEC

f = lime reactivity, usually (1.5)

The base saturation test is simply **the ratio of five nutrients (calcium, magnesium, potassium, hydrogen, and sodium) to each other**.

Benefits of Proper Lime Use

- ✓ Proper liming provides a number of benefits:
- ✓ Plants develop healthier roots because they are exposed to less potentially toxic aluminum.
- ✓ Better root growth may enhance drought tolerance.
- ✓ Lime is a source of calcium (as well as magnesium, if dolomitic limestone is applied).
- ✓ Nutrient solubility is improved by a higher pH, so plants have a better nutrient supply.
  (The optimum pH for most crops is 5.8 to 6.2 when grown on mineral soils in North Carolina.)
- ✓ Increased soil CEC occurs, as well as reduced leaching of basic cations, particularly potassium.
- ✓ Nodulation of legumes is enhanced, which improves nitrogen fixation.
- ✓ Optimal pH allows the breakdown of some herbicides, preventing damage to rotational crops.
- ✓ Some nematicides work better.

Summary

- Plant density
- Growth Stages
- Soil pH
- Soybeans require mineral nutrients for growth
- Sudden Death Syndrome (SDS)
- The best fertilizer for soybeans
- A good starter fertilizer for soybeans
- Preferred nutrient forms
- Fertilizers for Soybean in localize (Brazil, USA and China)- Myanmar ?
- Liming
- General; storage, processing, production

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Brazil

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7.) ပဲပုပ် အထွက်ကောင်းဖို့ရာ နည်းစနစ်မှန်စွာကျင့်သုံးပါ

8. ပဲပုပ်အထွက်တိုးအောင် ဘယ်လိုပြုစုမလဲ, စိုက်ပျိုးရေးရာ နည်းပညာ, (၂၀၁၉)

9. ဟင်းစားပဲပုပ် စိုက်ပျိုးနည်း, လင်းလင်းထွန်း(၂၀၁၉)

10. ပဲပုပ်၏ကျန်းမာရေးအကျိုးကျေးဇူးများ, ပေါက်ပေါက်(ကျန်းမာရေး)

Thank You for your Attending