ပဲမျိုးစုံသီးနှံစိုက်ပျိုး

ရန်သင့်တော်သည့်
မြေအမျိုးအစားနှင့်မြေဩဇာအသုံးပြုမှုနှုန်းထားများ

Legume (or) Pulse; Peas and Beans

Legume (or) Pulse; Peas and Beans

❁ မြန်မာလူဦးရေ၏ (၇၀ %) သည် အသက်ရှင်ရပ်တည်ရေးအတွက် စိုက်ပျိုးရေးကဏ္ဍအပေါ်တွင် မှီခိုနေရသည်။ ❁ ၁၉၆၀ ပြည့်မတိုင်ခင် မြန်မာနိုင်ငံသည် ကမ္ဘာ့ စပါးထုတ်လုပ်မှု အများဆုံး

အဆင့်တွင် ရှိနေခဲ့သည်။ ထို့အတူ ပဲမျိုးစုံသီးနှံထုတ်လုပ်မှုတွင်လည်း ဦးဆောင်နေပြီး နိုင်ငံ (၅၂) ခုသို့ ကုန်သွယ်တင်ပို့လျက်ရှိပါသည်။

(Myanmar is a leading producer of beans and pulses, and exports these to 52 countries) ကမ္ဘာ့ပဲမျိုးစုံစိုက်ပျိုးထုတ်လုပ်သောထိပ်တန်းနိုင်ငံ(၅)ခုတွင်ကနေဒါ၊အိန္ဒိယ၊ဩစတြေးလျ၊တန်ဇန်နီယားတို့နှင့်အတူမြန်မာနိုင်ငံပါဝင်နေသည်။

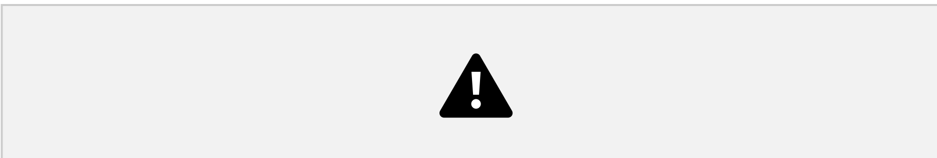
နိုင်ငံစီးပွားရေးသည် ပြည်ပပို့ကုန်ပေါ်တွင်မှီခိုနေရသဖြင့်၄င်း၊ ရေမြေ ရာသီဥတု ဒေသ အခြေအနေမှာ ပဲမျိုးစုံ သီးနှံ အတွက် သင့်တော်မျှတသော အခြေအနေမှာတည်ရှိနေ၍ အဓိကထုတ်စိုက်ပျိုးပြီး အရည်အသွေးကောင်း ပဲမျိုးစုံ ပို့ကုန်ရရှိရေး ကိုကြိုးပမ်း ဆောင်ရွက်သင့်ပါသည်။

လူတို့၏ကျန်းမာသန်စွမ်းရေးအတွက်အထောက်အကူပြုအစားအစာတစ်မျိုးဖြစ်လည်းပဲမျိုးစုံသီးနှံပါဝင် အမျိုးသားရေးကဏ္ဍကျန်းမာရေးနှင့်ငတ်မွတ်ခေါင်းပါးမှုလျော့ချရေးတွင်ပဲမျိုးစုံနှင့် အာဟာရထောက်ပံ့ရေးပါဝင် **(Most national dietary guidelines recommend pulses as part of a healthy diet.)**

နေ့စဉ်ပဲပုဂံလုံးတစ်ဝက်စားသုံးခြင်းဖြင့်အမျှင်ဓာတ်၊ပရိုတင်းဓာတ်၊ကယ်လဆီယမ်၊ပိုတက်စီယမ်၊ဖောလစ်အက်စစ်(ဗီတာမင်-ဉ)၊ ဇင့်၊သံဓာတ် နှင့် မဂ္ဂနီစီယမ် ဓာတ်တို့ရရှိစေပြီး ပြည့်ဝအဆီဓာတ်ကိုပါရရှိစေသည်။

(People eat at least ½ cup of pulses per day have higher intakes of fibre, protein, calcium, potassium, folate, zinc,

iron, and magnesium as well as lower intakes of total and saturated fat.)



Legumes and Soil Quality

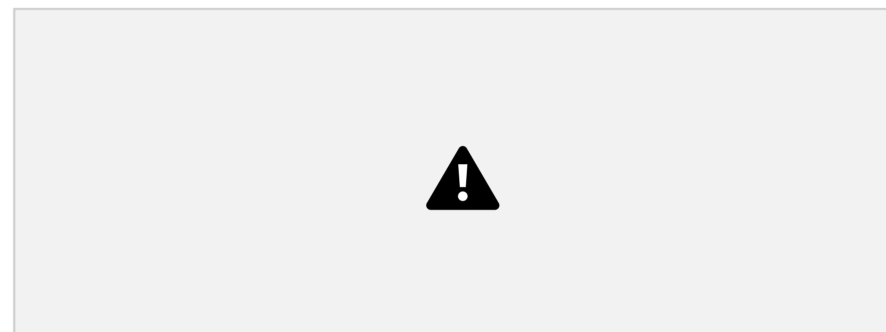
❑ The ability of legumes to fix atmospheric nitrogen is perhaps the most notable aspect that sets them apart from other plants. ❑ In addition, legumes can provide a wide range of important soil quality benefits.

❑ The soil quality benefits of legumes have been shown to be greater than the sum of their parts.

❑ Research results have shown yield increases of spring small grains of 7 to 14% after alfalfa.

❑ This yield increase is in addition to what can be attributed to improvements in moisture and nutrients measured in the soil. ❑ Yield increases to _rotation effects‘ including improved soil physical properties, depression of phytotoxic substances, addition of growth promoting substances, and decreased disease pressure. ❑ Legumes can provide a multitude of benefits to both the soil and other crops grown in combination with them or following them in a rotation.

❑ Locally adapted legumes can be used in any conservation situation to improve soil quality.



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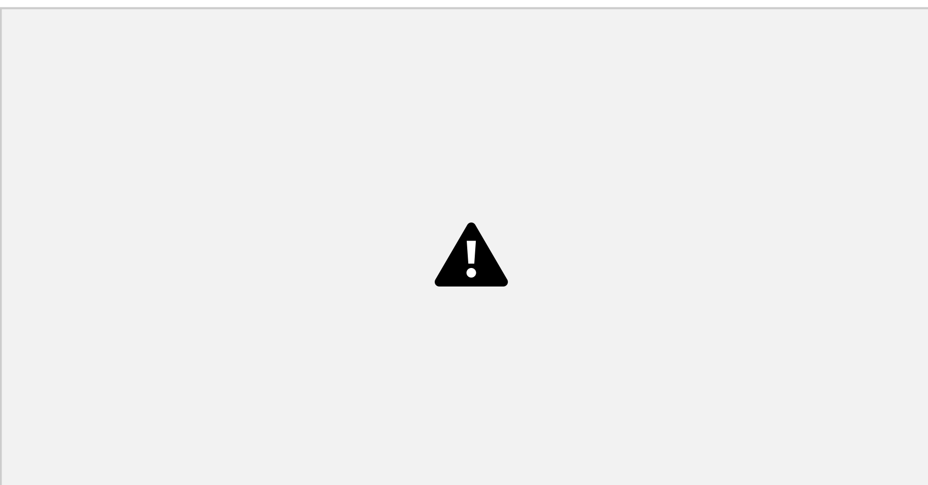

3

Pulses and Beans – The Nutritious Staple

- **Beans** are the most significant legume for human consumption since they rank as **the second richest source of protein in our diet.**
- Beans are among the world's earliest cultivated crops, along with wheat, barley, grapes, and melons.
- **Pulses** include all the edible seeds that grow in pods, and include all **types of peas, beans and lentils**.
- Cheap and affordable, besides protein, they are a **rich source of dietary fiber, minerals and vitamins.**

- They are **low in fat** and are **great sources of energy**, helping the human body get rid of **dietary deficiencies.**
- Their **protein content is as high as 24%.**
- They are the perfect complement to staples such as **wheat and rice to complete a nutritious,** wholesome meal.

Pulses and Beans Cultivation in the World

The **Fabaceae** family of flowering plants includes legumes such as beans, peas, peanuts, lupines, alfalfa, clover, acacia, and many others.

- The global production of peas has been increasing since 1961, reaching 17.3 million tonnes in 2019.
- The majority of the **20,000 species of legumes** are poisonous, but beans are safe to eat and are a **good source of protein**.
- **The top producers of peas in 2019 were China, India, and Russia.**
- **The top producers of beans in 2021 were Brazil, Myanmar, and India.**

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Pulses and Beans Cultivated Region in

Myanmar

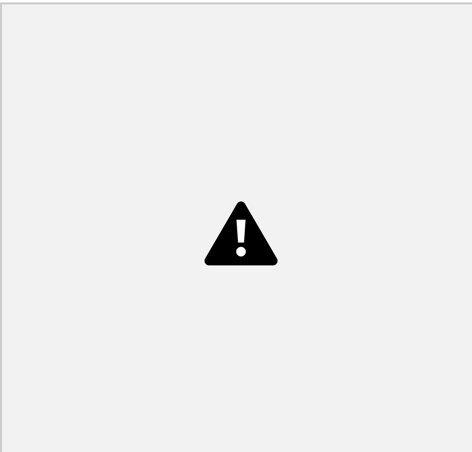
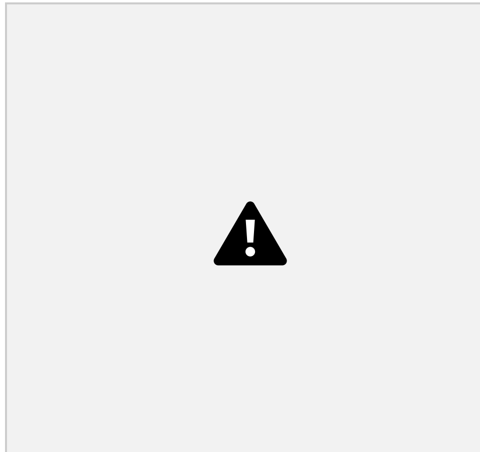
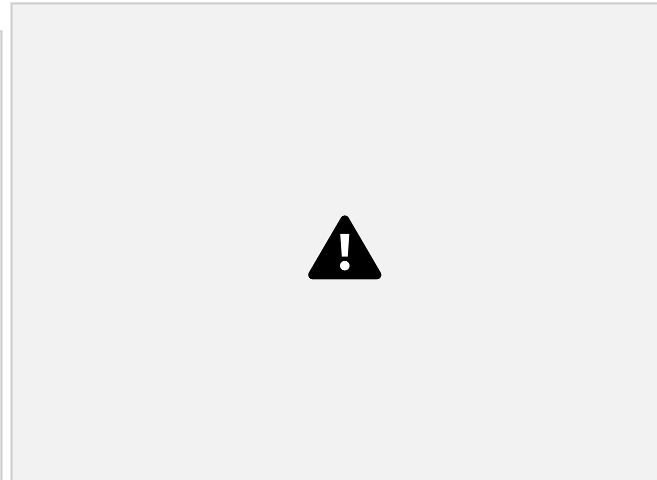
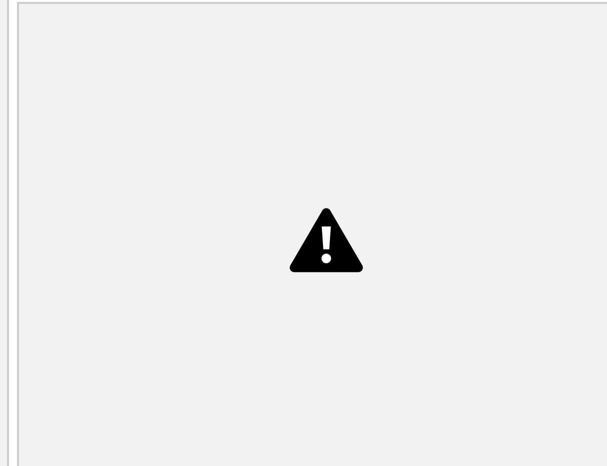
- Burma grows about 24 types of beans and pulses,
- Burma categorizes soybeans and ground nuts as beans and pulses.
- In Burma, normally grown immediately after the harvest of the main rice crop in the delta region (lower parts of Burma) and are grown as a monsoon crop in the central plain areas and in Shan State (southeastern part of country).
- About 70 percent of all beans and pulses are grown during the winter season with residual soil moisture, which reflects the yield per unit area.
- The yields range between 1.0 -1.3 metric tons (MT)/hectare.
- Black matpe, Mung bean, accounted for 70-75 percent of total pulse production and largest exported varieties.
- Approximately 80-90 percent of total Toor whole production and 70-80 percent of total Black matpe is exported to India and the domestic wholesale prices are highly dependent on India‘s demand.
- Another exported bean, the Mung bean, has more extended markets, including China, Vietnam,

Malaysia, Bangladesh, India, Indonesia, and European Union (EU) countries

Terminology

- The term *pulse*, as used by the United Nations' Food and Agriculture Organization (FAO), is reserved for legume crops harvested solely for the dry seed.
- This excludes **green beans** and **green peas**, which are considered **vegetable** crops. Also excluded are seeds that are mainly grown for oil extraction (**oilseeds** like **soybeans** and **peanuts**), and seeds which are used exclusively for sowing **forage** (**clovers, alfalfa**). These distinctions are not always clearly made, and many of the varieties used for dried pulses are also used for green vegetables, with their beans in pods while young.
- Fabaceae, such as **Scotch broom** and **Genisteae**, are leguminous but are usually not called legumes by farmers, who tend to restrict that term **to food crops**.

Legume Plant in the family Fabaceae

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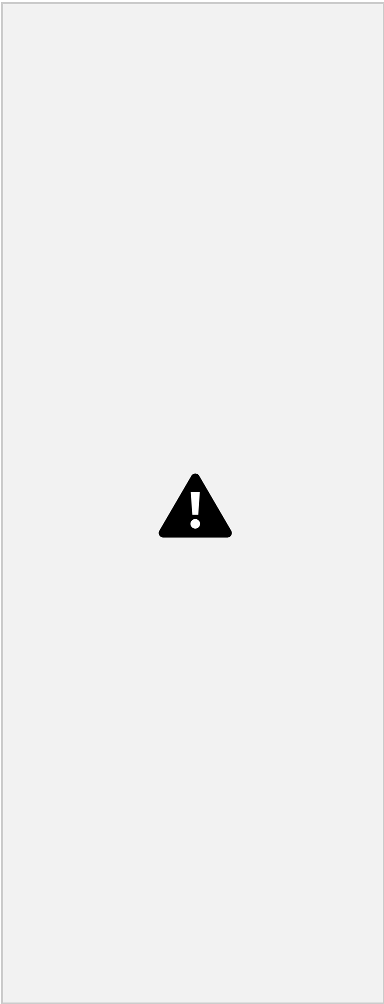
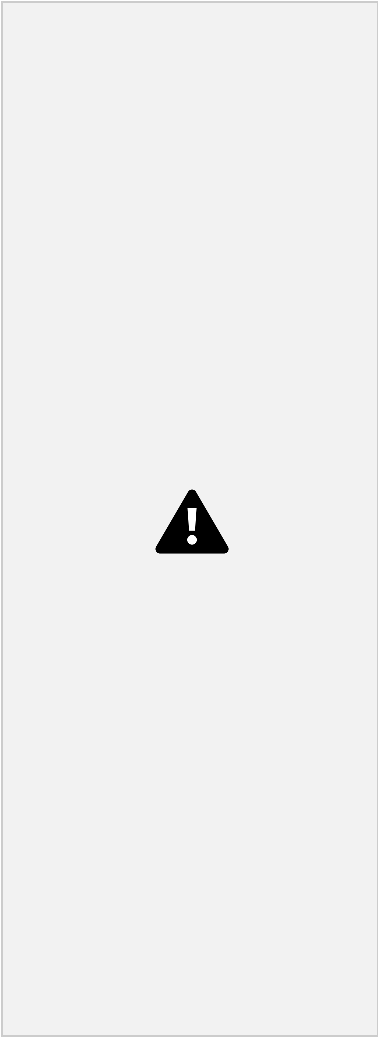
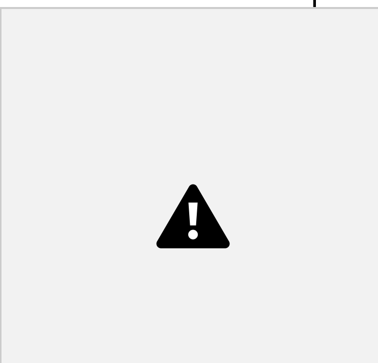
 

စဉ်	ပဲမျိုးအမည်		သိပ္ပံအခေါ်အဝေါ်
	မြန်မာ	အင်္ဂလိပ်	

၁	ကုလားပဲ	Chickpea,Chick pea, Gram, Desi chana, Grabanzo, Kabuli, Bengalgram	*Cicer arietinum*
၂	ပဲတီစိမ်း	Green mung beans, Green gram, Moong	*Vigna radiata*
၃	မတ်ပဲ	Black gram, Black Matpe,Urad, Urd	*Vigna mungo*
၄	ပဲစင်းငုံ	Pigeon pea, Toor whole, Red gram	*Cajanus cajan*
၅	ပဲလွမ်း	Cowpea	*Vigna unguiculata*
၆	မ မမောက်ပဲ	White Kidney bean, (white and red)	
၇	မ မပဲ	Groundnut, Peanut	*Arachis hypogaea*
၈	ပဲပုပ်	Soybean, Soy bean, Soya bean	*Glycine max*
၉	စားမတ်ပဲ	Garden pea	*Pisum sativum*
၁၀	မောပတ်ပဲ	Butter bean, Lima bean	*Phaseolus lunatus*
၁၁	ဗိုလ်ကိတ်	Cowpea, Bocate	*Vigna unguiculata*
၁၂	ပဲကကြီး	Lablab bean, Hyacinth bean, Indian bean	*Dolichos lablab*
၁၃	ပဲကကား (ဗိုလ်စာ်ပဲ၊ပဲကြဟ်ကေလ်)	Lima bean, Myanmar stripe bean	*Phaseolus lunatus.*L *Phasulus inamoenus*
၁၄	ပဲမောက်(စိမ်း)	Mung baen, Green mung bean, Green gram	*Phaseolus aureus,* *Radia tus linn,* *Vigna radiata*-L
၁၅	ပဲ ြူကမလး	Duffin bean, Rangoon white bean, Lima bean	*Phaseolus lunatus*

၁၆	စွေ်တာေီ (ပဲကတ္တီပါ)	Velvet beans, Lima bean (Red), Lima bean (Blue) Rai mash (India)	*Phaseolus lunatus Linn*
၁၇	ပဲယဉ်း	Rice bean (yellow) Bamboobean Indian bean Moth bean (India)	*Vigna umbellate thumb* *Phaseolus calaratus roxb* *Phaseolus acconitifolius*, *Vigna acconitifolius*
	ပဲယဉ်း(ေီ)	Rice bean (Red) Bamboobean Indian bean Moth bean (India)	*Vigna umbellate thumb* *Phaseolus calaratus roxb* *Phaseolus acconitifolius*, *Vigna acconitifolius*



Legume Plants Soil Nutrients

- Plants need the right combination of nutrients to live, grow and reproduce.
- Too little or too much of any one nutrient can cause problems.
- **Plant nutrients fall into 2 categories: macronutrients and micronutrients**.
- Macronutrients are those elements that are needed in relatively large amounts. They include nitrogen, potassium, sulfur, calcium, magnesium and phosphorus.

❖ Micronutrients are those elements that plants need in small amounts (sometimes trace amounts), like iron, boron, manganese, zinc, copper, chlorine and molybdenum.

❖ **Both macro- and micronutrients are naturally obtained by the roots from the soil.**

❖ **Plant roots require certain conditions to obtain these nutrients from the soil.**

❖ **First,** the soil must be **sufficiently moist** to allow the roots to take up and transport the nutrients. Sometimes correcting improper watering strategies will eliminate nutrient deficiency symptoms.

❖ **Second**, **the pH** of the soil must be within a certain range for nutrients to be release-able from the soil particles.

❖ **Third, the temperature** of the soil must fall within a certain range for nutrient uptake to occur. ❖ **The optimum range of temperature, pH and moisture is different for different species of plants.** ❖ Thus, nutrients may be physically present in the soil, but not available to plants.

❖ A knowledge of soil pH, texture, and history can be very useful for predicting what nutrients may become deficient.

Caveats - ကကိုေငင်စေစ်ဆ်ြခင်

 Many nutrient deficiencies may **look similar (virtual condition)**.

 It is important to know what a plant species looks like when it is healthy in order to recognize symptoms of distress, for example some plants were bred to have variegated patterns in the leaves when they are healthy. Many micronutrients are used by plants to process other nutrients or work together with other nutrients, so a deficiency of one may look like another (**for instance, molybdenum is required by legumes to complete the nitrogen fixation process).**

 If more than one problem is present, **if water stress, disease, or insect pressure occurs simultaneously with a nutrient deficiency,** or if two nutrients are deficient simultaneously, the typical symptoms may not occur, According to a report by UC Statewide IPM Program, beans require proper nutrition for normal growth and yields. Deficiencies or excesses of nutrients can cause disease-like conditions.

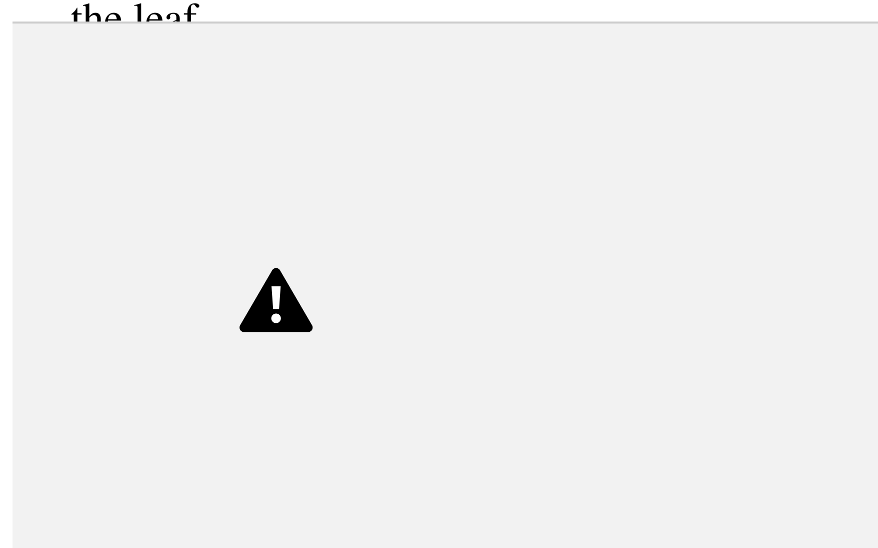
 Symptoms vary depending on the nutrient involved, the bean variety, and environmental conditions.

✔ Too much of any nutrient can be toxic to plants. ✔ This is most frequently evidenced by salt burn symptoms.

✔ These symptoms include marginal browning of leaves,

separated from green leaf tissue by a slender yellow halo.

✔ The browning pattern, also called necrosis, begins at the tip and proceeds to the base of the leaf along the edge of the leaf.



At a Glance

(အပေါ်ယံအမြင်)

✔ Know the characteristics of the plant when healthy to identify symptoms of distress

✔ Identify where symptoms are appearing (new leaves, old leaves, edge of leaf, veins etc.)

✔ Identify pattern of symptoms

✔ Compare symptoms to chart

✔ Follow directions on label of product for applying fertilizer if warranted

Bean's Optimum Soil Requirements

- ✔ **Organic matter > 1.5 %**
- ✔ **Calcium carbonate < 4 %**
- ✔ **EC conductivity < 4 mmohs/cm**
- ✔ **P (Olsen extractant) > about 20 ppm**
- ✔ **K (ammonium acetate) > 66 or (sodium acetate) > 75**

- ✔ **Available Fe and Mn > 5**
- ✔ **Available Zn > 1.5 ppm**
- ✔ **Susceptible to K deficiency (clay soils)**
- ✔ **P, Zn, Mn and Fe deficiency (intensive cropping in arid/ semi-arid regions)**

Source: IFA World Fertilizer Use Manual (1992)

Bean's Optimum Fertilizer Recommendation

✔ No needed N where *Rhizobium leguminosarum* in present in the soil.

✔ Some countries applied to the seed bed – 30-40 kg/ha N.

✔ General recommendations are 80-120 kg/ha $P_2O_5$and 100-120 kg/ha K_2O,

✔ about one fifth of the $P_2O_5$and one half of the K_2O being considered as advance for the next crop. ✔ For optimum production, soils should contain at least 10ppm sulphate S and below that level,15-20 kg/ha S should be applied (generally, superphosphate with 18-25 % P_2O_5 brings enough S for crop maintenance). ✔ Mg deficiency is rare but can be corrected by application to soil, or to leaves as 5% magnesium sulphate spray. ✔ Ca deficiency is very rare; uptake of 120 kg/ha by the plant is mostly returned to the soil at harvest time (but see above for the effect of acidity).

✔ Soils with < 0.5 water soluble boron should be given 1-2 kg/ha B but repeated foliar applications should never exceed 0.2 kg/ha B.

✔ Zn deficiency is rare in acid soil but appears on alkaline soils (pH>7), where the organic matter has been severely disturbed or leveled for irrigation: applications of 5 kg/ha Zn should be considered where deficiencies are known to occur. [Source: IFA World Fertilizer Use Manual (1992)]

Replace macronutrients in soil regularly (at least once per growing season)

Nutrient **Deficiency symptoms** **Comments** **Fertilizer Sources**

Calcium (Ca)

Nitrogen (N)

Magnesium (Mg)

Phosphorus (P)

Potassium (K)

Sulfur

New leaves (Top of plant) are

Distorted or irregularly shaped

Causes blossom-end rot.(ပန်းပွင့်မှုထိခိုက်)

General yellowing of older leaves (bottom of plan). The rest of the plant is often light green.

Older leaves turn yellow at edge leaving a green arrowhead shape in the center of the leaf.

Leaf tips look burnt, followed by older leaves turning a dark green or reddish-purple.

Older leaves may wilt, look

scorched. Interveinal chlorosis begins at the base, scorching. Inward from leaf margin.

Younger leaves turn yellow first. Sometimes

Desert soils and water generally Have plenty of calcium, so deficiency problems are rare. Excessive calcium can limit the availability of other nutrients.

Most plants absorb nitrogen in the form of ammonium of nitrate. These forms readily dissolve in water and leach away.

Plants absorb magnesium as an ion (charged particle) which can be readily leached from soil. May be

readily leached from soil if calcium is not present.

Plants absorb phosphorus in the form of phosphate. This form dissolve only slightly in water but pH strongly affects uptake.

Plant absorbs potassium as an ion which can be readily leached from soil. Desert soils and water generally have plenty of potassium, so deficiency problems are rare.

Plants absorb sulfur in the form of sulfate. This

Anything with the word —calcium‖: also gypsum

Anything with the words —ammonium‖, —nitrate‖, or

—Urea‖, also manures.

(magnesium sulfate).

greensand.

Anything with the words —magnesium‖, also Epsom salts

Anything with the words —phosphate‖ or —bone‖, Also

Anything with the words —potassium‖ or —potash‖.

Anything with the words

(S)

followed by older leaves. readily leaches from the

soil sulfur may acidly the —sulfate‖.

14

MICRONUTRIENTS

Replace when deficiency symptoms are evident.

Nutrient **Deficiency symptoms Comments Fertilizer Sources**

Boron (B)

absorb boron in the form of borate. Problems are seen in intensely cropped areas.

plenty of copper, so problems are rare.

Anything with the words —borax‖ or —borate‖

Copper (Cu)

Terminal buds die, witches' brooms form. Plants

Leaves are dark green, plant is stunted. Plants absorb copper as an ion. Arizona soils have

Anything with the words —copper‖. —cupric‖ or —cuprous‖

young leaves.

(leaves, shoots, fruit) generally. Dead spots or patches.

Iron

(Fe)

General yellowing of older leaves (bottom of plant). The rest of the plant is often light green

.

Molybdenum (Mo)

Yellowing occurs between the veins of young leaves. Pattern is not as distinct as with iron. Palm fronds are stunted and deformed, called —frizzle top‖. Reduction in size of plant parts

Manganese (Mn)

Terminal leaves may be rosetted, and Plants absorb Iron as an ion through

Zinc

Yellowing occurs between the veins of

their foliage as well as their roots. Uptake is strongly affected by pH. Chelated Iron is readily available for use by the plant., other forms of Iron may be tied up in the soil.

Plants absorb zinc as an ion through their foliage as well as

Anything with the words —Iron chelate‖

Often required with Zinc application.

.

Anything with the words —molybdate‖ or —molybdic‖

Plants absorb molybdenum in the form of molybdate. Problems are rare in Arizona soils but are occasionally seen on legumes where it mimics nitrogen deficiency.

Plants absorb manganese as an ion through their foliage as well as their roots.

Anything with the words —manganese‖ or —manganous‖

Anything with the word

(Zn) yellowing occurs between theveins of the new leaves. their roots. High pH may limit availability —zinc‖.

15

Nutrient deficiencies in common beans

(Adapted from Chapter 14 of *Nutrient Deficiencies and Toxicities in Crop Plants*, edited by William F. Bennet, 1993.)

Nutrient	Deficiency
Nitrogen (N)	Older leaves are pale green to yellow; stunted plants with fe flowers and poorly filled pods.
Phosphorus (P)	Slow growth; small dark green leaves in upper part of plant; leaves yellow then turn brown and senesce. Stunted plants w thin stems and short internodes. Flowers abort.

Potassium (K)	Symptoms mainly in young plants. Marginal chlorosis of ol leaves which turns to yellow brown scorch in between the v (sometimes resembling common bacterial blight, but witho water-soaked appearance); leaf may curl downward while s margins curl upward; plants can be stunted with poor root s leading to collapse.
Boron (B)	Terminal buds and apical meristems die; witches' broom; th deformed primary leaves; interveinal chlorosis; swollen ster near nodes.
Sulfur (S)	Uniform yellow chlorosis of leaves, similar to N deficiency.
Zinc (Zn)	Deformed, pale green younger leaves with yellow tips and margins, interveinal chlorosis, and development of necrotic with time; blossoms and pods may abort; dwarfed plants.

When it Occurs

Occurs in all soils, but especially in sandy soils or soils with low organic matter; can be induced by heavy rains or irrigation that cause leaching of nitrates. If soil pH is outside 6.0–8.0 range, N availability may be restricted.

Occurs in soils with low pH or that have leached nutrients. P availability is very reduced in soils with pH below 6.2.

Occurs in soils with low fertility but high calcium and magnesium, especially sandy soils. K is less available in soils with pH below 6.0.

Rare in beans—occurs in soils with coarse textures, low organic matter, and high aluminum and iron hydroxide. It can also occur in alluvial soils with high pH, or in dry, neutral to alkaline soils under intense light.

Rare in beans—can occur in soils with pH below 6.0.

Occurs in soils with high pH (or acidic soils that have been 'over limed' or have too much P). Can be worse under conditions of soil compaction, low organic matter, or too much manure or crop residue. The increased absorption of other nutrients can cause Zn deficiency, especially Fe.

Nutrient toxicities in common beans

(Adapted from Chapter 14 of *Nutrient Deficiencies and Toxicities in Crop Plants*, edited by William F. Bennet, 1993.)

Nutrient	Toxicity
Boron (B)	Stunting, yellowing, necrosis.

Occurs with non-uniform applications of fertilizer or bands of fertilizer too close to seed, especially in dry weather; can also occur if beans follow a crop heavily fertilized with B, such as turnips.
Boron toxicity is likely if dry beans are grown in the high-boron soils on the west side of the San Joaquin Valley, part of Yolo County, and several other areas in California.

Boron tolerance (ppm)

- Common beans: 0.50 to 0.75 ppm
- Lima beans: 0.75 to 1.0 ppm
- Blackeyes beans : 2.5 ppm
- Garbanzos: sensitivity likely around 1.0 ppm (no specific data available, but based on grower input from Yolo County, an area high in boron).

When it Occurs

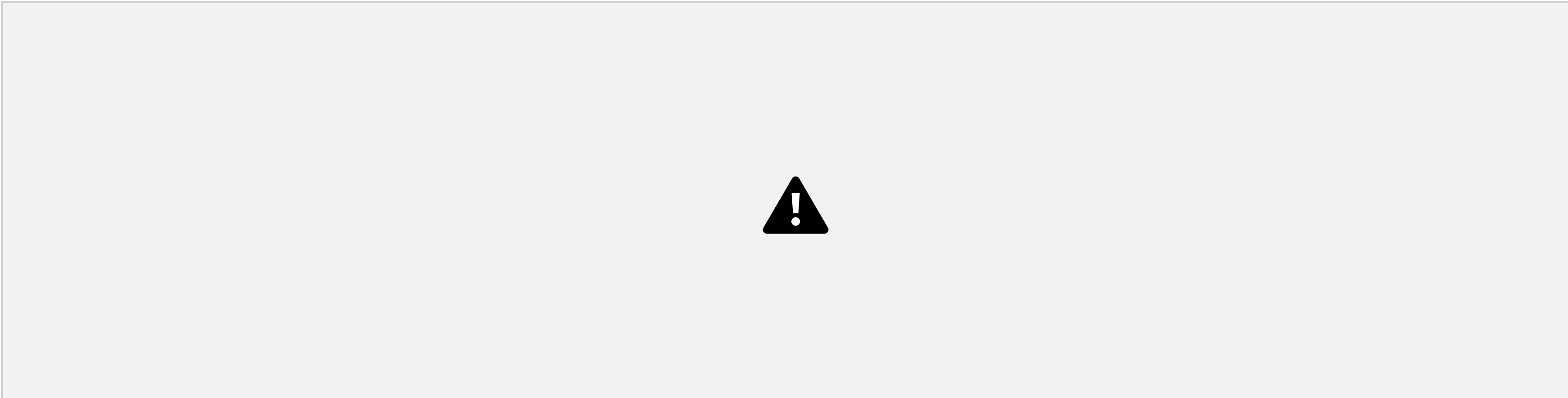
Yolo County, officially the County of Yolo, is a county located in the northern portion of the U.S. state of California. Yolo County was one of the original counties of California, created in 1850 at the time of statehood.

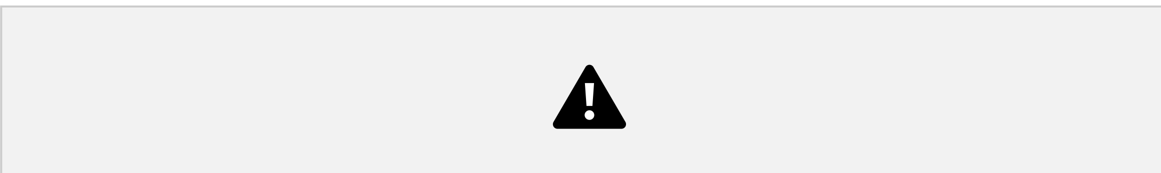
Legume Plants soil

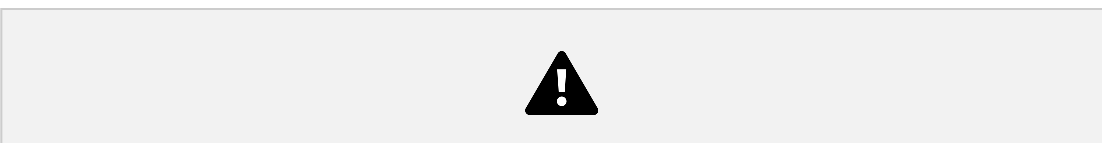
❖ According to **Garden.org**, beans are not too choosy about where they'll sink their roots. ❖ They'll give you a good crop in soil that's loamy, sandy, rocky, rich or poor and even in clay. ❖ But avoid planting beans in the shade or in soil that stays wet and doesn't drain well. ❖ Bean diseases thrive in wet conditions, and the roots may not get enough oxygen with water and mud clogging their air channels.

❖ **Beans like soil that's slightly acid, with the best pH range for them around 6.0 to 6.5 (pH is an acid-to-alkaline scale).**

❖ According to **Plantophiles**, beans are **light feeders** and **do not require a lot of feeding**. ❖ However, fertilizing the beans with good quality fertilizer will nourish (အစာအာဟာရြပည့္ေစ) the plant and the garden.







Beans Crop Nutrients Deficiency

Boron

Deficiency Symptoms

Appearance of curled and crinkled leaves.

Correction Measure

Foliar spray of Borax 0.2%

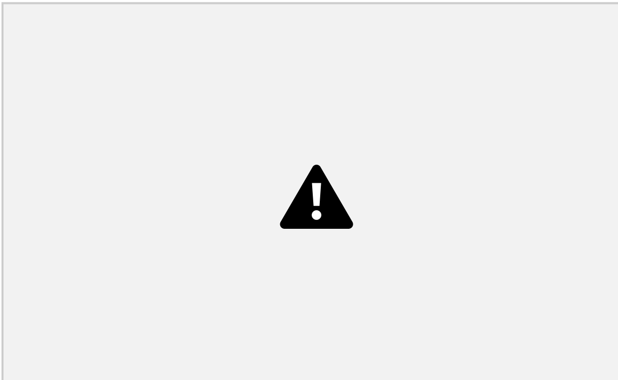
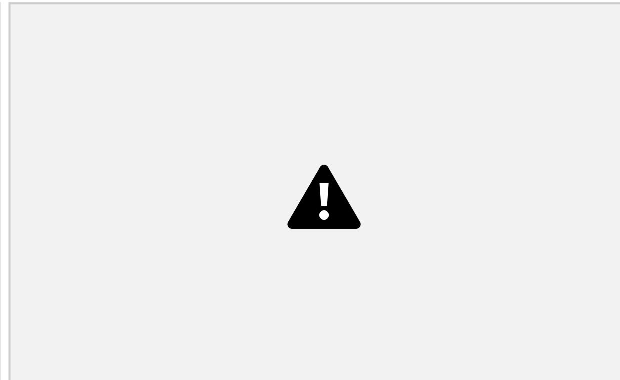
Iron

Deficiency Symptoms

Upper leaves light yellow to white veins remain green.

Correction Measure

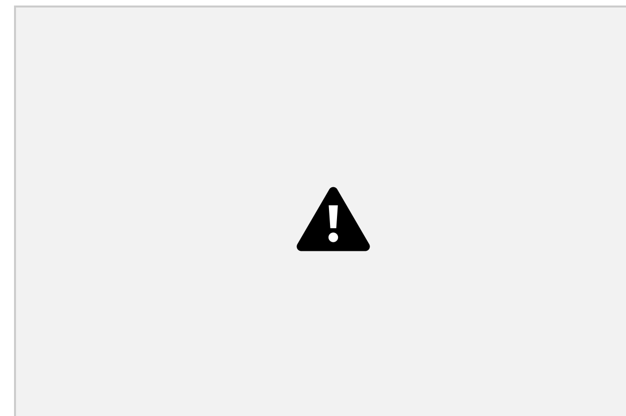
Foliar spray of $FeSO_4$ 0.5%.

Zinc

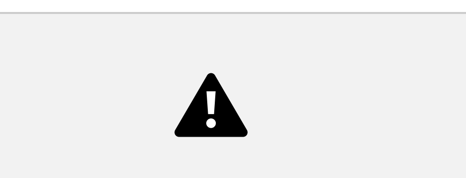
Deficiency Symptoms

The leaf interveinal tissue is yellowish between green veins. Necrotic areas appear if deficiency is severe. Pod set may be reduced.



Correction Measure

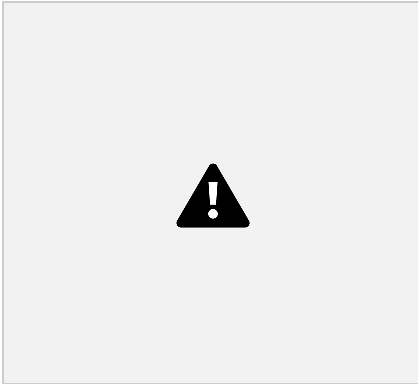
Soil application. of 5-10 kg $ZnSO_4$/ ha or foliar application. of 0.5% $ZnSO_4$.



Horse gram

Macrotyloma uniflorum (**horsegram**, also known as **horse gram**, **kulthi bean**, **gahat**,

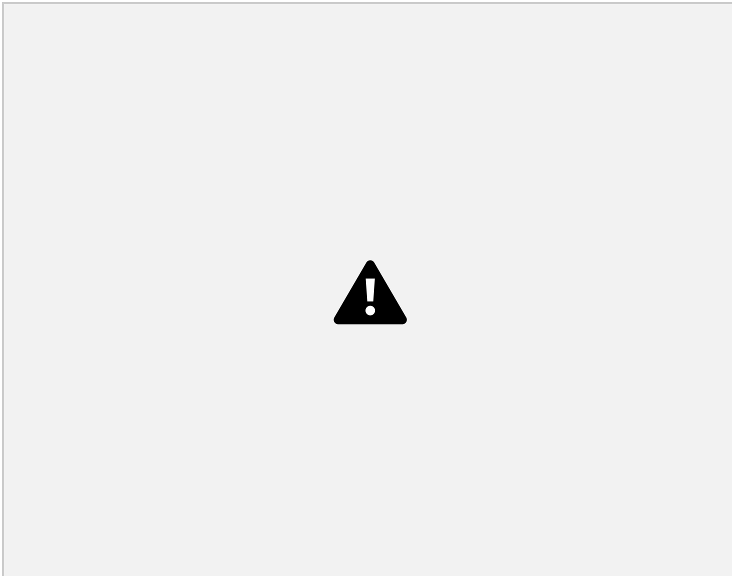
hurali, or **Madras gram**) is a legume native to tropical southern Asia, known for its distinct taste and texture, widely used legume in many cuisines.



Iron

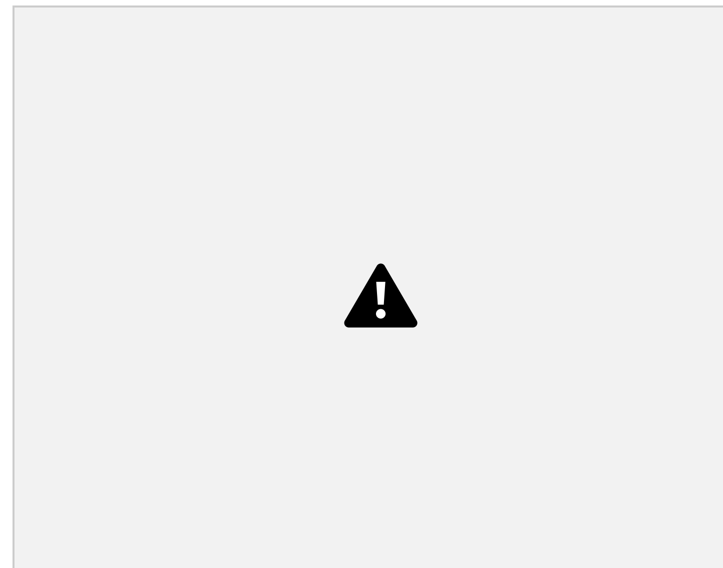
Deficiency Symptoms

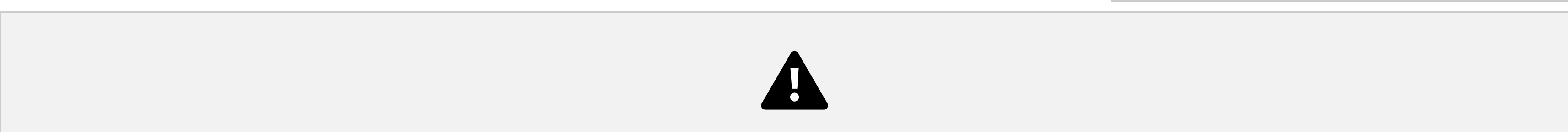
- Sandy land soil is contaminated by high limestone and iron rich soil are prone(ေရာဂါြဖစ်လွယ်ေစ) to this deficiency.
- Lesser aerated soil, sodic and saline soil types prone to this deficiency.
- The pale color of the leaves, low in chlorophyll, leaf area shrunken, yellow color, the veins are green in color.
- The leaves eventually turn yellow over during severe deficiency then turns pale yellow in color



Correction Measure

(10 g / liter) Ferrous sulphate through the spray solution by three times in the space of ten days or Apply Ferrous sulphate by 25 kg per hectare as basal.





Bengal gram (Chikpea) Crop Nutrients Deficiency

Nitrogen

Deficiency Symptoms

Growth will be stunted and leaves a very pale green.

Correction Measure

Foliar spray of 1% Urea

Phosphorus

Deficiency Symptoms

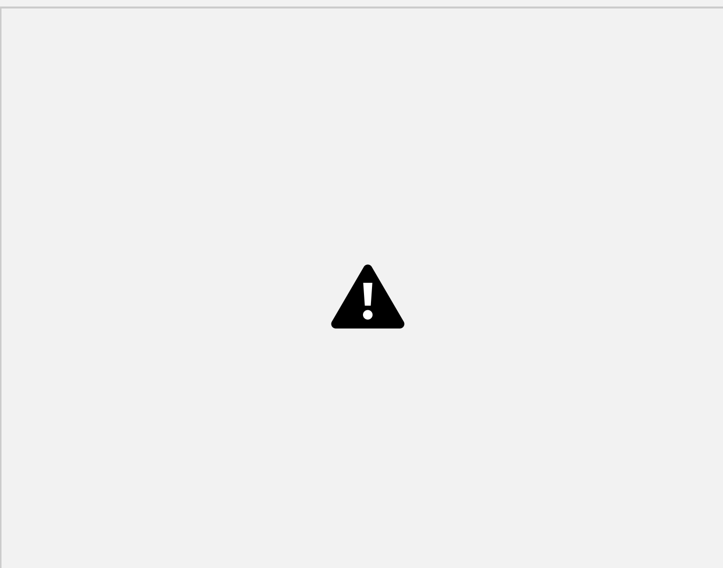
Growth is stunted, Leaves are tilted upward.

Leaves show brown spots after flowering.

Poor root development.

Correction Measure

Foliar spray of 1% DAP



Bengal gram Crop Nutrients Deficiency

Potassium

Deficiency Symptoms

Chlorotic areas increase as deficiency becomes more severe, then they merge so that chlorosis occurs around the edges of the leaf.

As deficiency becomes more severe, chlorosis progresses toward the center of the leaf.

Correction Measure

Foliar spray of 1% KCl

Sulphur

Deficiency Symptoms

Deficient plants become chlorotic.

New leaves are first affected, but gradually the entire plant becomes uniformly chlorotic.

Correction Measure

Foliar spray of $CaSO_4$ @ 0.5%

Bengal gram Crop Nutrients Deficiency

Iron

Deficiency Symptoms

Symptoms appear first on young emerging leaves.

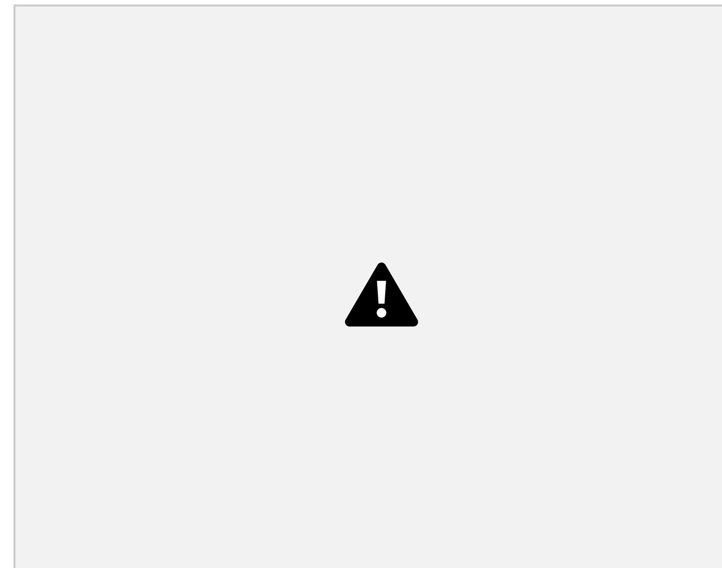
Interveinal areas turn chlorotic and become yellow.

Whole leaf turn yellow and white.

Stunted growth and poor pod set.

Correction Measure

Foliar spray of $FeSO_4$ @ 0.5%



Zinc

Deficiency Symptoms

Leaves chlorotic and then turn to rusty brown colour. Veins remain green. Leaves and shoots smaller than normal. Yellowing in interveinal areas.

Correction Measure

Foliar spray of $ZnSO_4$@ 05.%

Fertilizer Application of Green gram and Black gram

Green gram
Crop Nutrients Application;

❑ Nitrogen; 10-20kg N/ha has been recommended or Foliar spray of DAP 2% at weekly intervals.

❑ Potassium; Soil application of Murate of potash spraying of 1% potash at flowering stage. ❑ Calcium; Foliar spray of $CaSO_4$ 1% at fortnightly intervals.

❑ Boron; Foliar spray of Borax 0.2% at fortnightly intervals.

❑ Iron; Spraying of 1% $FeSO_4$ – 10 day intervel of 3 times. Application of 25 kg of $FeSO_4$as basal dose. ❑ Manganese; Spraying of 1% $MnSO_4$ during 20, 30, 40 DAS or application 10 kg of $MnSO_4$as a basal dose. ❑ Zinc; Application of basal dose $ZnSO_4$at the rate of 25 kg per ha. Spraying of 0.5% $ZnSO_4$ during 20, 30, 40th day after sowing.

Black gram Crop Nutrients Application;

❑ Magnesium; Foliar spray of $MgSO_4$ 1% at fortnightly intervals (two weeks)

- ❑ Calcium; Folia spray of $CaSO_4$@0.5-1.0%
- ❑ Boron; Foliar spray of Borax 0.2% at fortnightly intervals Manganese; Spraying of 1% $MnSO_4$ during 20, 30, 40 DAS or application 10 kg of $MnSO_4$as a basal dose
- ❑ Zinc; Application of basal dose $ZnSO_4$at the rate of 25 kg per ha. Spraying of 0.5% $ZnSO_4$ during 20, 30, 40th day after sowing.

Fertilizer Application of Soy Bean and Pigeon Beans

Soy bean Crop Nutrients Application;

- ❑ Nitrogen; Foliar spray Urea 1% at fortnightly interval
- ❑ Potassium; Foliar spray of KCl 1% at fortnightly interval
- ❑ Magnesium; Foliar spray of $MgSO_4$ @ 2% at fortnightly interval
- ❑ Sulphur; Foliar spraying of Calsium Sulphate 0.5-1.0 % can control the deficiency.
- ❑ Boron; Spraying of foliar application of Borax @ 3 g/Litre twice at 10 days interval. Application of Borax @ 5g/ha
- ❑ Iron; Foliar spray of $FeSO_4$ 1% at fortnightly intervals or soil application of $FeSO_4$ 5 to 10 kg/ha ❑ Manganese;

Foliar spray of $MnSO_4$ @ 0.5% at fortnightly intervals or soil application of $MnSO_4$ @ 20 to 25 kg/ha ❑ Zinc; Foliar spray of $ZnSO_4$ 1% at fortnightly intervals or soil application of $ZnSO_4$ 20 to 25 kg/ha

Pigeon Bean (Red Gram) Crop Nutrients

❑ Phosphorus; Foliar spray of DAP 2% at fortnightly interval.

❑ Potassium**;** Foliar spray of KCl 1% at fortnightly interval

❑ Magnesium; Foliar spray of $MgSO_4$ 2% and 1% Urea

❑ Sulphur; Foliar spraying of Calcium Sulphate 0.5 % can control sulphur deficiency

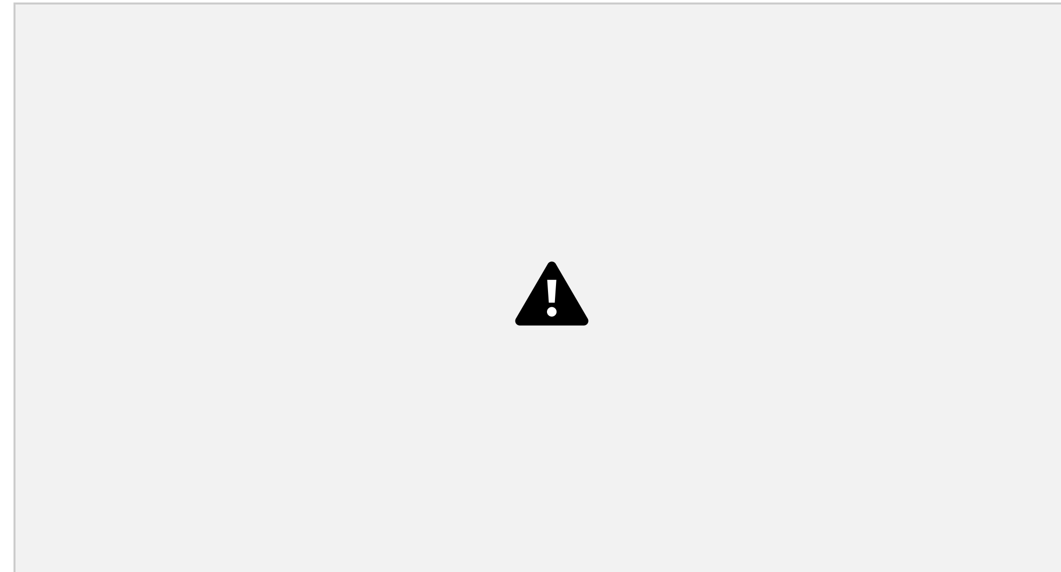
❑ Boron; Spraying of Boron 0.2 % at two week interval by foliar spray.

❑ Iron; Foliar spray of $FeSO_4$ 0.5% at weekly intervals

❑ Manganese; Spraying of manganese sulphate (5g / l) at 10 days interval

❑ Zinc; Foliar spray of $ZnSO_4$at 0.5% at fortnightly interval or soil application of $ZnSO_4$ 10-15 kg/ha.[25]

https://agritech.tnau.ac.in/agriculture/agri_index.html



Benefits of Legumes

Soil Quality Benefits of Legumes

- Soil quality benefits of legumes include: increasing soil organic matter, improving soil porosity, recycling nutrients, improving soil structure, decreasing soil pH, diversifying the microscopic life in the soil, and breaking disease build up and weed problems of grass-type crops.

Soil Organic Matter

- As mentioned previously, legumes are high in protein, and therefore, nitrogen rich. Because most crop residues contain much more carbon than nitrogen, and bacteria in the soil need both, the nitrogen supplied by legumes facilitates the decomposition of crop residues in the soil and their conversion to soil building organic matter.

Soil Porosity

- Several legumes have aggressive taproots reaching 6 to 8 feet deep and a half inch in diameter that open pathways deep into the soil. Nitrogen-rich legume residues encourage earthworms and the burrows they create. The root channels and earthworm burrows increase soil porosity, promoting air movement and water percolation deep into the soil.

Recycle Nutrients

Because perennial and biennial legumes root deeply in the soil, they have the ability to recycle crop nutrients that are deep in the soil profile. This results in a more efficient use of applied fertilizer and prevents nutrients (particularly nitrate nitrogen) from being lost due to leaching below the root zone of shallower-rooted crops in the rotation.

Benefits of Legumes

Improve Soil Structure

Research indicate improved soil physical properties following legumes. The improvements are attributed to increases in more stable soil aggregates. The protein, glomalin, symbiotically along the roots of legumes and other plants, serves as a —glue‖ that binds soil together into stable aggregates. This aggregate stability increases pore space and tilth, reducing both soil erodibility and crusting.

Lower Soil pH

Because inoculated, nodulated legumes acquire their N from the air as diatomic N rather than from the soil as nitrate, their net effect is to lower the pH of the soil. In greenhouse studies, alfalfa and soybeans lowered the pH in clay loam soil by one whole pH unit. Legumes could lower the pH and promote increased plant-soil-microbial activity on soils with a pH above the range for optimum crop growth and development.

- **Biological Diversity**
- Legumes contribute to an increased diversity of soil flora and fauna lending a greater stability to the total life of the soil. Legumes also foster production of a greater total biomass in the soil by providing additional N. Soil microbes use the increased N to break down carbon-rich residues of crops like wheat or corn.
- **Break Pest Cycles**
- Legumes provide an excellent break in a crop rotation that reduces the build-up of grassy weed problems, insects, and diseases. A three year interval between the same type (grassy, broadleaf, coolseason, warm season) crop is usually sufficient to greatly reduce weed, insect, and disease pressure.
- **Soil quality benefits of legumes include:**
  - increasing soil organic matter, improving soil porosity, recycling nutrients, improving soil structure, decreasing soil pH, diversifying the microscopic life in the soil, and breaking disease build-up and weed problems of grass-type crops.

Flavonoids are phytochemical compounds present in many plants, fruits, vegetables, and leaves, with potential applications in medicinal chemistry. Flavonoids possess a number of medicinal benefits, including anticancer, antioxidant, anti-inflammatory, and antiviral properties.

Nitrogen fixation

*Main : **Nitrogen fixation**, **Green manure**, and **Fertilizer tree***

- ❑ Many legumes contain symbiotic bacteria called Rhizobia within root nodules of their root systems (plants belonging to the genus **Styphnolobium** are one exception to this rule). These bacteria have the special ability of fixing nitrogen from atmospheric, molecular nitrogen (N_2) into ammonia (NH_3). The chemical reaction is:

$$N_2 + 8\ H^+ + 8\ e^- \rightarrow 2\ NH_3 + H_2$$

- ❑ Ammonia is then converted to another form, ammonium ($NH^+{}_4$), usable by (some) plants by the following reaction:

$$NH_3 + H^+ \rightarrow NH^+{}_4$$

- **This arrangement means that the root nodules are sources of nitrogen for legumes, making them relatively rich in plant proteins. All proteins contain nitrogenous amino acids. Nitrogen is therefore a necessary ingredient in the production of proteins. Hence, legumes are among the best sources of plant protein.**

- When a legume plant dies in the field, for example following the harvest, all of its remaining nitrogen, incorporated into amino acids inside the remaining plant parts, is released back into the soil. In the soil, the amino acids are converted to nitrate (NO^{-}_{3}), making the nitrogen available to other plants, thereby serving as fertilizer for future crops.

Nitrogen Fixation Legume plant

- Nitrogen Fixation Legume plant and seed tissue is relatively high in protein.
- This can be directly attributed to a legume's ability to supply most of its own nitrogen needs with the help of symbiotic Rhizobia bacteria living in their roots.
- Inoculated with the proper strain of Rhizobia bacteria, legumes can supply up to 90% of their own nitrogen (N). ❑ Shortly after a legume seed germinates in the presence of Rhizobia bacteria in the soil, the bacteria penetrate the root hairs and move into the root itself.

- The bacteria multiply, causing a swelling of the root to form pale pink nodules.
- Nitrogen gas present in the soil air is then bound by the bacteria which feed on carbohydrates manufactured by the above-ground plant during photosynthesis.
- The bacteria produce ammonia (NH_3) from the hydrogen acquired from the plant‘s carbohydrates and nitrogen from the air.
- The ammonia then provides a source of nitrogen for the plant to grow.
- This symbiotic relationship between bacteria and legume allows them both to flourish and produce a high-protein seed or forage crop.
- Even though legumes can fix nitrogen from the atmosphere, they can take up large quantities of soil nitrogen if it is available.
- The higher the protein content of a plant the more nitrogen it will return to the soil.
- Nitrogen is an important element for the formation of soil organic matter.

Nitrogen Fixation
Legume plant

- Nitrogen release from a legume crop occurs as the above-ground plant residues, roots and nodules gradually decompose.

- Soil microorganisms decompose the relatively nitrogen-rich organic material and release the nitrogen to the soil when they die.
- Usually about two-thirds of the nitrogen fixed by a legume crop becomes available the next growing season after a legume in a rotation.
- In a perennial grass and legume mixture, legumes not only supply their own N, but approximately 36% of the N needs of the grass plants growing alongside them.
- The total amount of N fixed and released by a legume can be estimated from the amount of seed produced by an annual legume as follows:

Bushels of seed/acre x 1.0 = lbs. of N/acre (Or) Pounds of seed/acre x .017 = lbs. of N/acre

- For perennial or biennial legumes such as alfalfa or sweetclover, 40 to 70 pounds of N are produced per ton of forage if the crop is left unharvested.
- If the crop is harvested as forage, the remaining stubble and roots will return 5 to 15 pounds of nitrogen to the soil as a function of each ton of forage removed.
- Tillage is not necessary to release legume-N into the soil. A study involving no-till corn after legumes demonstrated that the N benefits following a legume were the same whether the legume was killed with herbicide or with tillage.

Nitrogen cycle and its stages

- **Root nodules** are found on the **roots of plants**, primarily **legumes,** that form a **symbiosis** with **nitrogen-fixing bacteria.** **Under nitrogen-limiting conditions**, capable plants form a symbiotic relationship with a host-specific strain of bacteria known as **rhizobia**.This process has evolved multiple times within the legumes, as well as in other species found within the **Rosid** clade.
- Within legume root nodules, nitrogen gas (N_2) from the atmosphere is converted into **ammonia** (NH_3), which is then assimilated into **amino acids** (the building blocks of proteins), **nucleotides** (the building blocks of **DNA** and **RNA** as well as the important energy molecule **ATP**), and other cellular constituents such as **vitamins, flavones**, and **hormones**.
- Their ability to **fix gaseous nitrogen** makes legumes an ideal agricultural organism as their requirement for nitrogen fertilizer is reduced.
- **Indeed, high nitrogen content blocks nodule development as there is no benefit for the plant of forming the symbiosis**.
- The energy for splitting the nitrogen gas in the nodule comes from sugar that is translocate from the leaf (a product of **photosynthesis**).
- **Malate** as a breakdown product of **sucrose** is the direct carbon source for the **bacteroid**.
- **Nitrogen fixation in the nodule is very oxygen sensitive**.
- Legume nodules harbor an iron containing protein called **leghaemoglobin**, closely related to animal **myoglobin**, to facilitate the diffusion of oxygen gas used in respiration.

volatile organic compounds (VOCs) are

compounds that have a high vapor pressure and low water solubility

Cropping System

- In many traditional and organic farming practices, crop rotation involving legumes is common.
- By alternating between legumes and non-legumes, sometimes planting non-legumes two times ina row and thena legume, the field usually receivesa sufficient amount of nitrogenous compounds to producea good result, even when the crop is non-leguminous.
- Legumes are sometimes referred to as"green manure".
- Sri Lanka developed the farming practice known as coconut-soybean intercropping.
- Grain legumes are grown in coconut(*Cocos nuficera*) groves in two ways: intercropping or asa cash crop.
- These are grown mainly for their protein, vegetable oil and

ability to uphold soil fertility.

- However, continuous cropping after3–4 years decrease grain yields significantly

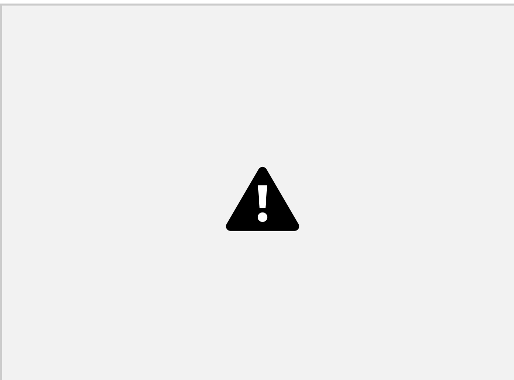
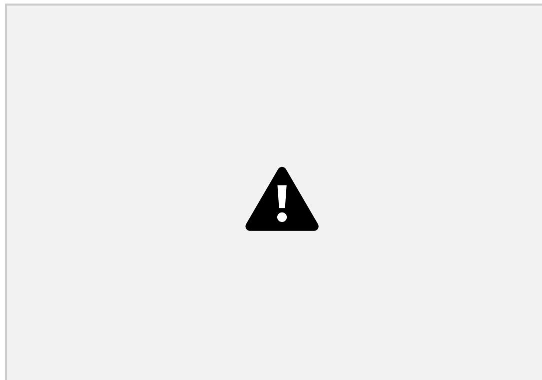
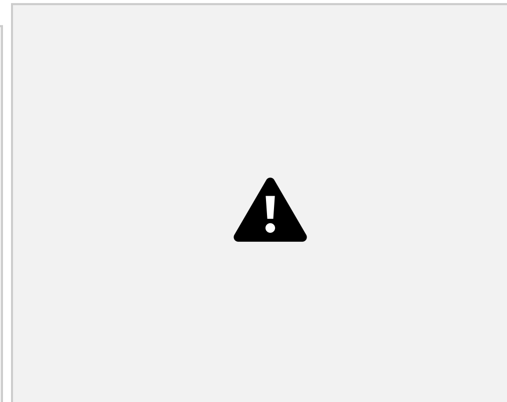
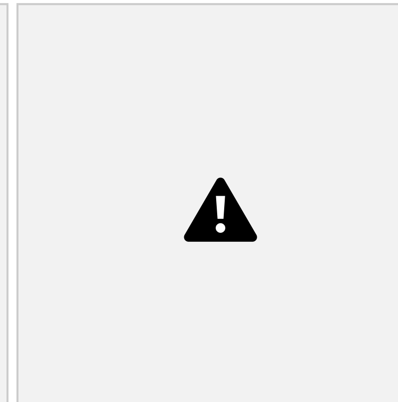
Legumes and symbiotic nitrogen fixing bacteria

- ❑ Legumes are notable in that most of them have **symbiotic nitrogen-fixing bacteria** in structures called **root nodules**. For that reason, they play a key role in **crop rotation**.
- ❑ **Crop rotation** is the practice of growing a series of different types of crops in the same area across a sequence of growing seasons.
- ❑ This practice reduces the reliance of crops on one set of nutrients, pest and weed pressure, along with the

probability of developing resistant pests and weeds.

- ❑ Nitrogen is the most commonly limiting nutrient in plants. Legumes use nitrogen fixing bacteria, specifically symbiotic rhizobia bacteria, within their root nodules to **counter the limitation**. ❑ Rhizobia bacteria convert nitrogen gas (N_2) to ammonia (NH_3) in a process called nitrogen fixation. ❑ Ammonia is then assimilated into nucleotides, amino acids, vitamins and flavones which are essential to the growth of the plant.
- ❑ The plant root cells convert sugar into organic acids which then supply to the rhizobia in exchange, hence a symbiotic relationship between rhizobia and the legumes.

Nodule-like structures

Nodules on the *Vicia Faba* roots.

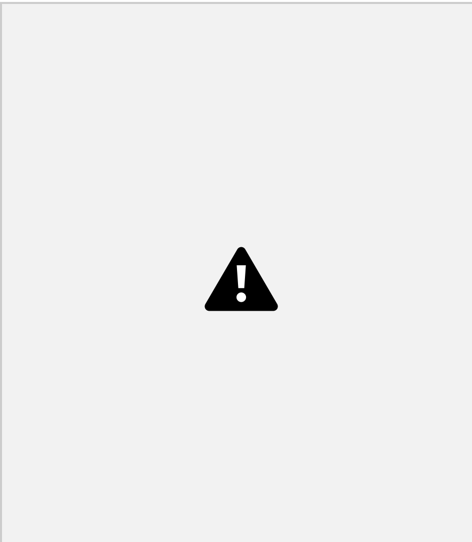
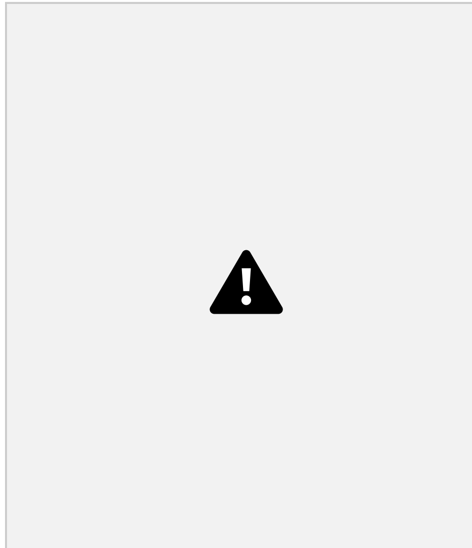
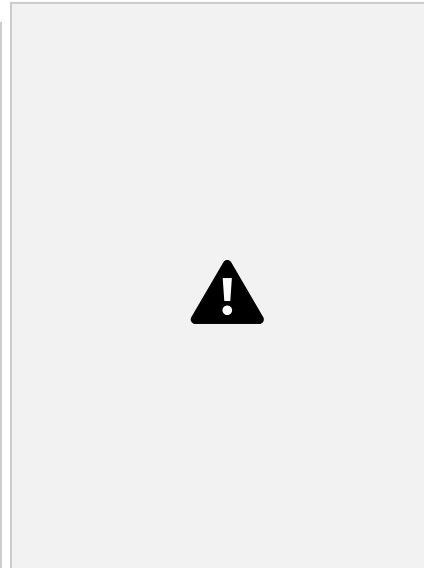
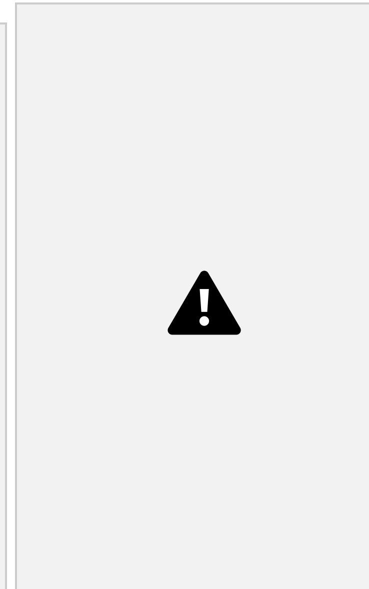
Soybean roots.

Robinia pseudoacacia

nodule of the Fabaceae plants family. **Black Locust**,

nodules

Close up of dissected *Medicago Root*

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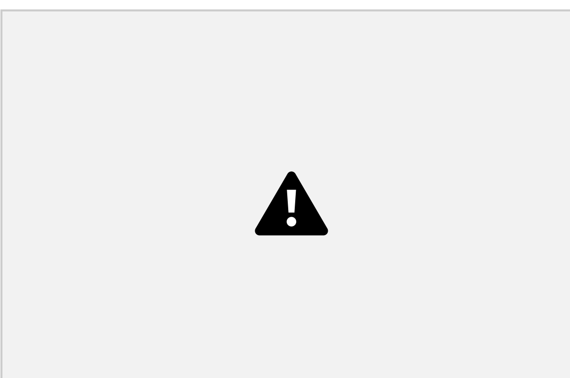
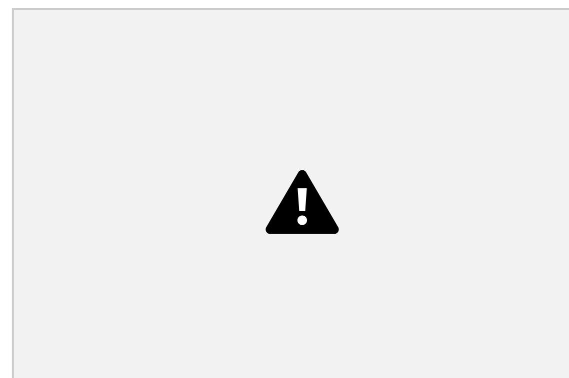
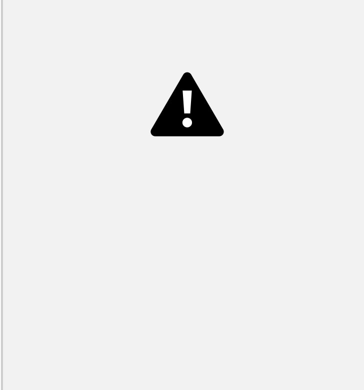
Nodule-like structures



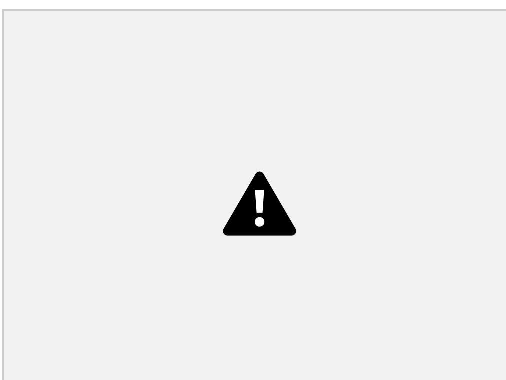


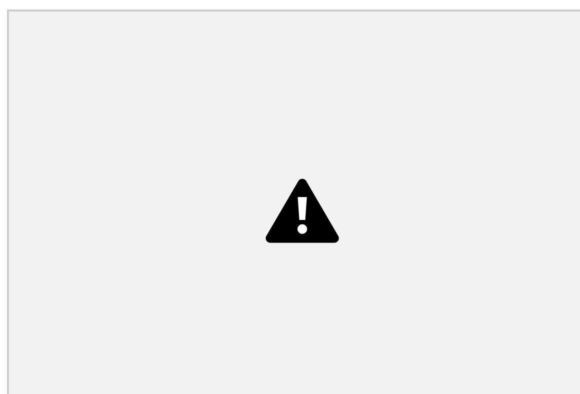
Medicago italica nodules.

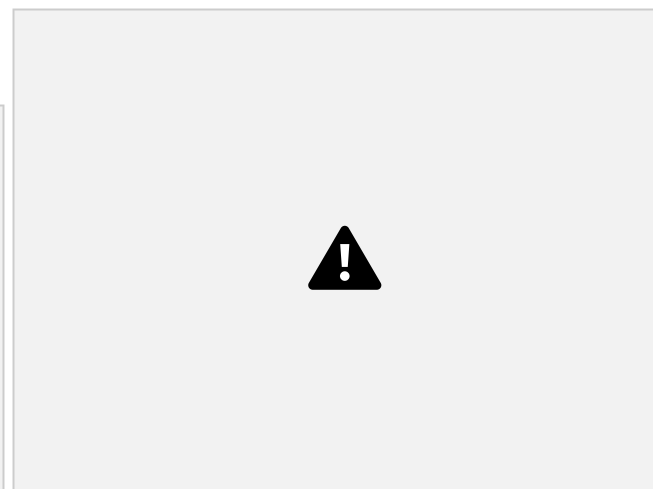
Cowpea (*Vigna unguiculata spp.*) roots.



Nitrogen-fixing nodules on a clover root.







Cross section of the nodule.

Climatic Condition and Legume Crops

Soil pH and Legume Crops

The majority of leguminous plants grow and develop better in neutral soils; the exception is lupine, which grows in low-pH soils.

The optimal pH values for leguminous plants are as follows:

pea – 6.0–7.5,
maillot – 7.0–8.7,
clover – 6.0–6.5,
lupine – 4.0–5.0,
alfalfa – 7.0– 8.3,
soybean – 5.5–6.5,
haricot – 7.0–8.0

(Appunu & Dhar, 2006; Moiseenko & Zajtseva, 2009; Nebolsin & Nebolsina, 1997; Valkov, 1986).

Rhizosphere microbiocenoses are involved in the transformation of substances and actively affect soil composition and acidity. When clover was grown on low-fertility soil, soil pH under the clover decreased from 7.0 to 4.2 because the H^+ions released by the roots outnumbered absorbed cations. Soil pH under ryegrass, however, remained at the initial level

(Dzyun, 2018; Kaufman & Blinnikova, 2018; Valentine, Benedito, & Kang, 2010)

Acidic Soils and Legume Cultivation

❑ Growers are advised to **double the inoculation rate** when sowing legumes into very acidic soils to ensure adequate rhizobia numbers are present when seeds germinate.

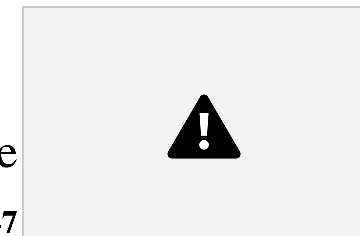
❑ Legume nodulation may be suboptimal below pH 5.5 and lime application should be considered to increase soil pH for grain legumes and crops other than lupine.

❑ Most legumes grow and develop better in neutral soils, with the exception of lupine, which grows at pH 4.0–5.0. Red clover secretes hydrogen ions into the soil through its roots, changing soil pH. ❑ Legume root nodules form better at pH 6.5–7.0, and **at pH values less than 3, the root cells' cytoplasm breaks**

down. At pH 8.7, the plants are deficient in NO_3^-, phosphates, iron, manganese, copper, and zinc.

- In acidic soils, an excess of Aluminum inhibits the uptake of phosphorus, calcium, potassium, iron, sodium, and boron by root cells.
- **Legumes are sensitive to the on centration of aluminum ions in the soil. In aluminum-sensitive pea varieties**, nutrient absorption is suppressed; hemicellulose, and cellulose synthesis is inhibited in root cell walls; membrane water permeability decreases and enzyme activity is inhibited.
- In an acidic medium, clover growth is inhibited, nodules form poorly, and nitrogen fixation rate decreases.
- The higher the acidity, the harder it is to **assimilate soil magnesium**.

lupine



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- **Magnesium deficiency** leads to reduced photosynthesis and decreased sugar transport to roots and nodules.

- As a result, nitrogen fixation stops, and the plant's leaves turn yellow and fall off. For legumes, the **Ca:Mg ratio is important**. The combined application of calcium and magnesium increases plant biomass yield, reduces nodule formation in lupine, and increases it in beans.

- This difference is related to the fact that beans, clover, and haricot are calciphiles, whereas is calciphobous. The use of waste beet sugar production – defecate, calcium fertilizer, is very effective.

- Decreased acidity increases leghemoglobin content in nodules, increases nodule weight, and increases nitrogen fixation 3–4 times.

- Acidity is among the most important indicators of soil fertility, and increased acidity serves as a deterrent to increasing productivity and degrading the quality of leguminous plants.

- **Legumes' role in agriculture is considerable: they improve soil structure, enrich soil with organic matter and biological nitrogen, and saturate humans and farm animals' diets with protein.**

Soil Salinization and Legume Crops

☞Soil salinization is a serious global environmental problem affecting sustainable development of agriculture. ☞Legumes are excellent candidates for the phytoremediation of saline soils.

☞Soil salinization is a major edaphic factor that decreases soil fertility and limits global agricultural production.

☞Saline soils have high electrical conductivity (EC), low water potential, low nutrient content, and excessive amounts of ionic salts, which adversely affect soil structural stability and plant growth. I

☞t is estimated that salt has affected more than 800 million hectares of cropping land worldwide accounting for 6% of the total land area.

☞Soil salinity is a continuous process occurring globally in over 100 countries.

☞Several studies have proposed that legumes are better candidates for phytoremediation because of their atmospheric nitrogen-fixing ability, which accelerates soil biochemical cycling and increases soil microbial activity ☞Wild soybean (Glycine soja) is a salt-tolerant legume widely distributed in the Yellow River Delta, China. ☞***G. soja*** could absorb approximately 264.57 kg soluble salt per hectare in one year from saline soils, and these salts are mainly stored in their roots

☞***Sesbania cannabina*** *(Corkwood tree)* is a salt-tolerant legume plant that improves coastal saline-alkali soils

☞**The potential of legumes** in **phytoremediating saline soils**; thus, a comprehensive understanding of the underlying mechanisms governing saline soil improvement is still lacking.

G. Soja <u>*Sesbania cannabina*</u>

(soybean)

Phytoremediation

- ❑ **Phytoremediation technologies** use living plants to clean up soil, air and water contaminated with hazardous contaminants.

- ❑ It is defined as "the use of green plants and the associated microorganisms, along with proper soil amendments and agronomic techniques to either contain, remove or render toxic environmental contaminants harmless".

- ❑ The term is an amalgam of the Greek **phyto (plant)** and Latin **remedium (restoring balance).**

- ❑ **Phytoremediation is proposed** as a cost-effective plant-based approach of environmental remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to detoxify various compounds.

- ❑ The concentrating effect results from the ability of certain plants called hyperaccumulators to bioaccumulate chemicals. **The remediation effect is quite different**.

- Toxic heavy metals cannot be degraded, but organic pollutants can be, and are generally the major targets for phytoremediation.
- Although attractive for its cost, phytoremediation has not been demonstrated to redress any significant environmental challenge to the extent that contaminated space has been reclaimed.
- **Several field trials confirmed the feasibility of using plants for environmental cleanup.**

Effect of phytoremediation on soil physicochemical properties

Phytoremediation is a promising remediation **strategy for salt-affected soil**.

- Soil remediation is expensive and complicated process.
- Phytoremediation could in principle be a more cost effective solution.
- Phytoremediation may be applied to polluted soil or static water environment.

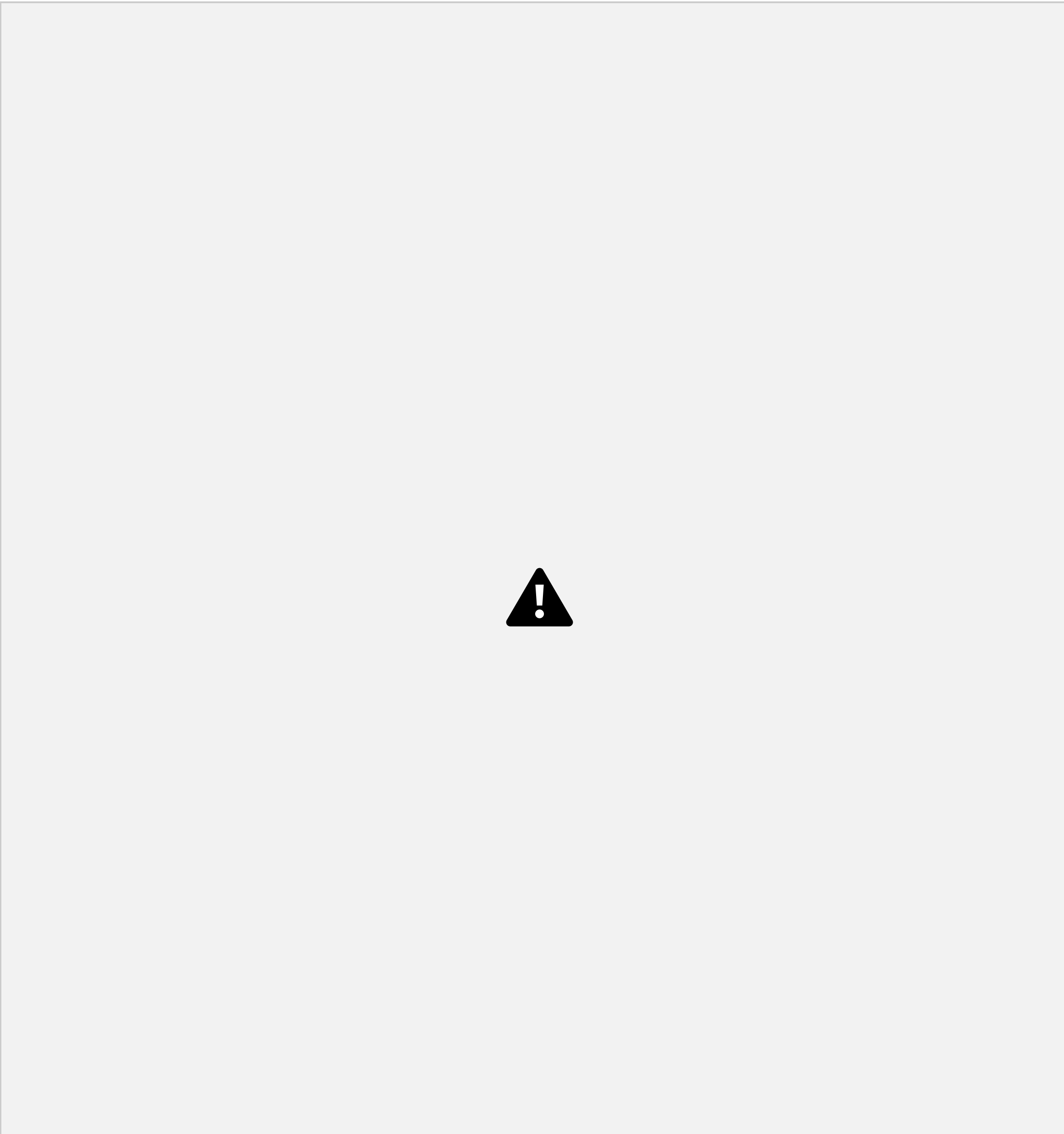
 This technology has been increasingly investigated and employed at sites with soils contaminated heavy metals like with cadmium, lead, aluminum, arsenic and antimony.

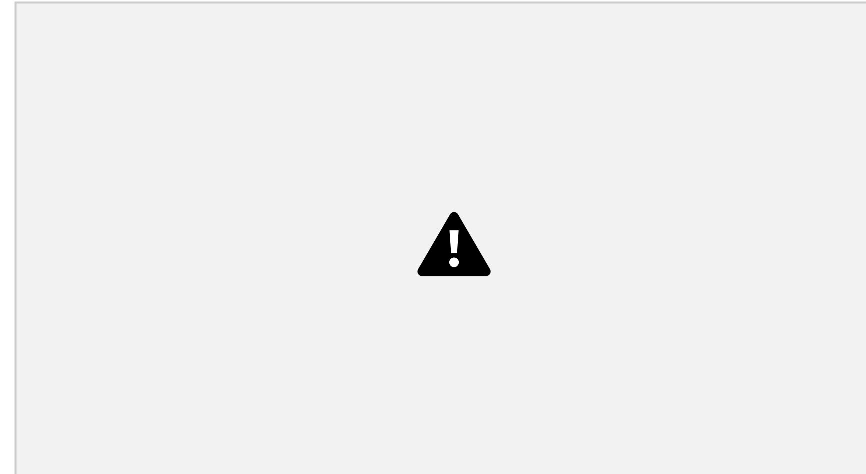
 These metals can cause oxidative stress in plants, destroy cell membrane integrity, interfere with nutrient uptake, inhibit photosynthesis and decrease plant chlorophyll.

 Phytoremediation has been used **successfully** include the **restoration of abandoned** metal mine workings, and sites where polychlorinated biphenyls have been dumped during manufacture and mitigation of ongoing coal mine discharges **reducing the impact of contaminants in soils, water, or air**.

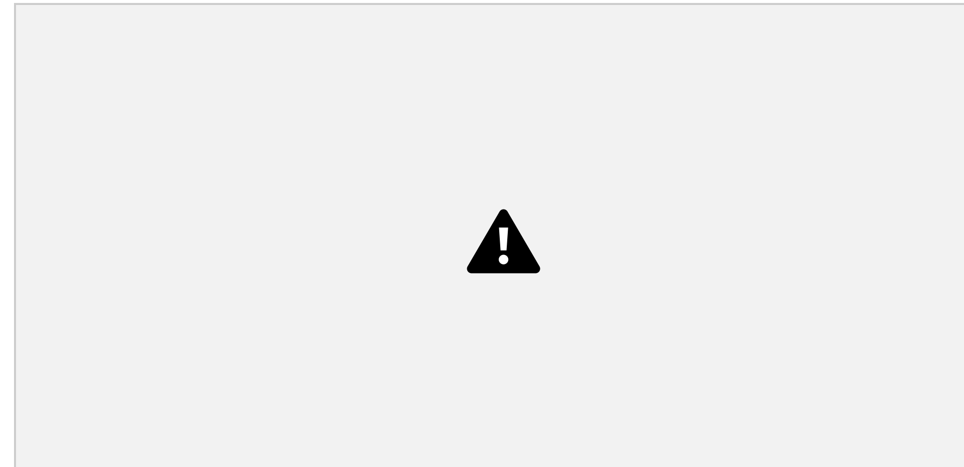
 Contaminants such as **metals, pesticides, solvents, explosives, and crude oil** and its derivatives, have been mitigated in phytoremediation projects worldwide.

 Many plants such as **mustard plants, alpine pennycress, hemp, and pigweed** have proven to be successful at **hyperaccumulating contaminants at toxic waste sites.**





Some heavy metals such as copper and zinc are removed from the soil by moving up into the plant roots.



The roots secrete enzymes that degrade (breakdown) organic pollutants in the soil.

Advantages and limitations of the phytoremediation

Advantages:

• the cost of the phytoremediation is lower than that of traditional processes[which?] both in situ and ex situ • the possibility of the recovery and re-use of valuable metals (by companies specializing in "phyto mining") • it preserves the topsoil, maintaining the fertility of the soil

• Increase soil health, yield, and plant phytochemicals

• the use of plants also reduces erosion and metal leaching in the soil

Limitations:

• phytoremediation is limited to the surface area and depth occupied by the roots.

• with plant-based systems of remediation, it is not possible to completely prevent the leaching of contaminants into the groundwater (without the complete removal of the contaminated ground, which in itself does not resolve the problem of contamination)

• the survival of the plants is affected by the toxicity of the contaminated land and the general condition of the soil

- bio-accumulation of contaminants, especially metals, into the plants can affect consumer products like food and cosmetics, and requires the safe disposal of the affected plant material
- when taking up heavy metals, sometimes the metal is bound to the soil organic matter, which makes it unavailable for the plant to extract

မြန်မာနိုင်ငံတွင်တွေ့ရှိရသော သီးနှံအမျိုးအစားအလိုက် စိုက်ပျိုးဖြစ်ထွန်းရာ မြေအမျိုးအစားများ

မြန်မာနိုင်ငံတွင်ရှိသောမြေအမျိုးအစားများအလိုက်တွေ့ရှိနိုင်သောတိုင်းနှင့်ပြည်နယ်များနှင့်စိုက်ပျိုးနိုင်သောသီးနှံအမျိုးအစားများ

(၁)လယ်မြေ -

မြန်မာနိုင်ငံ၏တောင်ဖက်ပိုင်းဧရာဝတီ၊ပဲခူး၊ရန်ကုန်၊တနင်္သာရီဒေသများတွင်၎င်းကမ်းရိုးတန်းဒေသများ(ရခိုင်၊တနင်္သာရီ၊မွန်)တို့တွင်၎င်းအပူပိုင်းဇုံမြေပြန့်ဒေသများတွင်၎င်းရှမ်းပြည်နယ်ရာအနှံ့အပြားတွင်၎င်းတွေ့ရသည်။ စပါးနှင့်**သီးထပ်ပဲမျိုးစုံ**၊နှမ်းစိုက်တကာသည်။

(၂) ဂဝံမြေ - ဂဝံမြေကို ကရင်၊ မွန်၊ ရခိုင်ပြည်နယ်နှင့် တနင်္သာရီ၊ ပဲခူး၊ ဧရာဝတီတိုင်းဒေသကြီးတို့ တွင် တွေ့ရပါသည်။ ဂဝံမြေတွင် ရာဘာ၊ ဆီအုန်း၊ ဒူးရင်း၊ နာနတ်၊ သီဟိုဠ်သရက်၊ ငှက်ပျော၊ အုန်း၊ စသည်သီးနှံများ စိုက်ပျိုးနိုင်ပါသည်။ **(၃) နီညိုရောင်မြေ-**

အမြဲစိမ်းသစ်တောများရှိရာဝိတိုရိယအငူမှမော်လမြိုင်၊နာဂရာအငူမှမြစ်ကြီးနားထိကျယ်ပြန့်စွာတွေ့ရပါသည်။

ကယားပြည်နယ်နှင့်ရန်ကုန်တိုင်းဒေသကြီးတို့မှအပကျန်ပြည်နယ်နှင့်တိုင်းဒေသကြီးအားလုံးတွင်တွေ့ရပါသည်။ နီညိုတောမြေတွင်ရာဘာ၊သရက်၊နာနတ်၊လက်ဖက်၊ကော်ဖီ၊ဥယျာဉ်ခြံသီးနှံများနှင့်သစ်တောများကိုစိုက်ပျိုးနိုင်ပါသည်။

(၄) ဝါညိုတောမြေ - ဝါညိုတောမြေကို ကရင်၊ မွန်၊ ရှမ်း ပြည်နယ် နှင့် တနင်္သာရီ၊ မကွေး၊မန္တလေး၊ရန်ကုန်၊ဧရာဝတီတိုင်းဒေသကြီး တို့တွင်တွေ့ရပါသည်။ ဝါညိုတောမြေတွင် ရာဘာ၊ နာနတ်၊ လက်ဖက်၊ နှင့် ဥယျာဉ်ခြံသီးနှံများစသည့် သီးနှံများ စိုက်ပျိုးနိုင်ပါသည်။

(၅) မြေနီ - မြေနီကို ရှမ်းပြည်နယ်၊ ကယားပြည်နယ် နှင့် မန္တလေးတိုင်းဒေသကြီးတို့တွင် တွေ့ရပါသည်။ မြေနီတွင် ယာစပါး၊ **ပဲပုပ်၊ မြေပဲ၊** လက်ဖက်၊ နှမ်း၊ ကော်ဖီ၊ ဟင်းသီးဟင်းရွက် နှင့် ဥယျာဉ်ခြံသီးနှံ စသည့်သီးနှံများ စိုက်ပျိုးနိုင်ပါသည်။ **(၆) မြေဝါ -** ရှမ်းကုန်းပြင်မြင့်၏ အနိမ့်ပိုင်းဆင်ခြေလျှောတွင်တွေ့ရပြီး ဂဝံမြေနှင့်မြေနီတို့ကြားတွင်နယ်နိမိတ်သဖွယ်ဖြစ်ပေါ်တည်ရှိသည်ကိုတွေ့မြင်ရသည်။ မြေနီနှင့်ဆင်တူ၍ ယာစပါး၊ **ပဲပုပ်၊ မြေပဲ**၊ လက်ဖက်၊ နှမ်း၊ ကော်ဖီ၊ ဟင်းသီးဟင်းရွက် နှင့် ဥယျာဉ်ခြံသီးနှံ စသည့်သီးနှံများ စိုက်ပျိုးနိုင်ပါသည်။

(၇) မြေဝါသဲဝန် - အပူပိုင်ဇုံပတ်ဝန်းကျင်ဒေသများကုန်းမြင့်ဒေသများနှင့်ဆက်နွှယ်၍တွေ့ရှိရသည်။အထူးသဖြင့်ပူအိုက်စွတ်စို
သောရာသီဥတုရှိသည့်မကွေးမန္တလေးစစ်ကိုင်းဒေသရှိသစ်ကကြီးပိုင်းရောင်မြေများကိုမြေဝါသဲဝန်ဟုခေါ်
သည်။ပဲမျိုးစုံနှမ်း ပြောင်းဝါစသည့်ယာသီးနှံများစိုက်ပျိုးသည်။

(၈) မြေနီသဲဝန် - မြေနီသဲဝန်မြေအမျိုးအစားကို စစ်ကိုင်း၊ မကွေး၊ မန္တလေးတိုင်းဒေသကြီးတို့တွင်
တွေ့ရပါသည်။ ၎င်းမြေမျိုးတွင် စပါး၊ **မြေပဲ၊** နှမ်း၊ နေကြာ၊ **ပဲမျိုးစုံ၊** ဝါ၊ ကကြိ၊ ငရုတ်၊
နှံစားပြောင်းနှင့် ဟင်းသီးဟင်းရွက် စသည့် သီးနှံများ စိုက်ပျိုးနိုင်ပါသည်။

(၉) စနယ်မြေစေး - စနယ်မြေအမျိုးအစားကို စစ်ကိုင်း၊ မန္တလေးနှင့် မကွေးတိုင်းဒေသကြီးတို့တွင်
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နှံစားပြောင်းစသည့် သီးနှံတို့ကို စိုက်ပျိုး နိုင်ပါသည်။

မြန်မာနိုင်ငံရာသီဥတုပြောင်းလဲမှု

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Components of Integrated Nutrient Management

Soils Plants Interaction and Environmental Biology

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USAID (2022) —ပြောင်းလဲလာသောရာသီဥတုနှင့်အညီလိုက်လျောညီထွေမှုရှိသောစိုက်ပျိုးရေးနည်းစနစ်မဟာဗျူဟာများ”၊ ရပ်ရွာလူထုစွမ်းဆောင်ရည်မြှင့်တင်ရေးစီမံကိန်း (၂၀၂၂)