



**University of Agricultural Sciences, Bangalore
Centre of Excellence on Watershed Management under REWARD**

**Behavioral Change Communication Module for
LRI based Fertilizer Application**

For Implementation of Pilot Study

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Training Module on Behavioral Change Communication on LRI based Fertilizer Application for the Staff implementing pilot study

Background: Land Resource Inventory (LRI) provides site and crop specific fertilizer recommendations based on the fertility status of the soils, but still, most of the farmers follow blanket recommendation. This has led to either over or sub optimal application of fertilizers in most of the situations, thereby increasing the input costs and reducing the profit margin or may result in lower yields. This can be avoided if the fertilizer applications are made based on the LRI recommendations. Considering this, the World Bank has emphasized to conduct pilot study in the REWARD program area to ascertain the impact of LRI based fertilizer application. The proposed pilot study will focus on aligning soil fertility status, fertilizer demand and its supply through interventions including - awareness building of farmers on soil nutrient status; influencing fertilizer purchase decisions of farmers to align them to the soil fertility status to avoid inappropriate use and overuse of chemical fertilizers; and nudging farmers towards adoption of integrated soil fertility, training of extension workers and fertilizer dealers, tracking data on fertilizer purchases made by farmers, will contribute to reducing inappropriate use and overuse of chemical fertilizers.

Considering the above, a pilot study will be conducted in six sub watersheds in six Districts covering four villages/ District to change the behavior of farmers towards LRI based fertilizer application using different approaches. The study will be conducted by the Nodal Scientists of LRI under REWARD program, from the University of Agricultural Sciences, Bangalore, Dharwad, Raichur, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, and University of Horticultural Sciences, Bagalkote, and the Special Officer, Centre of Excellence on Watershed Management, UASB. For effective implementation of pilot study, the Nodal Scientists will be supported by the Staff executing watershed development activities at sub watershed level viz., PIA - AO, AAO, DPC, Watershed Assistants-WA, LRI Extension Manager, Team Leader of FNGO, FNGO-Training Coordinator/ Watershed Manager, RSK staff, etc. All the staff responsible to implement pilot study should be equipped in behavioral change communication (BCC) modules for bringing desirable results from the pilot study. In this regard, three days training has been scheduled to prepare those staff implementing pilot studies on BCC.

Training Objectives:

1. To make the staff implementing pilot study to understand the systematics of LRI based fertilizer application
2. To prepare trainees on the methodology of conducting pilot study on LRI based fertilizer application
3. To make the trainees to comprehend the BCC approach and related module
4. To teach the actors involved in conducting pilot study on skills of using BCC tools and methods

Duration: Three days

Venue: Centre of Excellence on Watershed Management, UAS, Bangalore, and KVK-Chintamani

Training methods: Discussions and Exercises

Session Plan:

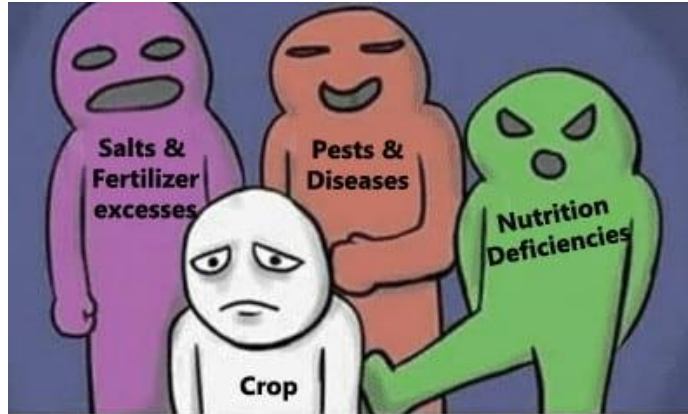
#	Topic	Time	Methods	Resource Person
Day-1: 16.05.2024 (Thursday)				
1	LRI based fertilizer application: Role of nutrients in plant growth, ill effects of indiscriminate use, LRI card interpretation, fertilizers adjustment as per the fertility status	10.00-11.30	PPT Discussion	Prakash, N B
2	Pilot study on LRI based fertilizer application: Objectives, methodology, impact indicators, data collection	11.30-13.00	PPT Discussion	Prakash, N B
3	Behavioral change communication - what and why?	14.00-15.00	PPT Discussion	Nagaraja, N
4	Behavioral change communication module: Steps, conditions and required change at each stage, methods and supporting tools/ aids to be used at different stages	15.00-17.00	PPT Discussion	Nagaraja, N
Day-2: 17.05.2024 (Friday)				
5	PRA tools for behavioral change: Seasonality analysis, Time trends, cause-effect relationship, matrix ranking, mobility map, venn diagram, SWOT analysis, resource map	09.00-17.00	PPT Discussion Exercise	Manjula, N Tanveer Ahmed
Day-3: 18.05.2024 (Saturday)				
6	Methods for Behavioral Change Communication:			
	• Focus group discussion	09.00-10.00	PPT Discussion Exercise	Chandregowda, M J
	• Demonstrations (On-farm/ Result/ Method)	10.00-11.00		Manjunathgowda
	• Participatory training	11.00-12.00		Shrisail S Dolli
	• Field visits and Field Day	12.00-13.00		Srinivasappa, K N
• Workshop, case study, social media	14.00-15.00	Shivalingaiah, Y N		
7	Action plan for rolling out pilot study	15.00-17.00	Exercise	Prakash, N B Nagaraja, N

Chapter-1

LRI based Fertilizer Application

Major nutrients, their role and deficiency symptoms in crop

Unlike pests and diseases with visible damage, nutrient deficiencies often show subtle signs that can be easily missed. By the time they're readily apparent, the plant's growth and development may already be significantly compromised and nutrient deficiencies are a common problem for all types of crops, regardless of location or climate. Even mild deficiencies can have long-term consequences, reducing plant health, yield potential, and overall crop quality. Plants require a specific set of nutrients for healthy growth and development. Among these, three macronutrients are crucial in large quantities for robust crops: Nitrogen (N), Phosphorus (P), and Potassium (K).



1. Nitrogen (N): The Building Block

- **Function:** Nitrogen is a fundamental element in chlorophyll, the pigment responsible for capturing sunlight energy for photosynthesis. It also forms the backbone of amino acids, building blocks of proteins, which are vital for all plant structures and functions.
- **Deficiency Symptoms:** Pale or yellowing of leaves, stunted growth, and reduced yields are common signs of nitrogen deficiency. When young corn leaves turn pale yellow or light green, have thin stalks and are slow to come to flower, it might be a nitrogen deficiency. The older plants exhibit a "V – shaped" yellowing at the tips of leaves and older leaves show symptoms first, with these tips and mid-ribs eventually senescing occurs.



2. Phosphorus (P): The Energy Source

- **Function:** Phosphorus plays a critical role in energy transfer within plants. It's a key component of ATP (adenosine triphosphate), the primary energy currency in cells, and is essential for root development, seed formation, and overall plant growth.
- **Deficiency Symptoms:** Stunted growth, delayed maturity, poor flowering or fruiting, and weak root systems can indicate insufficient phosphorus. Initially, plants with P nutrition deficiency appear darker green with reduced growth affecting the leaf size and stem thickness. As phosphorus nutrition deficiency continues, the older, lower leaves develop irregular spots of brown to dark brown dead tissue. In some plants, reddish to purple pigmentation may appear on the under or upper surface of leaf margins, lower leaves, and stems. Eventually, death of older leaves may occur. In most cases, lack of phosphorus delays flowering in plants.



3. Potassium (K): The Regulator

- **Function:** Potassium acts as a vital regulator within plant cells. It governs the movement of water and nutrients across cell membranes, impacting various physiological processes. Additionally, potassium activates enzymes involved in metabolism and disease resistance.
- **Deficiency Symptoms:** Weak stems, wilting during droughts, and poor fruit quality are potential signs of potassium deficiency. Light green or streaked with yellow leaves can indicate a potassium deficiency. This yellowing or "scorching" of the leaf margins, more common on the lower leaves, turns to necrosis, and in older plants, leaf tips and margins turn brown.



Ensuring a balanced supply of these essential macronutrients (N, P, K) is paramount for optimal crop performance. By understanding their specific roles, farmers can implement targeted nutrient management strategies to promote healthy plant development and maximize yields.

Secondary and micronutrients and their role in crop growth

While nitrogen, phosphorus, and potassium are essential for plant growth, they're not the only players on the field. Secondary and micronutrients, although needed in smaller quantities, are crucial for optimal crop health and yield.

Secondary Nutrients: The Supporting Cast

Plants need more than just the "big three" nutrients (nitrogen, phosphorus, and potassium) to thrive. Secondary nutrients – calcium (Ca), magnesium (Mg), and sulfur (S) are like the helpful assistants, playing a vital role in keeping your crops strong and productive and play vital supporting roles in plant development.

4. Calcium (Ca): Strong Bones for Plants

- **Function:** Calcium strengthens cell walls, aids in root development, and improves nutrient uptake. It is a component necessary for plant cell division. It neutralizes the effects of various toxins such as organic acids also help in the protein production of plants. It stimulates the transport of starch and sugar in plants.
- **Deficiency Symptoms:** Calcium is an immobile element. Therefore, the deficiency often begins at the soft part or near the young shoots. The shoots and flowers of the plant wither and curl. Young leaves will roll the edges of the leaves together but the tip of the leaves is curled to the back of the leaves. Sometimes brown spots may appear on the leaves. The top of the plant will die and when new shoots are formed, they will die again. Therefore, the plant looks bushier than normal plants. Blossom end rot in tomatoes and peppers (deformed, sunken fruit bottoms), weak stems that bend or break easily are most common crop specific symptoms.



5. Magnesium (Mg): The Heart of Chlorophyll

- **Function:** Magnesium is a central element in chlorophyll, the green pigment in leaves responsible for capturing sunlight energy for photosynthesis. It also activates numerous enzymes involved in various plant functions, including respiration, protein synthesis, and nutrient uptake.
- **Deficiency Symptoms:** Yellowing between leaf veins (interveinal chlorosis) is a telltale sign of magnesium deficiency. Leaves begin to yellow between their veins (like a net) while the veins themselves remain green. This happens because magnesium is mobile within the plant, and it gets transported from older leaves to support newer growth during a deficiency with a marbled appearance. Magnesium deficiency can lead to stunted plant growth due to reduced photosynthesis and impaired metabolic processes. In some cases, magnesium deficiency can cause leaves to develop a mottled appearance, with yellow patches interspersed with green areas.



6. Sulphur (S): Building Blocks and Defense

- **Function:** Sulphur is a key component of amino acids, the building blocks of proteins essential for all plant structures and functions. It's also involved in the formation of

coenzymes, which help enzymes to function properly. Additionally, sulphur plays a role in plant Défense mechanisms against diseases and pests.

- **Deficiency Symptoms:** Unlike nitrogen deficiency, where the lower leaves yellow first, sulphur deficiency typically causes younger leaves to turn a pale yellow. Similar to other deficiencies, stunted growth is a common symptom as sulphur deficiency limits protein synthesis and overall plant development. It plays a role in seed formation, and its deficiency can lead to reduced seed production and potentially lower yields.



Micronutrients: Tiny But Mighty

Plants are like intricate machines, each part requiring specific components to function optimally. While macronutrients are the building blocks, micronutrients, despite their minute quantities, are the essential vitamins and minerals that keep these machines running smoothly. Micronutrients, including iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), boron (B), molybdenum (Mo), and chlorine (Cl), are required in minute amounts but have significant impacts.

7. Iron (Fe): The Oxygen Carrier

- **Function:** Iron is essential for chlorophyll production and plays a critical role in respiration (cellular energy production), the process by which they convert oxygen and sugars into usable energy. Think of iron as the hemoglobin of plants. It's a vital component of enzymes involved in chlorophyll production, allowing plants to capture sunlight energy for photosynthesis.
- **Deficiency Symptoms:** Yellowing of young leaves (interveinal chlorosis) with green veins remaining, stunted growth are most common symptoms. This occurs because iron is immobile plant, and limited supplies are transported to new growth.



8. Zinc (Zn): A Guardian for Growth

- **Function:** Zinc is a true multi-tasker. It's essential for seed formation, promoting healthy cell division and embryo development. It also plays a role in stem growth, maintaining structural integrity, and helps plants utilize other nutrients effectively. Additionally, zinc strengthens the plant's defense system, making it more resistant to diseases.
- **Deficiency Symptoms:** Zinc deficiency can manifest in various ways, including stunted growth, rosettes (bunched leaves) at the top of the plant, and small, chlorotic (yellowing) leaves in newer growth.

The following diseases are commonly notice:

- i. **Khaira of paddy:** The entire older leaves show rusty brown appearance (due to chlorosis) and ultimately die.
- ii. **White bud (tip) of maize:** Unfolded newer leaves are often pale yellow to white. There will be appearance of light-yellow streaks between the veins of older leaves followed by white necrotic spots.
- iii. **Rosette of fruit trees:** It is also called as little leaf disease. Yellow mottling of leaves, reduction of leaf size with rosette appearance (due to reduced internodal distance) and die back of the affected branches are symptoms of the disease.
- iv. **Frenching of citrus:** Initially, yellow spots develop between the veins. Leaves become evenly smaller and develop chlorophyll at the basal end of mid rib.



9. Copper (Cu): A Catalyst

- **Function:** Copper acts as a catalyst in numerous plant functions, including respiration, seed production, and maintaining healthy stems and leaves. It also plays a role in lignin synthesis, a component that strengthens cell walls and provides structural support.
- **Deficiency Symptoms:** While less common, copper deficiency can cause wilting, bleaching of young leaves, and dieback of shoot tips. It causes necrosis of the tip of the young leaves, both vegetative and reproductive growth is retarded, wilting of terminal shoots occur which is followed by frequent death, leaf color is often faded due to reduction of carotene and other pigments, foliage shows burning of margins or chlorosis or rosetting and multiple bud formation, gumming may also occur (gummosis), younger leaves wither and show marginal chlorosis (yellowish grey) of tips which is called as Yellow tip or reclamation disease.

Following two diseases are common:

- i. **Exanthema or die back of fruit tree:** It is commonly found in citrus, plum, apple and pear. The symptoms include formation of strong water-shoots bearing large leaves, gummous tissue or the bark and longitudinal breaks. Fruits become brown, glossy and splitted. Affected shoots lose their leaves and die back and lateral shoots produce bunchy appearance.
- ii. **Reclamation disease:** It is also called as White Tip disease and is found in legumes, cereals, oats and beet. The tips of leaves become chlorotic followed by a failure of the plants to set seed.



10. Manganese (Mn): The Photosynthesis Powerhouse

- **Function:** Manganese is a key player in the efficient functioning of photosynthesis. It activates enzymes involved in splitting water molecules, a crucial step in the process. Additionally, manganese contributes to nitrogen utilization and disease resistance.

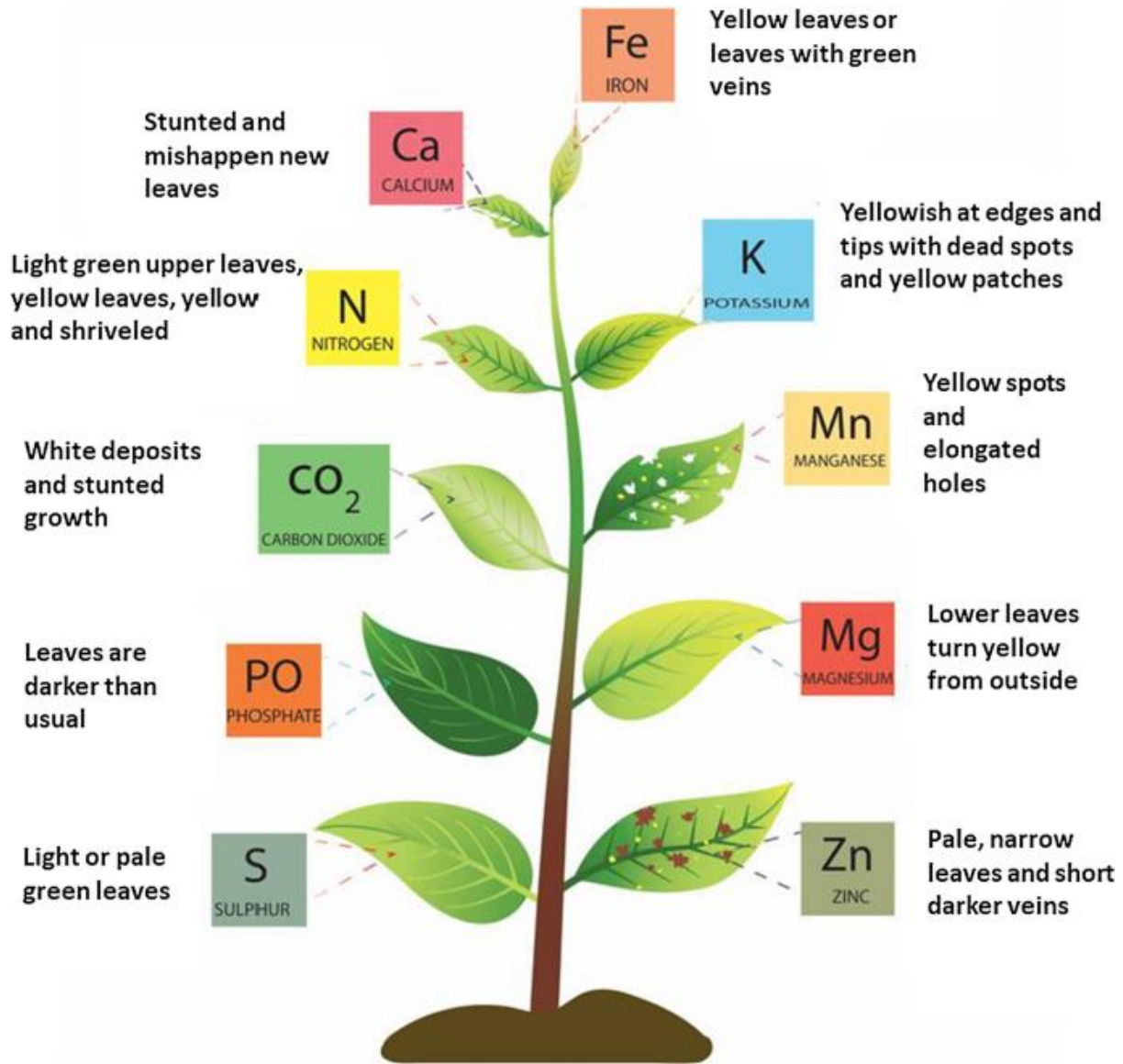
- **Deficiency Symptoms:** Early signs of manganese deficiency include yellowing or mottling of younger leaves, with brown spots potentially developing later. Stunted growth and delayed maturity are also common symptoms. Grey Speck also called as grey stripe, grey spot or dry spot in oats, pahla blight of sugarcane, marsh spot of pea and speckled yellow of sugar beet are most common crop specific symptoms.



11. Boron (B): The Architect of Structure and Reproduction

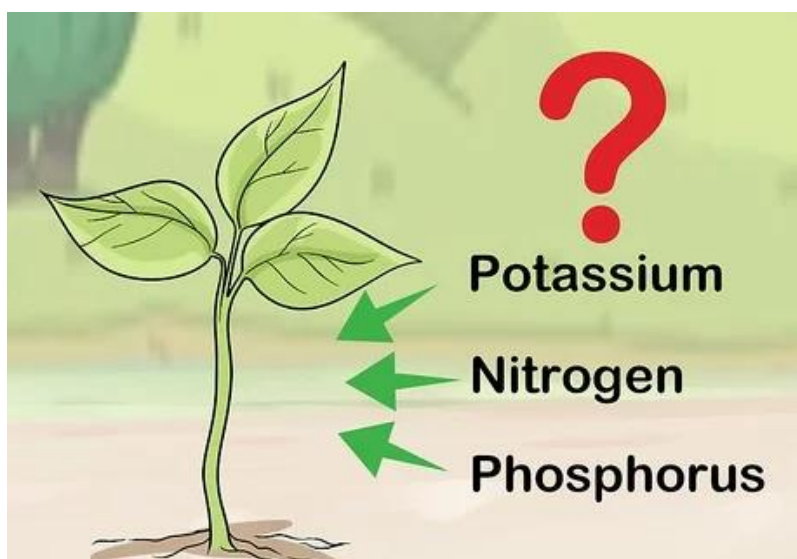
- **Function:** Boron is like a skilled architect for plants. It plays a vital role in cell wall development, influencing the structure and integrity of plant tissues. Boron is also crucial for seed formation and proper flower and fruit development.
- **Deficiency Symptoms:** Boron deficiency can manifest in various ways depending on the crop. Common signs include cracking or disfiguration of fruits and vegetables, weak stems, and yellowing or death of growing points. Diseases like heart rot of sugar beet and marigold, canker and internal black spot of garden pea, browning of cauliflower, top sickness of tobacco, hard fruit of citrus are most common crop specific symptoms.





Major nutrients recommendation for major crops

Determining the appropriate fertilizer and its quantity for plants is crucial in agriculture. Agricultural experts typically recommend specific fertilizers and quantities for different crops based on various factors such as crop nutrient requirements, developmental stages of the plants, soil fertility, rainfall patterns, irrigation, and other fundamental principles of agriculture. This helps avoid over-fertilization, which can lead to production imbalances and plant losses. Thus, it is essential to consider both the nutritional needs of the plants and the soil conditions to make informed decisions in agricultural practices. Major nutrient recommendations for major crops are not a one-size-fits-all solution. By understanding the science behind these recommendations, farmers can make informed decisions about nutrient management practices, maximizing crop yields while maintaining soil health and environmental sustainability.

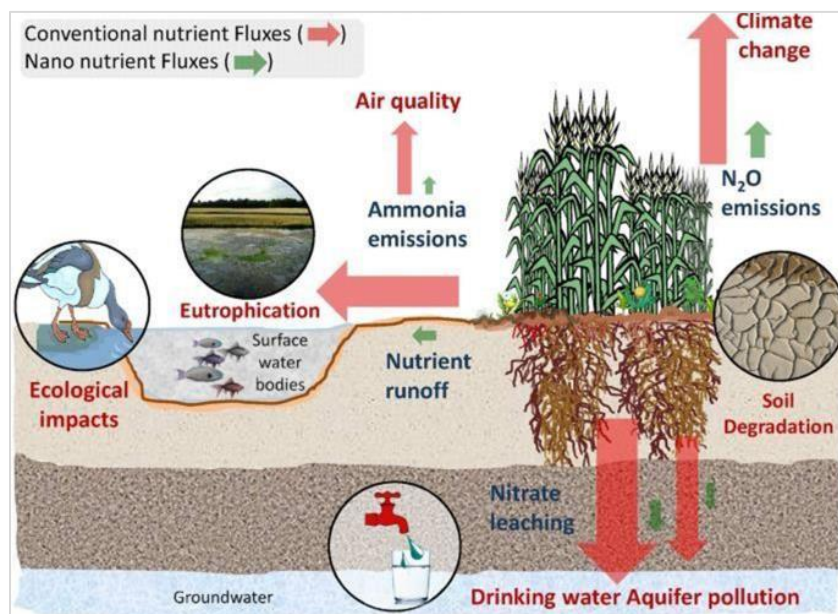


Crop	Nitrogen (N)	Phosphorus (P)	Potash (K)
	(kg/acre)		
Finger Millet	(20) 40	(16) 20	(15) 20
Maize	(40) 60	(20) 30	(10) 15
Pigeon Pea	(10)	(20)	(10)
Groundnut	(10)	(20) 30	(10) 15
Sunflower	(15) 36	(20) 36	(15) 25
Tomato	100	100	100
Chilli	(40) 60	(20) 30	(20) 30
Cotton	(32) 60	(16) 30	(16) 30
Ginger	40	20	20
Turmeric	60	50	100

Note: The number in parentheses () is the nutrient recommended for crops under rainfed condition

III effects of Indiscriminate use of Inorganic fertilizers

Fertilizers play a vital role in enriching soils and boosting crop but indiscriminate overapplication of chemical fertilizers comes with many environmental and health consequences that compound over time. Indiscriminate use of synthetic fertilizers can result in soil contamination by heavy metals, reduction in the nutritional value of crops, reduction in soil fertility etc.



Impact of excessive use of fertilizers:

Soil health - Improper use of fertilizers can lead to negative consequences. Disrupt the natural balance of nutrients in the soil, leading to nutrient imbalances and reduced soil quality. This can result in the loss of soil organic matter, decreased soil fertility and increased susceptibility to erosion

Heavy metal contamination - Fertilizers contaminate the soil with impurities, which come from the raw materials used for their manufacture. Mixed fertilizers often contain ammonium nitrate (NH_4NO_3), phosphorus as P_2O_5 , and potassium as K_2O . The Arsenic, Lead and Cadmium present in traces in rock phosphate mineral get transferred to super phosphate fertilizer. Since the metals are not degradable, their accumulation in the soil above their toxic levels due to excessive use of phosphate fertilizers becomes an indestructible poison for crops

Nutritional value of the crops- Over use of NPK fertilizers reduces the quantity of vegetables and crops grown on soil over the years. It also reduces the protein content of wheat, maize, grams, etc., grown on that soil. The carbohydrate quality of such crops also gets degraded. Excess potassium content in soil decreases Vitamin C and carotene content in vegetables and fruits. The vegetables and fruits grown on overfertilized soil are more prone to attacks by insects and disease

Increasing soil acidity- Overusing chemical fertilizers can acidify soils over time and cause essential nutrients like potassium, calcium, and magnesium to leach away. With unbalanced nutrition, soils lose their fertile structure and ability to support diverse microbial ecosystems essential for plant growth. Crop yields then decline unless even more fertilizers are applied

Groundwater contamination - When chemical fertilizers are applied to farmlands, excess nutrients not taken up by plants may leach into the soil, eventually reaching groundwater reserves. Additionally, rainfall or irrigation can lead to runoff, carrying these nutrients into nearby rivers, lakes, and oceans. This excessive nutrient influx disrupts the natural balance of aquatic ecosystems, leading to harmful algal blooms and oxygen-depleted dead zones

Health risks through water contamination - The contamination of drinking water supplies by chemical fertilizers poses threats to human and animal health. Nitrate leakage, for example has been linked to *blue baby syndrome* that decreases oxygen transport in infants' blood. Nitrogen in drinking water may also increase risks for thyroid problems, cancer, birth defects and miscarriages

Disruption of Aquatic Life - The influx of nutrients from chemical fertilizers fosters rapid growth of algae in water bodies. While this may seem beneficial at first, the subsequent decay of these algae consumes oxygen, leading to hypoxic conditions harmful to fish and other aquatic organisms. This disruption can cause population declines, affecting entire aquatic food chains

Salt burns - These burns indicate excessive use of chemical fertilizers. Fertilizers with a high saline index and chemicals like sodium nitrate are the ones that get the most attention or follow-up to avoid salt burns

Atmosphere – Improper use of fertilizers also have implications for the atmosphere, primarily through the release of nitrogen-based gases. Inorganic fertilizers, particularly those containing ammonium or urea, can contribute to the emission of nitrous oxide (N_2O), a potent greenhouse gas that contributes to climate change. Additionally, excessive nitrogen application can lead to ammonia (NH_3) volatilization resulting in air pollution and respiratory health issues

Excessive growth - Because of the excessive and uncontrolled application of chemical fertilizers, the proportions and growth of the plants may exceed typical criteria. When this point is reached, the harvest and survival of the plants are jeopardized, rather than improving productivity

Adjustment of recommended dose of fertilizer based on soil nutrient status



Soil analysis provides a detailed picture of the available nutrients in your soil. This helps identify deficiencies before they become a problem. Based on the soil analysis results, one can choose fertilizers that provide the specific nutrients to the crops need, avoiding unnecessary application of other elements which promotes a more sustainable approach to crop management. By optimizing nutrient use, one can minimize environmental impact and improve soil health in the long run. By prioritizing soil analysis and addressing nutrient deficiencies, a strong foundation for healthy plant growth, maximize yields, and minimize losses from other stresses can be achieved.

The table provided below shows how to adjust the recommended dose of fertilizer (RDF) of any crop based on the soil nutrient status for Nitrogen (N), Phosphorus (P₂O₅), and Potassium (K₂O).

Nutrient	Very low	Low	Medium	High	Very high
	kg ha⁻¹				
Available N	<140	140 to 280	281 to 560	561 to 700	>700
Available P₂O₅	<11.45	11.45 to 22.9	22.91 to 57.25	57.26 to 91.6	>91.60
Available K₂O	<72.3	72.3 to 144.6	144.7 to 337.4	337.5 to 674.8	>674.8
Correction/ Adjustment	RDF x 1.67	RDF x 1.33	RDF x 1.00	RDF x 0.67	RDF x 0.33

Based on the above table provided, the following example can be used for a maize crop having RDF 60:30:15 kg/acre of NPK if the soil fertility status is very low, low and medium respectively:

If the soil nutrient status is Very Low

	Fertilizers in kg per acre	
Nitrogen - 60 (RDF) x 1.67 = 100	Urea: 217	Urea: 175
Phosphate - 30 (RDF) x 1.67 = 50	SSP: 313	DAP: 109
Potash - 15 (RDF) x 1.67 = 25	MOP: 42	MOP: 42

If the soil nutrient status is Medium

	Fertilizers in kg per acre	
Nitrogen - 60 (RDF) x 1.00 = 60	Urea: 130	Urea: 105
Phosphate - 30 (RDF) x 1.00 = 30	SSP: 188	DAP: 65
Potash - 15 (RDF) x 1.00 = 15	MOP: 25	MOP: 25

If the soil nutrient status is Very High

	Fertilizers in kg per acre	
Nitrogen - 60 (RDF) x 0.33 = 20	Urea: 44	Urea: 35
Phosphate - 30 (RDF) x 0.33 = 10	SSP: 63	DAP: 22
Potash - 15 (RDF) x 0.33 = 5	MOP: 08	MOP: 08

Land Resource Inventory (LRI) Card interpretation

What is LRI card?

Land resource inventory card is a printed document given to a farmer for each of his land holdings. It provides information about the soil's health condition based on soil physical and chemical properties. It helps farmers assess the quality of their farm soil and improve its productivity in the long run.

Based on these parameters, the LRI card provides recommendations on fertilizer use and other soil management practices. It also evaluates the changes in soil health that occur due to land management practices.

Land resource inventory card contains the following information:

1. Farmers general information
 - Name
 - Gender
 - Micro watershed name
 - Adress
 - Soil sampling year
 - Survey/ Hissa No.
 - Area in (Acre/ gunta)
 - Annual rainfall (mm)
2. Details of land surface and soil properties
 - Soil depth
 - Soil texture
 - Soil gravelliness (%)
 - Soil slope (%)
 - Soil erosion
 - Land capability classes
 - Soil water holding capacity
 - Soil and water conservation plan
 - Traditional soil name
3. Soil test results: pH, Electrical conductivity, Organic carbon, Available nitrogen, Available Phosphorus, Available potassium, Sulphur, iron, manganese, zinc, copper and boron
4. Secondary and micronutrients recommendations for deficient soils

- Soil nutrient classification for very low, low, medium, high and very high soils
- Suggested crop plan (Highly suitable, moderately suitable, marginally suitable and not suitable) based on land resource information

How to use Land Resource Inventory Card

- Depth** : Shallow soils are to be used for growing short duration & shallow rooted crops. Digging deep/bigger than recommended size pits & filling with good quality loamy soils from outside for planting Horticultural crops suggested.
- Texture** : Clayey soils are to be moderated by adding sandy soils or weathered parent material. Quantity of material to be added depends on the local crops requirements. For sandy soil addition of tank silt or black clayey soils provides better soil air-water relationship environment.
- Gravelliness** : Addition of tank silt or black clayey soils to increase soil volume is better. This helps in increasing soil available water & nutrient holding capacity.
- Slope** : By following appropriate suggested conservation measures like trench cum bunding, graded bunding, strengthening of existing bunds or sowing crops across the slope, better management of lands can be achieved. Bunds Strengthening has to be done every year.
- Soil Erosion** : Reducing the slope by appropriate bunding, levelling, planting across the slope, growing cover crops & mulching are suggested.
- Available Water Capacity** : By addition of organic matter, in-situ moisture conservation, addition of clayey materials to sandy soils shall help to improve the AWC to some extent.
- Soil and Water Conservation Plan**: The recommended soil and water conservation and drainage line treatment plans are to be followed. Proper maintenance is most essential.
- Always apply recommended level of FYM/compost before crop sowing.
- There is no need of adding amendment (lime of gypsum) if the Soil pH is neutral (pH6.5-7.5)
- Application of required quantity of burnt lime is recommended if the soil pH is <6.5. Repeat the soil test after two years and correct based on the soil pH values.
- In Sodic soils (pH >8.5) apply recommended dose of Gypsum & drain out the excess salts with good quality irrigation water.
- Apply 25 percent extra RDF if the soil is low in major nutrients and reduce 25 percent from RDF if the soil has high NPK content. For example if the soil is deficient in nitrogen, application of 125kg RDF nitrogen is recommended in place of 100 kg N. The same needs to be followed for P & K also.
- Incorporation of bio-fertilizers like Rhizobium, Azotobacter, Azospirillum, Phosphate Solubilizing Bacteria and Mycorrhiza will enhance availability of major & micro nutrients to the plants & also reduces the cost of cultivation. While applying, soil moisture condition should be good.
- It is recommended to go for soil test at every 2 years interval.

For More Informations Please refer Sujala Website (Sujala3lri.karnataka.gov.in)



REWARD
Watershed Development Department Kaveri Bhavana,
Bangalore-560 009
And
ICAR - National Bureau of Soil Survey and Land Use Planning,
Regional centre, Hebbal, Bangalore -560 024
Contact: E-Mail: nbssgis@gmail.com

Land Resource Inventory Card

Farmer's Name	D Sugunamma
Gender: Male/Female	Female
Microwatershed Name	Kamatampalli (4C3D7V01)
Address	Agutamadike Village Bagepalli Taluk, Chikkaballapura District
Soil sampling year	2023
Survey/Hissa No	46/3
Area in (Acre/Gunta)	1.6
Annual Rainfall (mm)	835
*Note: Survey Number total area	

Details Of Land Surface And Soil Properties	
Soil Depth	Shallow (25-50 cm)
Soil Texture	Loamy sand
Soil Gravelliness (%)	Very gravelly (35-60 %)
Soil Slope (%)	Gently sloping (3-5%)
Soil Erosion	Severe Erosion
Land Capability Classes	Moderately good cultivable lands with erosion and soil limitations
Soil Water Holding Capacity	Very low (<50 mm/m)
Soil & Water Conservation Plan	Trench cum bunding
Traditional Soil Name	Shallow Red gravelly Loamy soil

Farmers Helpline Centers: Agricultural Problems-1800-425-3553, Varuna Mitra-92433 45433, Horticulture Helpline-1800-4257910 and Krishi murata vahini-1800-425-1552

Laboratory Name and Address:

National Bureau of Soil Survey and Land Use Planning, Regional centre, Hebbal, Bangalore -560 024.

Soil Test Results				
Sl.no	Parameter	Test value	Unit	Rating
01	Soil reaction (pH)	5.5-6.0	-	Moderately acid
02	Electrical Conductivity (EC)	<2	dSm ⁻¹	Non saline
03	Organic Carbon (OC)	0.25-0.5	%	Low
04	Available Nitrogen (N)	<140	Kg/ha	Very Low
05	Available phosphorus (P ₂ O ₅)	<11.5	Kg/ha	Very Low
06	Available Potassium (K ₂ O)	<72	Kg/ha	Very Low
07	Available Sulphur (S)	10-20	P.P.M	Medium
08	Available Zinc (Zn)	<0.6	P.P.M	Deficient
09	Available Boron (B)	<0.5	P.P.M	Low
10	Available Iron (Fe)	>4.5	P.P.M	Sufficient
11	Available Manganese (Mn)	>1.0	P.P.M	Sufficient
12	Available Copper (Cu)	>0.2	P.P.M	Sufficient

Note: Fertility data obtained from 320 meters, and may not match the actual value. Properties indicated correspond to the maximum area covered in the survey number. For complete details please refer the LRI reports /atlases of the watershed area.

Colour Code: ● Dark Green : Very High Rating ● Green:High Rating ● Yellow:Medium Rating ● Orange :Low Rating ● Red : Very Low Rating

Soil Nutrient Classification

Based on the soil test results the soil is classified as Low, Medium and High in the below table.

Nutrient	Very Low	Low	Medium	High	Very High
Organic Carbon (%)	<0.25	0.25-0.5	0.5-0.75	0.75-1.00	>1.00
Available Nitrogen (Kg/ha)	< 140	140-280	280-560	560-700	>700
Available phosphorus (Kg/ha)	< 11.5	11.5-23	23-57	57-91	>91
Available Potassium (Kg/ha)	< 72	72-145	145-337	337-675	> 675
Available Sulphur (P.P.M)	-	<10	10-20	>20	-
Micronutrients	Deficient	Sufficient			
Available Zinc (P.P.M)	-	<0.6	>0.6	-	-
Available Iron (P.P.M)	-	<4.5	>4.5	-	-
Available Copper (P.P.M)	-	<0.2	>0.2	-	-
Available Manganese (P.P.M)	-	<1.0	>1.0	-	-
Micronutrient	Low	Medium	High		
Available Boron (P.P.M)	-	< 0.5	0.5 - 1.0	> 1.0	-

Secondary and Micronutrients Recommendation for Deficient Soil

Sl.no	Parameter	Fertilizer	Micronutrient fertilizers May be applied in consultation with scientists of KVK and RSK since the recommendation varies from crop to crop
1	Sulphur (S)	Gypsum	
2	Boran (B)	Borax	
3	Zinc(Zn)	Zinc Sulphate	
4	Iron(Fe)	Ferrous Sulphate	
5	Manganese(Mn)	Manganese Sulphate	
6	Copper(Cu)	Copper Sulphate	

Suggested Crop Plan Based on Land Resource Information

Suitability	Suitable Crops	Limitations	Suggested Interventions
Highly suitable			
Moderately suitable			
Marginally suitable	Beetroot, Field Bean, Chrysanthemum, Marigold, Onion, Tomato, Brijjal, Cowpea, Groundnut, Maize, Carrot, Sheema, Bamboo, Cauliflower, Ragi	Rooting conditions	Use of short duration varieties, Drought resistant crops, sowing across the slope. Land leveling without exposing parent material.
	Lowland Paddy	Rooting and Gravelliness conditions	
Not suitable	Guava, Mango, Papaya, Teak, Silver oak, Malabar, Neem, Red gram, Sunflower	Rooting conditions	

Note: Horticultural crops subjected to availability of good quality irrigation water.

Issued Month & Year: November 2023

Benefits of LRI card

- The LRI card monitors soil type and quality and provides a report. Based on the report, farmers can wisely cultivate crops and boost their land's productivity and incomes in the long run.
- The LRI card provides a clear picture to farmers of which nutrients are lacking in their soils. It helps them know which fertilizers should be used and in what quantity.
- In the LRI card, the authorities observe the soil regularly and provide a report to the farmers once every three years. This ensures that farmers have up-to-date information about their soil's nature and other related aspects.
- Experts also provide recommendations about the nutrients and other measures to improve the soil's quality.

Chapter-2

Guidelines for Pilot Study on LRI based Fertilizer Application

Though Land Resource Inventory (LRI) provides site and crop specific fertilizer recommendations based on the fertility status of the soils, still most of the farmers follow blanket recommendation as the norm rather than an exception in the State. This has led to either over or sub optimal application of fertilizers in most of the situations, thereby increasing the input costs and reducing the profit margin or may result in lower yields. This can be avoided if the fertilizer applications are made based on the LRI recommendations. An attempt has been in this pilot study to identify effective approaches to influence the behavior of farmers towards LRI based fertilizer recommendations for up scaling the approach and to quantify the impact of LRI based fertilizer application over the conventional approach.

Objectives:

1. To assess the extent of change in behavior of farmers towards LRI based fertilizer application under different methods
2. To quantify the extent of benefits derived from LRI based fertilizer application
3. To understand the knowledge and attitude of extension functionaries and fertilizer dealers towards LRI based fertilizer application
4. To provide inputs for integrating fertilizers Point of Sales (PoS) with LRI cards and Farmer Registration and Unified beneficiary Information System (FRUITS)

Study Area:

One sub-watershed developed/ selected for development on saturation mode under REWARD program to be selected. In the selected sub-watershed, three identical villages based on matching in respect of (a) soil series, (b) extent of cultivable area and (c) major crops grown to be selected. For control, similar village outside but adjacent to the REWARD program area will be selected. About 50 ha cultivable area with all the farmers in selected 50 ha area to be considered in each village (about 100 farmers). In any case, number of farmers should not be less than 300 from the first three treatment villages.

Treatments:

- | | | |
|---------------------------|---|--|
| T1-Control | : | It is a control village without any LRI activities. This village can be among adjacent villages of REWARD program |
| T2-LRI card+ LRI Literacy | : | LRI completed village, distributed LRI cards. Training on how to interpret information presented in LRI card for LRI based fertilizer application for given crop |

- T3-T2+BCC : In this village, in addition to LRI card distribution and LRI literacy activity, implementing behavioral change communication strategy on LRI based fertilizer application
- T4-Demonstration : In this village, demonstrations @ 2 hectares per each major crop per soil series and will be taken. (For example: 2 soil series and 3 major crops with 2 ha per demo, it comes to 6 demonstrations in 12 hectares) Fertilizers as per LRI recommendation for all the selected demonstrations to be provided.

Study Period: Two years starting from *Kharif* 2024

Implementation Support:

For effective implementation the Nodal Scientist/ other Scientist of SAU, and Project Assistant hired for pilot study, should ensure the support and involvement of the staff involved in the execution of watershed development activities like PIA (AO, AAO, DPC, Watershed Assistant-WA, LRI Extension Manager, Team Leader of FNGO, FNGO-TC), WEC members-2 and Fertilizer dealers for facilitation while implementing the pilot study. The support of the process monitoring agency TERI and Consulting Research Agency IRMA, may also be availed appropriately.

Indicators for Assessment of treatment effects:

1. Crop wise quantities of fertilizers applied per unit area
2. Crop wise cost of fertilizers per unit area
3. Crop wise cost of production per unit area
4. Crop wise productivity levels per unit area
5. Crop wise returns per unit area
6. Attitude of farmers towards LRI based approach of fertilizers application
7. Knowledge level of farmers on LRI based approach of fertilizers application
8. Acceptance level of farmers towards LRI based approach of fertilizers application
9. Per cent farmers applying fertilizers as per LRI recommendations
10. Per cent farmers influenced by demonstration on LRI based fertilizer application (T-4)
11. Comparison of LRI based approach with conventional approach with respect to investment on fertilizers, yield, returns for the crops under consideration(T-4)
12. Attitude of field level extension functionaries towards LRI based approach of fertilizers application (general)
13. Knowledge level of field level extension functionaries on LRI based approach of fertilizers application (general)
14. Attitude of fertilizer dealers towards LRI based approach of fertilizers application (general)
15. Knowledge level of fertilizer dealers on LRI based approach of fertilizers application (general)

Data collection:

1. **Baseline data on:** (a) extent of cultivable area, (b) number of households, (c) major crops grown and area, (d) crop wise quantity of fertilizers used, (e) crop wise investment on fertilizers, (f) crop yield- main and by products (g) attitude of farmers towards LRI based fertilizer application, (h) knowledge level of farmers on LRI based fertilizer application, (i) attitude of field level extension functionaries towards LRI based approach of fertilizers application, (j) knowledge level of field level extension functionaries on LRI based approach of fertilizers application etc. (k) attitude of fertilizer dealers towards LRI based approach of fertilizers application, (l) knowledge level of fertilizer dealers on LRI based approach of fertilizers application etc.
2. **Real time data during pilot study:** (a) crop wise fertilizer application, (b) crop wise investment on fertilizers, (c) crop wise yield-main and by products, (d) number of farmers adopting LRI based approach, (e) attitude, knowledge and acceptance level of farmers, (f) attitude, knowledge and acceptance level of extension functionaries and fertilizer dealers towards LRI based fertilizer application

Impact Assessment:

Based on the data collected on the above indicators (a) before, (b) during and (c) after completion of each season as well as (d) at end of pilot studies, the impact assessment will be done on major factors (a) productivity levels, (b) economic returns, (c) returns to per unit of nutrient, (d) nutrient cost per unit of produce, (e) knowledge and acceptance levels of LRI based approach by various actors, (f) strategy to upscale the LRI based approach, (g) future research and extension needs, (h) inputs for policy guidance and others

Progress Review:

Progress will be reviewed quarterly and annually by the Technical Expert Committee constituted for pilot studies under REWARD program.

Budget:

The budget of Rs 22.00 lakhs per SAU as approved in the third Project Technical Committee (PTC) of REWARD program, will be released from CoE-WM as per requirement

Chapter-3

Behavioral Change Communication on LRI based Fertilizer Application

A. About Behavior and Behavioral Change

Behavior is a response to things that are happening internally and externally. Internal - thoughts and feelings; External - the environment, including other people. Most of our behavior is habitual. Behaviors become automatic when repeated over time. A good example of this is driving. When you learn to drive, it requires conscious effort to learn and remember all the right steps like mirror, signal, maneuver, anyone? But as time goes on, those actions form habits. This happens when you have practiced them so often that they become automatic.

Successful behavioral change is hard because our brains get stuck in fixed patterns. But the same mechanism that fixes our problem behavior as mental habits is often the solution to changing them. In agriculture, changing the behavior of farmer towards a new practice is also a daunting task for the extension workers due to personal, social, situational, climatic, economic, market and other factors. Therefore, it is a challenge for the extension functionaries to change the behavior of farmers.

Behavior Change Communication (BCC) refers to the strategic use of communications to positively influence people's knowledge, attitudes, and practices. The approach uses a critical discernment of people's behavior and then aligns it with persuasive communication methodologies. Effective BCC requires, on the one hand, a strong knowledge of how individuals and communities think and act and, on the other, the customization of messages and communication activities based on those observed needs and local realities. The tailored messages are then disseminated through various selected channels of communication, such as farmer-to-farmer, group, and mass media to bring about positive changes in behavior regarding specific challenges. Behavior change does not happen overnight, it requires sustained efforts by multiple stakeholders working at different levels.

B. Preparatory Phase on Behavioral Change Communication on LRI Fertilizer Application

In the preparatory phase, following four steps will be followed in developing BCC program strategy for rolling out pilot on LRI based fertilizer application:

1. Understanding the target audience and necessity of BCC on LRI based fertilizer application:

As part of REWRD program, it is expected to conduct pilot study on LRI based fertilizer application due to the fact that most farmers follow blanket recommendation of fertilizers,

although LRI provides site and crop specific fertilizer recommendations based on the fertility status of the soils, still the proposed pilot study will focus on aligning soil fertility status with the crop requirement as per the package of practices recommended by the SAUs in the state, awareness building campaign among farmers to follow the optimum use of fertilizers as per the nutrient status and crop needs to avoid inappropriate use and overuse of chemical fertilizers; and nudging farmers towards adoption of integrated soil fertility management, training of extension workers and fertilizer dealers on the importance of soil based nutrient recommendation.

The first step to a successful BCC program strategy is to carry out research about the target audience, including an extensive assessment of the behavior to be changed and the reasons underpinning it. This requires assessing their knowledge, attitudes, needs, and habits on current nutrient management strategies. At this stage it is important to know whether farmers know the importance of each nutrient in crop growth? how fertilizers are decided for the crops? what fertilizers and how much quantities are applied by farmers? what makes them to use the fertilizers indiscriminately? are they familiar about LRI based approach in fertilizer application? if not, why? is it due to lack of awareness or any other reasons? This information can be elicited through focus group discussion and PRA methods.

- 2. Developing and Pretesting BCC material:** The Centre of Excellence on Watershed Management (CoE-WM) will develop BCC material (covering print, electronic and social media), considering the principles (a)messages should be concise, (b)easy to understand, and (c)delivered in a manner that directly applies to them and their behavior, (d) their level of knowledge, (e)their challenges, and their perceptions about what can and cannot be done. The developed BCC material will be pre-tested to determine whether developed material conform to (a)the objectives of the program, (b)the needs of the audience, (c)clarity of the message, (d)easy to remember and motivate for change. While doing so, the CoE-WM will take feedback from various stakeholders.
- 3. Training and Capacity Building of Staff involved in BCC:** The Centre of Excellence on Watershed Management, UAS, GKVK will conduct training to equip the staff involved in implementation of BCC module to bring changes among farmers on LRI based fertilizer application. The trainees will be the scientific staff of SAUs (Nodal Scientists, Project Assistants) and PIA and RSK (AO, AAO, DPC, FNGO team, LRI managers). The training content include basics of behavioral change, approaches to be followed to bring about changes, important methods, tools and aids. Enough opportunity for the trainees to practice the use of methods, tools and aids will be provided to attain proficiency.

- 4. Supply of Pre-tested BCC material to Partner Institutes:** The CoE-WM will get the required quantities of developed and pre-tested material (6 sets) to all the partner institutes Nodal Scientists and their team for use in the pilot study villages.

C. Execution phase of Behavioral Change Communication at the Village level

The BCC strategy for the pilot on LRI based fertilizer application is developed based on Transtheoretical Model of Health Behavior Change, which suggests that there are six stages of changing one's behavior. (1) pre-contemplation stage, where the individual is yet to determine a problem even exists in their behavior, (2) contemplation stage at this stage, acknowledgment of the problem begins, but the individual may not be ready to make a change, (3) preparation or determination stage, the individual start getting ready to make a change, (4) action or willpower stage, individual makes decisive action towards changing behavior. At this point the individual is undergoing increased awareness, education, and capacity building, (5) maintenance stage, here the individual tries to consistently maintain the changed behavior. In this regard, consistency can be linked to a cycle of information and engagement to create an environment that is conducive towards positive change and (6) termination stage, at this stage full change occurs, the individual does not return to old behavior.

Based on the above model, the customized strategy for implementing the activities that reflect the new behavior change (e.g., LRI cards literacy leading to application of LRI based fertilizer for selected crops based on the soil fertility level) training and capacity building of key players (fertilizer dealers/ RSK staff) with the necessary skills for creating a multiplier effect for the desired behavior change. Practical exercises and serious games which can help carry out the messaging in a fun, interactive, and effective manner is explained through five steps as detailed below.

D. Steps in Behavioral change on LRI based fertilizer application



1. Establishing need for LRI based fertilizer application
2. Conviction for LRI based fertilizer application
3. Preparedness for LRI based fertilizer application
4. Action on LRI based fertilizer application
5. Continuation of LRI based fertilizer application

1. Establishing need for LRI based fertilizer application

<i>Conditions operating</i>	<i>Required action</i>
<ol style="list-style-type: none"> 1. Not yet aware of the behavior they need to change 2. Don't see problem in the existing behavior and aren't interested in new behavior 3. May become defensive if someone pressures them to change 4. They also avoid speaking, reading, or thinking about it 	<ol style="list-style-type: none"> 1. Understanding the existing approach followed in fertilizer application 2. Introducing the concept of LRI based fertilizer application approach 3. Observing their reaction to changed approach 4. Reinforcing the need for changed approach

At this stage, farmers are not yet aware of LRI based fertilizer application is beneficial for them to adopt. They don't see any problem in the present fertilizer application approach and aren't interested in getting help to improve. They may become defensive if someone pressures them to change to a new system. However, there is a scope for establishing need for better nutrient management approach. Hence, the following approaches are suggested at this stage to establish need for LRI based nutrient application.

Suggested approach for behavioral change:

1. Focus group discussion meeting to understand existing approach in fertilizer application (with 8-10 well informed persons in the village)
 - Introduction to pilot study
 - Understanding existing approach in fertilizer application
 - Setting agenda for pilot study
2. PRA exercises:
 - Seasonality analysis (to know fertilizers used during different seasons and crops)
 - Trends analysis (to know the changes taken place over the years in respect of use of organic & chemical fertilizers)
 - Matrix ranking (to know the decision on fertilizers use for crops and to compare conventional approach with LRI based nutrient management approach)
 - Mobility map (to know the movement of farmers to get fertilizers, other inputs and technical information)
 - Venn diagram (to know the importance and closeness of relevant institutions/ organizations/ agencies to the farmers)
 - Additionally, resource mapping to be done in control villages to understand the crops grown, area and other details

3. Discussion with identified farmers: Appropriate AV aids to explain about the importance of LRI based fertilizer application (customized AV aids will be prepared on the theme)
4. Distribution of leaflet on LRI based fertilizer application
5. Display of charts at prominent places on important topics like: role of nutrients, deficiency symptoms, LRI based nutrient management approach
6. Fixing the date and place for conducting training
7. Formation of WhatsApp group

2. Conviction for LRI based fertilizer application

<i>Conditions operating</i>	<i>Required action</i>
<ol style="list-style-type: none"> 1. Aware of the deficiencies in the existing approach 2. But not yet ready to change their current behavior 3. Start thinking about it 4. Know it's necessary to change but aren't ready 5. Weigh the pros and cons and whether the long-term benefits outweigh the short-term effort 	<ol style="list-style-type: none"> 1. Making the farmers to exhibit positive attitude towards LRI based fertilizer application approach 2. If still reservations exist about utility/effectiveness of changed approach, reinforce on the new approach 3. Leading them to know more about the new approach 4. Comparing both approaches to know pros and cons

At this stage, farmers are aware of the importance of LRI based fertilizer application approach. But they're not yet ready to change their existing practice. They do start thinking about it, however. They know it's necessary to change but aren't ready. They might weigh the pros and cons and whether the long-term benefits outweigh the short-term effort. Following approaches are suggested at this stage to convince the farmers on LRI based fertilizer application.

Suggested approach for behavioral change

1. Conducting training to teach cognitive and psychomotor skills

Content of training:

- Importance of major, secondary and micro nutrients in crop production
- Identifiable deficiency symptoms
- Different brands of fertilizers and nutrient content
- Importance of LRI based fertilizer application approach
- Interpretation of LRI card

- Quantifiable benefits of LRI based fertilizer application approach
 - Estimation of fertilizers required for different crops based on soil nutrient status vis a vis conventional approach
 - Efficient methods in nutrients application
 - SWOT analysis on current and LRI based fertilizer application approach
2. Distribution of reference material covering the above topics to support their learning
 3. Educational games on the theme-LRI based fertilizer application approaches

3. Preparedness for LRI based fertilizer application

<i>Conditions operating</i>	<i>Required action</i>
<ol style="list-style-type: none"> 1. Ready to make a change 2. Become committed to changing and motivated to take the necessary steps 3. Read, talk, and gather information about the introduced behavioral change 4. Crucial to the success of behavior change 	<ol style="list-style-type: none"> 1. Agreeing to adopt LRI based fertilizer application approach 2. Getting much more details about procedures in application of new approach 3. Setting agenda for implementing new approach

This is the phase where the farmers are ready to change to new approach in fertilizer application. They become committed to changing and motivated to take the necessary steps. They read, talk, and gather more information about the suggested approach. The preparation stage is crucial to the success of behavior change. At this stage, following approaches are required.

Suggested approach for behavioral change

1. Focus group discussion meeting with selected farmers:
 - Discuss about crops to be grown
 - LRI based nutrients estimation for selected crops
2. Discussion on hypothetical case studies on fertilizer use (a) indiscriminately, (b) LRI based
3. Making the farmers to read and understand reference material supplied during training
4. A template/ format for fertilizers calculation for selected crops based on soil nutrient status as in LRI card
5. Prepare calendar of operations

4. Action on LRI based fertilizer application

<i>Conditions operating</i>	<i>Required action</i>
<ol style="list-style-type: none"> 1. Use the strategies learnt in the previous phase to start a new, behavior 2. This takes willpower, and there is a high risk of failure and slipping back into old behavior 3. It can help to avoid external temptation and set rewards for achieving intermediate goals 4. The support of others is essential at this stage 	<ol style="list-style-type: none"> 1. With the support from Scientists, PIA and Project Assistant, the farmers considered under pilot will commit to adopt LRI based fertilizer application approach 2. The staff responsible for implementing the pilot should continue to monitor the implementation process and support as and when required

At this stage, farmers use the strategies they learnt in the previous phase to start implementing LRI based fertilizer application. It can help to avoid external temptation and set rewards for achieving intermediate goals. The support of others is also essential at this stage. Following is the suggested approach at this stage.

Suggested approach for behavioral change

1. Workshop with selected farmers to prepare action plan
 - Estimation of fertilizers required for farmers for crops grown by them
 - Finalizing the calendar of operations for each farmer
 - Information to be documented by each farmer (specimen format to be given)
2. WhatsApp messages to farmers to purchase fertilizers as per LRI recommendation-Reinforcement
3. Tracking the adoption of activities as per calendar of operations – WhatsApp group and visit to farmers fields
4. Field visits at regular intervals at crucial stages of crops and fertilizer application to guide, support implementation, record observations and clarify the doubts
5. Method demonstrations to teach important psycho motor skills to farmers:
 - Method of fertilizers application
 - Observations on growth and yield parameters and recording them appropriately
 - Crop management practices as per need
6. Field day at in impressive stage of crop:
 - Involvement of all those farmers adopting LRI based nutrient management approach
 - Invite farmers from neighboring villages

- Involve PIA, line departments officials, fertilizer dealers, SHGs, EC members, media persons etc.
 - Prepare and distribute literature on the process followed by the farmers in the village on LRI based fertilizer management approach
7. Workshop to analyze the results of pilot study
- To draw conclusions on the study
 - Set agenda and action plan for continuing LRI based fertilizer application approach in the subsequent season

5. Continuation of LRI based fertilizer application

<i>Conditions operating</i>	<i>Required action</i>
<ol style="list-style-type: none"> 1. People have made progress and realized the benefits of changed approach 2. Understand that maintaining change will require effort, but aware of its value 3. Create strategies to prevent relapse 	<ol style="list-style-type: none"> 1. Quantification of beneficial effects of LRI based fertilizer application approach 2. Conviction to adopt in future 3. Continued support from PIA and other line departments

In this stage, farmers have made progress and realized the benefits of LRI based fertilizer application. They understand that continuing this approach will require commitment and effort, but they are also aware of its value. To make those farmers adopted LRI based approaches to continue in future, following action is suggested at this stage.

Suggested approach for behavioral change

1. Focus group discussion meeting after the harvest of crop to
 - Analyze the pilots in term of productivity and economic benefits
 - Arriving at conclusions on the approach followed
 - Encouraging to continue in the subsequent seasons
2. Preparation of literature on the process and impact of pilot
3. Listing the farmers willing to continue in future
4. Extending required technical support
5. Continued technical information support through print and electronic means (WhatsApp, printed literature etc.)

Monitoring and Evaluation: Tracking of outputs to ensure that material is utilized as planned with desired effects, and tracking the reaction of the target audience to ensure that they are motivated by the approach to change their behavior (e.g. internalizing the LRI based approach for nutrient management of crops during different seasons and for different crops). Evaluation of the monitoring results will also help identify the lessons learnt in the first year of field implementation, where the program is weak and needs revision, and where it is strong and should be replicated. Feedback from the target groups and stakeholders are absolute necessities as based on these feedbacks, new sets of knowledge can be incorporated in the second year of pilot study thus laying the foundation for new sets of behavior on fertilizer application.

Key for Successful BCC on LRI Fertilizer Application: A successful BCC program requires extensive participation of the target audience, enablers and stakeholders in all its stages of development and implementation of BCC approach. The target audience are farmers selected for pilot study. The enablers are the scientific staff of SAUs and PIA and RSK (AO, AAO, DPC, FNGO team, LRI managers). The stakeholders are fertilizer dealers, watershed executive committees. There should be constant support from the line departments for continuing the changed behavior as an individual needs a supportive environment for maintaining and sustaining positive changes.

BCC Methods and Tools/ Aids

BCC Methods

1. Folk media- Gigi, Lavani and folk song
2. Focus Group Discussion Meeting
3. Participatory training
4. Case study
5. Workshop
6. Method demonstration
7. Result/ On-Farm Demonstration
8. Field Visits
9. Field Day
10. Use of social media-WhatsApp
11. PRA exercises
12. Animated video

BCC Tools/ Aids

1. Charts (for display at prominent place in village)

1. Fertilizer use pattern- past, present and ideal (LRI based approach)
2. Major nutrients and their role in crop growth
3. Important micro/ secondary nutrients and role
4. Deficiency symptoms of important nutrients
5. Impact of excessive use of nutrients
6. LRI based fertilizer application-what and why?
7. LRI card and its implication
8. Major nutrient recommendation for major crops
9. Adjustment factors for correcting as per soil fertility status in LRI card

2. Educational game (Foam board cuttings of different items as per their size)

- 3x2 feet with five distinct marking and colors as dark green, green, yellow, orange and red
- Photos of maize, red gram, cotton
- Fertilizer bags urea, SP, MoP, 15 all, 17 all, 19 all, DAP
- Correction factor strips RDF x 0.33, RDF x 0.66, RDF x 0, RDF x 1.33, RDF x 1.67
- Numbers 0-9 (10 sets of each number?)

3. Leaflet/ Folder

- Leaflet covering information in brief on the project, present approach in crop nutrient management, need for LRI based fertilizer application and approaches to be followed (will have graphics/ photos, publishing source, address for seeking additional information)

4. Brochure/ booklet (for distribution after training farmers/ fertilizer dealers in villages)

- It will be 8-12 pages including cover and back page. It will have details on major nutrients required for crops, their importance in crop growth, form in which the nutrients are to be supplied and recommended quantities to major crops, ill effects of indiscriminate use of fertilizers, Concept, importance and approaches in LRI based approach in fertilizer application. More of graphics/ diagrams/ photos will be included

5. Flip book with about 15 sheets of 2x3 feet size for its use in village to explain farmers on the importance and approaches in effective nutrient management through LRI based fertilizer application

6. Animated version of PPT or other format on the theme with voice over

Chapter-4

Behavioral Change Communication Methods and Aids/ Tools

1. Focus Group Discussion

A focus group discussion (FGD) involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest. It is a form of qualitative research where questions are asked about their perceptions, attitudes, beliefs, opinion or ideas. In focus group discussion participants are free to talk with other group members. It generally involves group interviewing in which a small group of usually 8 to 12 people. It is led by a moderator (Scientist/ PIA) in a loosely structured discussion of various topics of interest.

The group's composition and the group discussion should be carefully planned to create a non-intimidating environment, so that participants feel free to talk openly and give honest opinions. Since participants are actively encouraged to not only express their own opinions, but also respond to other members and questions posed by the leader, focus groups offer a depth, nuance, and variety to the discussion that would not be available through surveys.

Additionally, as FGDs are structured and directed, but also expressive, they can yield a lot of information in a relatively short time. Therefore, FGDs are a good way to gather in-depth information about a community's thoughts and opinions on a topic (LRI based fertilizer application). The course of the discussion is usually planned in advance and most moderators rely on an outline, or guide, to ensure that all topics of interest are covered.

Key Features of FGDs

- Involves organized discussion with a selected group of individuals to gain information about their views and experiences of a topic
- Particularly suited for obtaining several perspectives about the same topic
- Helps in gaining insights into people's shared understanding of everyday life and the ways in which individuals are influenced by others in a group situation
- The role of the moderator is very significant, as good levels of group leadership and interpersonal skill are required to moderate a group successfully

Skills Required to Conduct FGDs

Focus group discussion, like other methods, it requires considerable skills, competencies and expertise such as:

- The moderator needs to be flexible and free of biasness and prejudices

- A good understanding of the subject, problem, or topic to be investigated. This includes both theoretical knowledge and practical experience
- Proficiency in the language in which discussions will be conducted. Focus group discussion cannot be conducted through an interpreter or by third person, no matter what types of skills he/she has
- Facilitating and conducting a focus group interview requires considerable group process skill. It is important to know how to manage the interview so that one or two people do not dominate it, and so that those participants who tend not to be highly verbal are able to share their views
- Training or experience in conducting group discussion. This is very important because an unskilled moderator can unknowingly inhibit the free flow of discussion and draw unjustifiable conclusions and findings

2. Participatory Training

Training is a specialized kind of education, which is skill oriented. It is education for a very specific purpose, where the end product is pre-determined based on performance. The concern here is enhancing the ability of an individual to accomplish a set of tasks. This requires the knowledge and skills to perform the tasks, and acceptable standards at which the tasks are performed. Thus, training begins with a set of pre-determined tasks and proceeds to design an educational process, which ensures that the individual acquire the needed competence in terms of knowledge, skills, attitudes and standards. The emphasis is on providing the educational opportunities, which result in the acquisition of new or upgraded abilities in performing the tasks.

Participatory training is also called as active learning. It is a method of adult education which incorporates direct participation and creates an atmosphere for sharing experience. It involves adults practicing new skills and applying new knowledge and attitudes during activities.

In participatory training, the trainer is a facilitator, is a good communicator, works at the same level as the participants, respects participants' ideas and experiences, is supportive of the learning process and organizer of learning experience. The participants in this method are the members of communication network, feel at ease, participate actively, share experiences, ask questions, make mistakes, and take risks as part of the training process and use trainer as a resource, guide and mentor

Participatory training process emphasizes systematic and comprehensive efforts to design, conduct and evaluate training program. It comprises of a series of steps in three distinct phases. The pre-training phase focuses on designing of training program. During training phase, focus is

on group facilitations, debriefing and consolidation and creating conducive learning environment. The post training phase includes such steps as evaluation, follow up and report writing.

Pre-Training Phase:

Decide about the changes needed among farmers:

- Create desire and emotional appreciation of LRI based fertilizer application
- Building skills of estimating nutrients required to be supplied based on the soil fertility status and as per the requirement of crops grown and selecting type and quantity of fertilizers meet the requirements

Training content:

- Importance of major, secondary and micro nutrients in crop production
- Identification of important nutrients deficiency symptoms
- Different brands of fertilizers and their nutrient content
- Importance of LRI based fertilizer application approach
- Interpretation of LRI card
- Quantifiable benefits of LRI based fertilizer application approach
- Estimation of fertilizers required for different crops based on soil nutrient status *vis a vis* conventional approach
- Efficient methods in nutrients application
- SWOT analysis of current and LRI based fertilizer application approach

Session Plan:

Based on the training objectives, content and duration, prepare session plan as indicated below:

<i>Date & Time</i>	<i>Topic</i>	<i>Teaching method</i>	<i>Resources required</i>	<i>Resource person</i>

Training methods:

Though, there are several training methods and aids, they should be selected as per the type of behavioral changes to bring in among the trainees. Some the methods useful for training on behavioral change towards LRI based fertilizers, following are suggested:

- Discussions supported by flip chart/PPT, experience sharing
- exercises and simulations
- The case study method
- Demonstration
- Practice
- Video film

Training Phase:

In the training phase, the trainer plays very crucial role. At this stage, logistics, physical facilities, ensuring resource persons' availability, arrangements for training resources and methods, creating conducive learning situations are important. Training events are to be organized as per the session plan.

Monitoring and Evaluation: Monitoring is essentially an ongoing process to ensure that the training program is on track and that the pace and content of learning remain relevant to the group of learners. The pace of learning is closely observed to adapt its pace and depth to the requirements of learners.

How to Evaluate?

Evaluation, feedback can be sought from the participants at the end of training

Post training phase:

Follow up to training: Follow-up of the training program is essentially meant to continue the process of learning initiated during the training program. Each training program creates a set of knowledge and ideas; which learners try to implement in their own situations. These efforts may require further support as follow-up.

3. Case study

Meaning and purpose: This technique encourages participants to analyse situations they might encounter and determine how they would respond. A case study is basically a story written to show a detailed description of an event that is followed by questions for participants to discuss.

Stories of people with similar problems in other villages make ideal subjects for case study analysis. The case study should be designed in such a way that the story is relevant to participants and they have enough time to read, think and discuss. A case study is everything about something. The time frame of the case and facts are important for the case study.

Process: The facilitator hands out a case study that describes a relevant situation or problem to be addressed. Participants read the case study. Participants are either broken up into small groups to discuss or may stay in the large group to discuss the story. The instructor facilitates questioning and approaches to alternative solutions.

Advantages: It encourages participants to identify alternative behaviours and solutions to situations and problems they might experience in the community. Case studies on LRI based Fertilizer Applications to be prepared and used

4. Workshop:

Workshop is an effective method that extension workers can use to teach new skills to groups of farmers. Adults attend workshops for varying reasons, depending on their needs and motivations. Some are asked by supervisors to attend while others are looking to interact with peers. Other participants may have a specific problem they want solved, or they may simply want to learn more about a specific topic. Farmers in any given workshop will have a mix of these expectations and goals. The challenge for the workshop designer, therefore, is to identify those expectations and craft the workshop to best engage and meet the needs of the participants

Workshop like other teaching settings, require facilitators who can successfully apply adult education principles to share new knowledge. However, workshops also have unique characteristics that differ from other teaching settings. There are four key characteristics that define a workshop:

- Short-term intensive learning
- Small group interaction
- Active involvement
- Application of new learning

Guidelines for conducting workshops: To conduct effective workshops, the following elements are recommended:

- Workshops should be planned around very specific learning objectives. Too often, workshop designers try to include excessive information, with little being learned because of the amount shared

- The intended outcomes and their importance should be stated early in the workshop.
- Workshop instruction should be developed around solving a problem or completing a task that is relevant to the participants
- Provide an opportunity for participants to share their own experience about the topics being discussed. Then use these real-life examples to highlight the key objectives of the workshop
- Allot time for participants to practice new skills learnt at the workshop. Participants who practice newly learned material in the workshop are more likely to implement these new practices when they return home

Key Workshop Interactions: There are three important types of interactions that should occur in workshops:

- Facilitator ↔ Participant
- Content ↔ Participant
- Participant ↔ Participant

These interactions facilitate active involvement in the learning process, enabling participants to engage with the facilitator, the material and other participants. Such positive interaction is an important aspect of effective workshops. If lecturing is used in a workshop, it should be brief. As learning is a social experience for most adults, plan times for participants to share and learn from each other in small groups. The workshop should also be an opportunity for participants to actively apply the new knowledge and skills learned during the training.

5. Method Demonstration

Meaning: A method demonstration is a short time demonstration before a group to teach as how to carry out an entirely new practice (skill) or an old practice in a better way.

Example: Efficient methods of fertilizer application, seed treatment, preparing spray solution etc.

Purpose:

- It teaches skills and to stimulate people for action
- To build up learners' confidence and satisfaction on the practice

Points to be considered while conducting method demonstration:

- Method demonstration should be need - based and organized timely
- Give advance publicity to build up the interest and secure wide participation

- Use materials that are easily available to the rural people
- Clarify doubts, but avoid argument
- Appreciate the methods already in use by the group

Procedure:

Conducting method demonstration: The procedure of conducting method demonstration is divided into three stages.

Planning stage:

- Analyze the skills required
- Inform well in advance about the time, place and date to have clear look at demonstration
- Ensure the material required for conducting method demonstration well in advance
- Select the place where all the farmers could be able to see the method demonstration

Conducting stage:

- Be at the spot early to check up equipment and material required for conducting method demonstration
- Practice all the steps/skills before carrying out method demonstration
- Make a proper arrangement to facilitate all the participants to have clear look at demonstration and to take part in the discussion
- Conduct demonstration step by step
- Give opportunity to all the individuals to practice the skill
- Distribute leaflets or any other literature related to the demonstration

Evaluation stage:

- List out the number of participants with names
- Get the names of participants who come forward to take up a particular skill shown in the method demonstration
- Follow-up the participants who have practiced skills

6. Result/ On-Farm Demonstration (OFD):

The result demonstration conducted by the demonstrator farmer under supervision of the extension worker to prove that the recommended practice will work locally. A result demonstration is conducted to show the public how a practice, variety or technique works. No other educational method affects the rate of adoption by its target audiences as much as does the result demonstration. In our case, demonstrating how LRI based fertilizer application is superior over the conventional approach of nutrient management.

Objectives: To demonstrate the effectiveness of LRI based fertilizer application on increased productivity, economic benefits etc.

Methodology: The demonstrations are the most effective extension methods to convince the farmers. They have to be conducted systematically to achieve intended results, improperly managed /ineffective demonstrations can create negative feeling among farmers about the new approaches and bring down the credibility of extension functionaries and research system. Therefore, activities to be carried out at planning, implementation and follow up stages of demonstrations are as follows:

Planning stage:

Coverage: In the selected village two hectares demonstrations for each major crop for one soil phase. Ex. If there are two soil series and three major crops grown in the selected village, then totally six demonstrations of two ha each (totally 12 ha).

Selection of demonstration site and farmers: After identifying soil series, the villagers should be enabled to select demonstration sites of 2 hectares each for each major crop of that soil series. At least two soil series are to be covered in the selected village. The selection of sites and farmers to take place in Gram Sabha. Guidelines/ criteria for selection of farmers have to be given to villagers to select appropriate sites and demonstrators. While selecting farmers, criteria should be (a) the farmers should be willing to adopt all the technologies suggested, (b) willing to maintain records), (c) share the technologies adopted with others

Sensitizing the farmers: After the selection of farmers for the demonstrations, they need to be sensitized about LRI based fertilizer application for increasing the productivity per unit area with the existing natural resource base. The educational activities like discussions/ interactions, presentation by the scientists involved in studies need to be organized

Baseline data: For the selected sites and farmers, baseline data on previously grown crops, technologies adopted, manures and fertilizers applied, yield obtained and economic returns need to be collected through personal discussion with the selected farmers and the same to be submitted to the server via mobile phone/ tab

Finalization of technologies: Discuss and finalize the technologies that should go in to the demonstration

Finalization of inputs: Estimate the fertilizers required as per the soil fertility status and crop need and get them in advance

Development of calendar of operations: After finalization of technologies, inputs and material required for conducting demonstrations, calendar of operations specifying weekly/fortnightly activities to be carried out. The calendar of activities to be decided jointly by the farmers and pilot study implementing staff

Implementation stage:

Guidance to farmers: As a first step in implementation stage, the selected farmer demonstrators have to be educated on the selected technologies to increase their cognitive and affective skills of the technology. It is very important to make them to understand what, why, how and when of the technologies. At the end of this step, they should be clear about sequential activities to be carried out in the demonstration plots, skills required, important risks and uncertainties, mitigation strategies etc.

Demonstration layout: Layout of the demonstration plot with control plot has to be done after the preparatory tillage operations. Demonstration boards specifying purpose, technologies adopted, area, sowing date, farmers name etc. to be displayed near the plot for providing information to visitors

Presence of implementing agency: The implementing agency must be present when crucial operations are done like formation of irrigation layouts/in situ moisture conservation operations, sowing, fertilizers application, plant protection etc. Further, representative of the implementing agency has to (a) regularly visit the demonstration site, preferably once in a week to observe the operations done by the farmers, condition of the crop, suggest the farmers about next week's operations, (b) enable the farmer to document the details operations done, labor and other inputs used during the week in the demonstration record, (c) conduct educational activities like discussion meetings/ method demonstrations to teach specific skills like preparing the spray solution and spraying techniques etc. involving all the demonstrator farmers

Using demonstration site as an education Centre: The demonstration site has to be used as teaching and learning Centre by inviting farmers from different villages to expose them to the new technologies adopted

Field day: To give wide publicity to demonstration and to encourage potential adopters of the technologies, the field day has to be organized at an impressive stage of the crop. During field

day, visit to demonstration plot, direct interaction with the demonstrator farmers, sharing of experience by demonstrators, estimation of yield etc. has to be ensured. The feedback of the visiting farmers needs to be obtained. Also, their willingness to adopt technology in their fields to be recorded and to be given to extension functionaries of their respective area to extend required support at the time of implementation of technologies in subsequent seasons

Monitoring and evaluation: To ensure the quality of demonstrations, a check list has to be prepared and used. The check list should have matrix of activities to be carried out from beginning to end, and for each activity, time of completion and quantity of inputs used to be recorded. Based on the extent of deviations from timely implementation and quantity of inputs used, assessment has to be done to know the process followed. Impact to be assessed based on productivity levels and from economic angle. Also, number of farmers visited, number expressed satisfaction, and number willing to practice has to be recorded

Harvesting and analysis: At the right time, harvesting has to be done. To have objective assessment of yield obtained in the demonstration plots, it is required to collaborate with Department of Economics and Statistics, GoK and taluk Assistant Director of Agriculture. After completion of harvesting and post-harvest operations, detailed impact analysis to know the productivity of crops, yield per unit of nutrient, economic benefits in terms of investment, returns, BC ratio etc.

Publicity: After completion of harvesting and impact analysis, the results obtained in the demonstration plots need to be publicized through print media, electronic media, sharing the experience in bi- monthly workshops of DoA, district and taluk level meetings etc.

Follow up stage: In the subsequent seasons, the demonstrator farmers need to be ensured to continue the technologies demonstrated to them. Required technical information and collaborative arrangements need to be ensured by the agency implemented the pilot study demonstrations. Further, among the farmers attended the field day and other educational activities, might have evinced interest to adopt LRI based approach in fertilizers application for such farmers required support need to be extended for spread of technologies

7. Field Visits

Meaning: It is a small group of interested farmers led by the Scientist/ PIA who visits the plots / sites to study some current problems, differences in local production etc. It is powerful teaching device, which provides scope to observe, analyse and infer.

Purpose:

- To diagnose the technical problems
- To elicit the information from the farmers
- To inform and convince the farmers about the problems existing in the field
- To educate other farmers about the demonstrated technology

Procedure:

The procedure varies according to the purpose

- If it is for the identification of field problems, the field visit may be either preplanned or spontaneous
- If it is to observe the difference in the technology adopted among farmers, an element of surprise and impartiality can be achieved by a visit without pre- planning
- If it is to study the impact of new technology proper preparatory work is helpful in all these cases.
 - Protracted deliberation must be ensured on the points observed, lessons to be drawn and utilization of these lessons
 - Preparedness and advance thinking on these points are necessary
 - Follow-up action is an integral part of the method

8. Field Day

Field day is an educational opportunity, planned and organized to involve interested farmers, farm leaders, fertilizer dealers, and organizational representatives. Focus of attention is on the recommended new technology to highlight its impact (LRI based fertilizer application), as well as to facilitate an exchange of views of adoption of the new technology.

Purpose:

- To observe and assess the applicability and effectiveness of new technology in the field situation
- To facilitate discussion among groups of participants resulting in firm views on the recommended technology
- To create a favorable climate for a rapid diffusion of the technology

Procedure:

Three stages for effective conduct of the field is presented below:

Planning:

- Schedule the field day at an appropriate stage of the crop growth
- Select the participants of the field day including farmers, farm leaders, input dealers, organizations and extension specialists and give advance intimation to them
- Decide and plan the events of the day
- Arrange the necessary banners, posters, support literature and teaching aids
- The concerned demonstrator-farmers should be briefed and guided to conduct the activity

Conducting:

- The objectives of the demonstration should be explained
- The farmers involved in demonstration should be allowed to explain all the activities carried out by them
- The participants should be made to visit the plot preferably in small groups
- Arrange interaction session among demonstrator-farmers, experts and visitors

Follow-up:

- List the willing persons to adopt LRI based fertilizer application technology demonstrated
- Extend the technical support for those farmers agreed to adopt LRI based approach

9. Use of Social media-WhatsApp

WhatsApp, a mobile based technology allows us to use messaging service. It enables us to send and receive messages, make voice and video calls, and access other WhatsApp features using the computer.

Using the advantages of WhatsApp, it is essential to form LRI based fertilizer Application (LFA) WhatsApp group for each village considered for pilot, including all the farmers considered for the pilot study, implementing partners (SAUs, PIA, RSK, fertilizer dealers) for messaging the updates, short videos, and inform the activities to be taken up.

10.PRA exercises

Seasonality Analysis

Seasonal analysis is also called seasonal calendar, seasonal activity, profile and seasonal analysis. It is used for temporal analysis across annual cycles, with months or seasons as the basic unit of analysis. It reflects the perceptions of the local people regarding seasonal variations on a wide

range of times. Seasonal diagram, however, is not based on statistics, though they may be triangulated against secondary or primary data in order to verify the information generated.

The Purpose is to know the crops grown in different seasons and manure and fertilizers used for crops

Material Required: Seed, cards, marker pens, chalk of different colours and other locally available materials like twigs, pebbles, etc.

Procedure:

- Explain the objective of the exercise to the participants
- Start a discussion on the present month and then the work they have been doing during the season. Move to the present month and the other relevant ones. Write the names on cards in bold letters
- Ask them to identify a unique characteristic of each month, one by one, that would remind them of the month. It can be a symbol or drawing. Encourage them to do it by themselves. It can be fun and add to their involvement. This will ensure that even the illiterate participate meaningfully
- Draw a grid with chalk on the floor. In the grid have at least 13 columns and many rows as the items you want to study. Keep the cards with names of the months and visuals or symbols in the top boxes in order, horizontally
- Now on the vertical axis, take the aspects whose seasonal variations you are interested in to represent the magnitude of the activity using different number of seeds or sticks of different sizes can be used to indicate the number of days. Similarly, sticks of different size can be used to indicate the quantity of rainfall during the month
- After completing one aspect or activity move to another, until all of them are similarly covered
- Copy the diagram on a piece of paper with legends and details of the participants, facilitators locality and date
- Thank the participants for their active participation and valuable time
- Later triangulate, verify the findings with other key information to ensure that the information generated are correct

Cause-effect Diagram

Cause-effect Diagram focuses on the causal factors of a phenomenon, activity, or problem, and the effects thereof. The cause-effect diagram presents visually the causes, effects and their inter-linkage, which help in arriving at an in-depth understanding of a particular topic, and provide scope for analysis and subsequent action by the local people.

The Purpose is to analyse the causes for the problems arising due to indiscriminate use of fertilizers to the crops

Material Required: The material required may vary considerably depending upon the process. Cards of small sizes, seeds colours, markers, chalks, large - size paper, etc., are required in any case.

Process:

- Decide on a topic for a cause-effect diagram and invite a group of participants who are interested in the topic for the exercise
- Introduce the topic to the participants. Explain the purpose of the exercise. Keep a sheet of paper with the topic or the subject of the cause diagram written in bold letters in front of the participants. Visual depiction is preferable
- Ask the participants to focus on discussing the causes of the phenomenon (ex. decreased fertility status of soils or problematic soils). As they come up with the causes, note them down. Once it appears that there are no more causes to be discussed, list the effects of the problem/issue. Note down the points in brief
- Again, read out the list of causes and effects. Ask them if they would like to make any modifications like deleting or adding new items into the list
- Handover the colored cards to the participants and ask them to depict as well as write down the causes on separate cards. Try to involve as many participants as possible in the process. Even if the participants are literate, visual depictions may provide others with an opportunity for getting involved
- Show the completed cards and verify whether the participants can identify the symbols or diagrams
- Once the diagram is ready, ask the participants to have a look and make alterations if required. Note down the diagram on a sheet of paper with details
- Based on the diagram ask questions on aspects about which you have doubts or want to get a more in-depth understanding

Time trends

Time trends are also called as trend analysis is used to explore temporal dimensions with a focus on change. It captures and trends related to certain variables over different spans of time. It is, thus, people's account of the past and of how things have changed and hence also provides a historical perspective.

The local people have a good understanding of the present situation and the changes that have taken place over the years. Trend analysis can provide a good idea of the quantitative changes over time in different aspects of village life, such as organic manures application, yields, population, livestock population, the number of trees, area under cultivation, rainfall, etc., it helps to understand increases and decreases in different aspects of the local people lives rather than precise shifts. The discussion that follows a trend analysis may also look into the causes of changes and thus provide and understanding of the dynamics of change.

The Purpose is to learn from the community as to how they perceive in application of manures and fertilizers over time.

Material required: The material required for trend analysis includes cards, chalks, chart paper, bold markers of different colours, sand and pebbles

Procedure:

- Select a group of local people who are interested in the exercise. Explain them the purpose of the exercise
- Initiate a discussion on the present situation and then move on to the aspects you are interested in pursuing. This sets the climate for trend analysis
- Ask participants to make the matrix on the ground, using chalk. Ask them to represent from top to bottom the landmark years and from left to right various aspects like density of trees, grass, water availability, wild animals, etc.
- Ask the participants to depict the situation today and in the past for each of the selected parameter
- Once the diagram is ready, ask them whether they are satisfied with it or whether they would like to make any change
- Encourage them to discuss their findings and reflect on them some key questions for the discussion could include,
 - Major trends and findings
 - Causes of the trends
 - What can be done?
 - Who can play a role in it?

- What can the participants and local peoples do themselves?
- What can they do with a little assistance from outside?
- Copy the diagram onto a sheet of paper with details of the legend, the scoring system, the participants and facilitators, and the location and date

Matrix Ranking

Matrix ranking/ scoring method is useful whenever you want to arrive at comparative understanding of various items of certain characteristics.

The Purpose is to take decisions among the alternative available *viz.*, conventional and LRI based approach in fertilizers application for crops grown

Material Required: Colours, twigs, leaves, pebbles, small stones etc.

Process:

- Describe the topic (LRI based and conventional approaches in fertilizer management) on which you want to develop an in-depth understanding of the pattern of decision making on a number of different criteria
- Identify the individuals with whom you would like to do the matrix
- Clearly explain the purpose of the exercise
- List down various options on the topic (apt quantity of nutrients to crop, cost, yield, soil health, income per unit of fertilizer etc.)
- Arrive at the criteria both positive and negative criteria
- Draw up a matrix with the items/ options top to bottom and criteria left to right
- Take up a criterion and ask the participants to rank the objects on the basis of that criterion. At this stage, it is better to ask which is best? Which is worst? of the remaining which is better? etc.
- While ranking ask the participants to use stones or locally available materials (if the ranking has to be done on 5 - point scale and the villagers ranking for a particular option on the pre-decided criterion is very good they can put 5 stones in that box)
- After completion of the diagram on the floor, transfer it on to the drawing sheet

Mobility Map

Mobility map is used to explore the movement pattern of an individual, a group, or the community. The focus is on where people go and for what. Other aspects, like the frequency of visits, distance, and the importance of the place visited, may also be studied and depicted. It reflects the people's perception of movement patterns and the reasons thereof.

The Purpose is to understand the movement of farmers to the places for purchasing manures, fertilizers and other inputs and marketing the produce

The following information to be elicited from the mobility map: (a) Places (b) Purpose (c) Direction (d) Distance (e) Mode (f) Frequency (g) Cost of transport to and from a village

Material Required: Locally available material including stones, seeds, chalks and cards of different colours can be used for the mobility map.

The suggested steps for mobility mapping are as follows:

- Select a person, group or community whose mobility pattern you are interested in understanding
- Explain the purpose of the exercise and initiate a discussion on the places they visit. List down the places. As they close the list, ask them whether they would like to add some more or delete any of the place in the list
- Ask them to write the name of the places on small pieces of paper in bold letters. Encourage them to depict the place using symbols or visuals, particularly if the participants are non-literate
- Draw a circle in the middle of a paper or ground, representing the village/locality and ask them to locate the pieces of paper with the names of the places they visit around the circle in such a way that they are properly represented
- Ask them to link the cards representing the places visited with the circle depicting their locality by lines. The thickness of the lines could represent a particular feature, such as the frequency of the visits
- Ask them to follow a similar process, for all other places that they visit, one by one
- Encourage them to represent other aspects in the form of visit, symbols or in writing
- Brainstorm and arrive at the aspects which could be represented including
 - Purpose of visiting the place
 - Importance of the places visited
 - Distance of the places
 - Mode of transport
 - Frequency of visits
- Whether alone or with someone
- Copy the diagram on to paper with all the details.
- Triangulate the diagram and other details generated during discussions with others in the locality

Venn Diagram

Venn diagram is used to study institutional relationship and is sometimes also referred to as institutional diagram. It is however, popularly known as Chapati diagram as the method uses circles of various sizes to represent institutions or individuals. The bigger the circle, the more important is the institution or individual. The distance between circles represents, for example, the degree of influence or contact between institutions and individuals. Overlapping circles indicate interactions and the extent of overlap can indicate the level of interaction.

The Purpose is to understand local peoples' perception about local institutions, individuals, programmes, etc. The method provides valuable insights into and analyses of the power structure, the decision-making process, etc., the need to strengthen the community's institutions can also be ascertained.

Venn diagram is particularly useful when you want to study and analyse:

- Various institutions and individuals and their influence on the local people
- Various groups and individuals in the locality and their influence
- The main actors in the community and their conspicuous and inconspicuous influence

The following information is elicited in Venn diagram:

- Relative importance of various institutions in the village
- Relationship among them
- Linkages among them
- Weaknesses with respect to decision making process
- Development of the village by institutions
- Duplication of efforts among institutions
- Gap identification between institutions
- Objectives and felt needs of farmers
- Concentration of power within villages

Material Required: Paper circles are the most frequently used materials in Venn diagramming. It can also be drawn directly on the ground or on paper, but that does not allow the size or location of circles to be changed. Sometimes, after the circles are drawn, participants discuss the diagram and want to change the size or location. They hesitate to do so if the Venn diagram has been drawn, but if the circles are cut from paper, they find making modifications easy at any point in the process.

Process:

- Explain the purpose for the exercise to the participants
- Ask them to list the various institutions, individuals, etc, as per the objectives of the exercise
- Ask them to write and/ or depict them on small cards. Visual depiction becomes necessary if there are non-literate participants
- Ask the participants to place the cards on one of the variables of study, e.g., perceived importance of the institutions, in a descending order. Once the cards are arranged in an order, ask them whether they agree or would like to make modifications.
- Encourage them to make changes, if they are interested
- Ask them to assign paper circles of different size (cut and kept ready) to the institutions or individuals in such a way that the bigger the circle, the higher that institutions or individual ranks on that variable. Paste the circles on the drawing sheet with names of institutions or individual
- Draw a circle on the ground representing the community. Ask them to place the circle in such a way that those high on the second variable, accessibility, are kept close together, while those low on the variable are kept away from the circle representing the community
- Once all the cards are placed, ask them if they agree with the placement. In case they want to place with an overlap, the degree of overlap indicates the degree of interaction.
- Ask them to discuss and explain why they placed the cards in such a manner. Note down the points of discussion and explanation
- Copy the output onto a sheet of paper. Record the name of the village, participants, date, legends, what the size of the circle represents and what the distance represents

SWOT Analysis

It is an analysis of strengths, weaknesses, opportunities, and threads involved in an activity/ event/ technology. To take a decision about a technology, or an option, or an event its strengths, weaknesses, opportunities and threats are analysed critically. After the analysis, favourable decisions are taken if lesser threats or weaknesses are observed. The SWOT analysis to be done for understanding strengths, weaknesses, opportunities and threats involved in LRI based approach in fertilizer application.

Material Required: Chart paper, marker pens, cut size cards.

Process:

- Identify a group of knowledgeable persons of village
- Explain them about the purpose of the exercise
- Select issue to be analysed: LRI based approach in fertilizer application

- Ask the identified group of people to write strengths, weaknesses, opportunities and threats on the selected issue on cut size cards. Let them exhaust all possible strengths, weakness etc.
- Ask the group to write one item/ card (if 5 strengths are there let them write them on 5 cards)
- Ask them to draw four columns and write in each column strengths, weaknesses, opportunities and threats
- Ask them to place the written cards under appropriate column (preferably in order of importance)
- After completion discuss with the group and cross check

Resource Mapping

Resource map focuses on the natural resources in the locality and depicts land, hills, rivers, field, vegetation, etc. A resource map in PRA is not drawn to scale. It is not done by experts but by the local people. The local people are considered to have an in-depth knowledge of the surroundings where they have survived for a long time. Hence the resource map drawn by the local people is considered to be accurate and detailed. It is important to keep in mind, however, that it reflects the peoples' perceptions rather than precise measurements to scale. Thus, a resource map reflects how people view their own locality in terms of natural resources.

The resource map to be employed in control village which is outside the watershed selected for saturation under REWARD program. Since, the cadastral or other types of maps are not available, the resource map is an ideal approach to know the agricultural lands located in the village, variations in the soils, crops grown etc. While getting the resource map drawn by the villagers, following aspects may be considered:

- Topography, terrain and slopes
- Forest, vegetation and tree species
- Soil type, fertility, erosion and depth
- Land use, command area, boundaries and ownership
- Waterbodies, irrigation sources and drainage
- Watershed development, various soil and water conservation measures etc.
- Agricultural development, cropping pattern, productivity, etc.

Material Required: Seeds of different types, soil, chalks coloured powder, stones and pebbles, twigs, leaves, paper, and cardboard have to be used for making resource maps. The list, however, is not exhaustive.

Process of Resource Mapping: The main steps include:

- Select a proper place for preparing a resource map of the area in consultation with the local people
- Fix the time and invite people from different sections of the society
- Ensure that the marginalized groups and women definitely participate
- Start the exercise at the fixed time. First explain the purpose of the exercise
- Ask them to start showing the major resources. Encourage them to use locally available material in a creative way and to make the map as representative as possible
- Do not interfere. Allow them to do it on their own. In case they get stuck, help them out
- Listen carefully to the discussions they have, while preparing the map. Note down the relevant points
- Copy the map on to a large sheet of paper with all details including legends
- Triangulate what is on in the map. One way is to go for a transect. The other way is to talk about the map with certain key people in the village and get their feedback

Schedule-1

Schedule to collect information on the pilot study from farmers

Pilot Study on LRI based Fertilizer Application under REWARD Program

Part-1: About the watershed

#	Item/ Particulars	
1.	District	
2.	Taluk	
3.	Hobli	
4.	Sub-watershed name	
5.	Sub-watershed code	
6.	Village	
7.	Treatment (T1/ T2/ T3/ T4)	

Part-2: About the farmers

#	Item/ Particulars	
1.	Name	
2.	Farmer Photograph	
2.	Gender (Male / Female)	
3.	Father/ Husband's name	
4.	Mobile number	
5.	Educational status (number of years of schooling)	
6.	Category of farmer-Social class (SC/ ST/ OBC/ Gen)	
7.	Category of farmer-Land holding (MF/SF/BF)	
8.	Aadhaar number	
9.	FRUITS ID number	
10.	Source of purchase of fertilizers (dealers/ society/ FPO/ others)	
11.	Address of dealers/ society/ FPO/ others	
12.	Sale of produce (open market/ APMC/ middle men/ others)	
13.	LRI card received (Yes/ No)	
14.	Total land holding details in acres (survey and hissa wise area and)	

Part-3: About the crops grown by the farmers

Information to be collected at five stages as indicated below:

- 1) Pre-Pilot 2024 (during the previous year 2023-24)
- 2) Pilot 2024
- 3) October 2024
- 4) June 2025
- 5) October 2025

#	Particulars	Crop-1	Crop2	Crop3
1	Name of the crop			
2	Area (of the crop) in acres			
3	survey and hissa number (of the area in which crop is grown)			
4	Soil series			
5	Fertility Status of Land (For each of the three nutrients namely N, P and K fertility status under five categories to be captured)			
6	Variety			
7	Duration (days)			
8	Season (Kharif/ Rabi/ Summer)			
9	Type of land (Rainfed/irrigated)			
10	Source of irrigation (activated IF not rainfed - borewell/ tank/ canal/ others)			
11	Cost of seed (including own seed) (Rs.)			
12	Manures and fertilizers			
	12.1. Organic manures (compost/ FYM/ green manure/ tank silt/others)			
	Name			
	Quantity (tons)			
	Cost (Rs.)			
	12.2. Biofertilizers			
	Name			
	Quantity (gms)			
	Cost (Rs.)			
	12.3. Chemical fertilizers			
	Name-1			
	Basal dose qty (kgs)			
	Top dress qty (kgs)			
	Total Quantity (kgs)			
	Total Cost (Rs.)			

#	Particulars	Crop-1	Crop2	Crop3
	Name-2			
	Basal dose qty (kgs)			
	Top dress qty (kgs)			
	Total Quantity (kgs)			
	Total Cost (Rs.)			
13	Method of fertilizers application (broadcasting/ line/ band/ spot)			
14	Cost of plant protection chemicals (Rs.)			
15	Labour details			
	Own labour (number)			
	Cost (Rs.)			
	Hired labour (number)			
	Cost (Rs.)			
	Cost of animal drawn work (Rs.)			
	Cost of mechanized works (Rs.)			
16	Irrigation cost (if purchased/ repairs during crop season/ fuel cost/ electricity) (Rs.)			
17	Other production cost, if any (Rs.)			
18	Total cost of production (Rs.)			
19	Returns			
	Quantity of main product (quintals)			
	Price/ unit (Rs.)			
	A. Total main product amount (Rs.)			
	Quantity of by product (tons)			
	Price/ unit (Rs.)			
	B. Total by product amount (Rs.)			
	Total returns (main and by product) (Rs.) A+B			

Part-4: Attitude towards LRI based fertilizer application

#	Statement	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1.	LRI based fertilizer recommendation to crops is a boon to farmers					
2.	Do not see much advantage in LRI based fertilizer					

#	Statement	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
	application for fertilizer intensive crops					
3.	LRI based fertilizer application help to optimize crop yields					
4.	LRI based fertilizer application is suitable for dryland crops only					
5.	LRI based fertilizer application do not harm useful microorganisms present in the soil					
6.	The RSK staff are competent to guide on fertilizers dosage for crops based on LRI card					
7.	The information presented in LRI card is enough to take rational decisions on nutrients' selection					
8.	The accuracy of information presented in LRI card is doubtful					
9.	Not sure of getting better economic gains by adopting LRI based fertilizer application					
10.	LRI based approach help to save cost of fertilizers compare to indiscriminate use					
11.	Local Fertilizer Dealers' advice on fertilizer dosage is more dependable as they know soil characteristics and crop needs of the locality					

Part-5: Acceptance level of LRI based approach

#	Statement	Acceptance level		
		Very Much	Much	Not
1.	Format or layout of presentation of information in LRI card			
2.	Adequacy of information presented in LRI card			
3.	Usefulness of information presented in LRI card			
4.	Easiness to understand the contents of LRI card for its application			
5.	Adopt LRI based fertilizer application to crops grown by me			

Part-6: Status of application of fertilizers as per LRI

1. Whose advice do you seek to decide the type and quantity of fertilizers?
 - a. On my own
 - b. Fertilizer dealer
 - c. RSK staff
 - d. Neighbors

2. What is the most appropriate information source to decide required quantities of fertilizers for the crops?
 - a. Own experience
 - b. Package of practices
 - c. Soil test report
 - d. LRI card

3. Have you applied fertilizers as per LRI card?
 - a. No
 - b. Not aware
 - c. Not skillful to use LRI information
 - d. Yes

4. If you have applied fertilizers as per LRI card, what is your opinion?
 - a. Cannot differentiate the benefits of conventional and LRI approach
 - b. Able to save fertilizer cost
 - c. Able to get more yield
 - d. b and c

5. If you are trained on use of LRI card, will you follow LRI based fertilizer application?
 - a. No
 - b. Try next season/ year
 - c. Try this season in smaller area
 - d. Try this season for all the crops

Part-7: Knowledge on LRI based fertilizer application

1. Under which project, the LRI card is distributed to farmer?
 - a. Krishi Bhagya
 - b. Precision farming
 - c. Sujala/ REWARD
 - d. National Horticulture Mission
2. What information a farmer can get from LRI card?
 - a. Suitable conservation measures
 - b. Soil fertility status
 - c. Crop suitability
 - d. All the above
3. What is the inference for yellow color in respect of soil nutrient status in LRI card?
 - a. Very high
 - b. High
 - c. Medium
 - d. Low
4. What is the adjustment factor to align fertilizers when soil nutrient status is low?
 - a. RDF x 1.67
 - b. RDF x 1.33
 - c. RDF x 1.00
 - d. RDF x 0.66
5. RDF for maize is 60:30:15 kg/ acre. If soil nitrogen content is medium, what is the adjustment factor to be followed?
 - a. RDF x 1.00
 - b. RDF x 0.66
 - c. RDF x 1.33
 - d. RDF x 1.67

6. What is the role of nitrogen in plants?
 - a. For better growth
 - b. For disease resistance
 - c. For stopping fruit drop
 - d. For pest resistance

7. What are the ill effects of using excess chemical fertilizers?
 - a. Reduction in the soil health
 - b. Contamination of water bodies
 - c. Harm soil microorganisms
 - d. All the above

8. If your plants suffer from nitrogen deficiency, which part of young leaves will turn yellow first?
 - a. Lower part
 - b. Upper part
 - c. Fruits
 - d. Tip of the plant

9. If soil is characterized as very acidic, what can be done to reduce the harmful effects associated with this?
 - a. Apply gypsum
 - b. Apply lime
 - c. Apply manure
 - d. Apply urea

10. To apply 46 kg of nitrogen, how much urea to be used?
 - a. 50 kg
 - b. 100 kg
 - c. 150 kg
 - d. 200 kg

11. Which of the following is a secondary nutrient?
 - a. Potash
 - b. Phosphorous
 - c. Sulphur
 - d. Nitrogen

12. What type of data from an LRI is most important for determining fertilizer needs?
 - a. Soil depth
 - b. Soil slope
 - c. Soil fertility
 - d. Weather patterns

13. While interpreting LRI data for fertilizer application, what should a farmer consider?
 - a. Soil fertility status
 - b. Crop nutrient needs
 - c. Crop season
 - d. All the above

14. To apply 46 kg of phosphorus, how much DAP to be used?
 - a. 46 kg
 - b. 100 kg
 - c. 150 kg
 - d. 200 kg

15. What are the benefits of LRI based fertilizer application?
 - a. Optimized yield
 - b. Balance in soil fertility
 - c. Better economic returns
 - d. All the above

Schedule-2

Schedule to collect information from PIA/ RSK Staff/ Fertilizer Dealers

Part-1: About the watershed

#	Item/ Particulars	
1.	District	
2.	Taluk	
3.	Hobli	
4.	Sub-watershed name	
5.	Sub-watershed code	

Part-2: About the Staff

#	Item/ Particulars	
1.	Name	
2.	Gender (M/ F)	
3.	Father/ Husband's name	
4.	Mobile number	
5.	Email ID	
6.	Educational status (SSLC/ Intermediate/ Diploma/ Degree/ Degree in Agric. Science/ Post Graduate/ Post Graduate in Agric. Sciences/ Doctorate/ Doctorate in Agric. Sciences)	
7.	PIA cadre (ADA/ AO/ AAO/ AHO/ RFO/ DPC/ WA/ LRI-EM, TL-FNGO, FNGO-TC/ WM)	
8.	Since how long associated with REWARD (less than 6 months/ 1 year/ 1.5 years/ 2 years/ above 2 years)	
9.	RSK staff cadre (AO/ AAO)	
10.	Since how long associated with REWARD (less than 6 months/ 1 year/ 1.5 years/ 2 years/ above 2 years)	
11.	RSK name	
12.	Fertilizer dealer	
13.	Since how long dealing with fertilizer sales (less than 2 years/ 2-5 years/ above 5 years)	
14.	Fertilizer dealer's place	

Part-3: Attitude of Staff towards LRI based fertilizer application

#	Statement	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
1.	LRI based fertilizer recommendation to crops is a boon to farmers					

#	Statement	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
2.	Do not see much advantage in LRI based fertilizer application for fertilizer intensive crops					
3.	LRI based fertilizer application help to optimize crop yields					
4.	LRI based fertilizer application is suitable for dryland crops only					
5.	LRI based fertilizer application do not harm useful microorganisms present in the soil					
6.	The RSK staff are competent to guide on fertilizers dosage for crops based on LRI card					
7.	The information presented in LRI card is enough to take rational decisions on nutrients' selection					
8.	The accuracy of information presented in LRI card is doubtful					
9.	Not sure of getting better economic gains by adopting LRI based fertilizer application					
10.	LRI based approach help to save cost of fertilizers compare to indiscriminate use					
11.	Local Fertilizer Dealers' advice on fertilizer dosage is more dependable as they know soil characteristics and crop needs of the locality					

Part-4: Acceptance level of LRI based approach

#	Statement	Acceptance level		
		Very Much	Much	Not
1.	Format or layout of presentation of information in LRI card			
2.	Adequacy of information presented in LRI card			
3.	Usefulness of information presented in LRI card			
4.	Easiness to understand the contents of LRI card for its application			
5.	Promote LRI based fertilizer application to crops grown by farmers			

Part-5: Knowledge on LRI based fertilizer application

1. What is the main purpose of a land resource inventory (LRI) for fertilizer application?
 - a. To increase overall fertilizer use
 - b. To create a specific fertilizer application plan for each field area
 - c. To eliminate the need for soil testing
 - d. To simplify the fertilizer application process

2. What type of data from an LRI is most important for determining fertilizer needs?
 - a. Land area
 - b. Crop type history
 - c. Soil fertility
 - d. Weather patterns

3. A farmer notices a specific area of their field with lower soil fertility in their LRI data What is the most appropriate action based on this information?
 - a. Apply the same amount of fertilizer across the entire field
 - b. Increase the fertilizer application rate only in that specific area
 - c. Plant a different type of crop in that area
 - d. Ignore this information as it's likely not significant

4. LRI data is most valuable for fertilizer application in:
 - a. Large, uniform fields with
 - b. Diverse fields with varying soil conditions and crop types
 - c. Fields with a long history of organic fertilizer use
 - d. Fields located near major waterways

5. What is the main difference between blanket application and LRI based application of fertilizer?
 - a. Blanket applies more fertilizer overall
 - b. LRI applies fertilizer based on specific needs of different areas
 - c. Broadcast application requires specialized equipment
 - d. LRI based application is faster than blanket application

6. While interpreting LRI data for fertilizer application, a farmer should consider:
 - a. Only the current soil fertility levels
 - b. Both soil fertility and crop nutrient needs
 - c. Solely the historical fertilizer application rates
 - d. Primarily the weather forecast for the upcoming season

7. Which of the following is NOT a common method for collecting LRI data for fertilizer application?
 - a. Interviewing the landowner about past land use practices
 - b. Using remote sensing imagery to analyze field characteristics
 - c. Taking soil samples from different locations within the field
 - d. Observing vegetation health and growth patterns across the field

8. What is the biggest challenge a farmer might face when implementing LRI-based fertilizer application?
 - a. The cost of soil testing
 - b. Difficulty in interpreting LRI data
 - c. The physical effort required for data collection
 - d. The lack of available fertilizer types

9. What is the most important factor for a farmer to consider when choosing a fertilizer based on LRI data?
 - a. The brand name of the fertilizer
 - b. The specific nutrient content of the fertilizer to address soil deficiencies
 - c. The color and texture of the fertilizer product
 - d. The marketing claims made about the fertilizer

10. While interpreting LRI card, what does red color indicates with respect to application of fertilizers?
 - a. Increased application of fertilizers
 - b. Decreased application of fertilizers

- c. No change in application rates
 - d. Switching to a completely different fertilizer type
11. What information a farmer can get from LRI card?
- a. Suitable conservation measures
 - b. Soil fertility status
 - c. Crop suitability
 - d. All the above
12. What is the adjustment factor to align fertilizers when soil nutrient status is low?
- a. RDF x 1.67
 - b. RDF x 1.33
 - c. RDF x 1.00
 - d. RDF x 0.66
13. RDF for maize is 60:30:15 kg/ acre. If soil nitrogen content is medium, what is the adjustment factor to be followed?
- a. RDF x 1.00
 - b. RDF x 0.66
 - c. RDF x 1.33
 - d. RDF x 1.67
14. What are the ill effects of using excess chemical fertilizers?
- a. Reduction in the soil health
 - b. Contamination of water bodies
 - c. Harm soil microorganisms
 - d. All the above
15. Which of the following is a secondary nutrient?
- a. Potash
 - b. Phosphorous
 - c. Sulphur
 - d. Nitrogen

Schedule-3

Information to be Maintained by Demonstrator Farmer on LRI based Fertilizer Application

#	Particulars		Description				
1	Sub-watershed	:					
2	Micro-watershed	:					
3	Village	:					
4	Name of the farmer	:					
5	Demonstration area (ac)	:					
6	Soil nutrient status as per LRI card						
6.1	Available N	:	V. Low	Low	Medium	High	V. High
6.2	Available P	:	V. Low	Low	Medium	High	V. High
6.3	Available K	:	V. Low	Low	Medium	High	V. High
7	Season	:	Kharif /Rabi/ Summer				
8	Crop	:					
9	Variety	:					
10	Date of sowing	:					
11	Organic manures						
11.1	Name	:					
	Quantity (t)	:					
	Cost (Rs.)	:					
11.2	Name	:					
	Quantity (t)	:					
	Cost (Rs.)	:					
12	Bio-fertilizers used						
	Name	:					
	Quantity (kg)	:					
	Cost (Rs.)	:					
13	Chemical Fertilizers						
13.1	Basal dose						
	Fertilizer-1	:					
	Quantity (kg)	:					
	Cost (Rs.)	:					
	Fertilizer-2	:					
	Quantity (kg)	:					
	Cost (Rs.)	:					
	Fertilizer-3	:					
	Quantity (kg)	:					
	Cost (Rs.)	:					

#	Particulars		Description
13.2	Top dressing-1		
	Fertilizer-1	:	
	Quantity (kg)	:	
	Cost (Rs.)	:	
	Fertilizer-2	:	
	Quantity (kg)	:	
13.3	Top dressing-2		
	Fertilizer-1	:	
	Quantity (kg)	:	
	Cost (Rs.)	:	
	Fertilizer-2	:	
	Quantity (kg)	:	
14	Labour used		
	14.1 Preparatory works up to sowing		
	Number	:	
	Amount (Rs.)	:	
	14.2 Intercultural operations		
	Number	:	
	Amount (Rs.)	:	
14.3	Harvesting operations		
	Number	:	
	Amount (Rs.)	:	
15	Mechanical power hire charge		
16	Other expenditure		
17.0	Yield		
17.1	Main product		
	Quantity (q)	:	
	Amount (Rs.)	:	
17.2	By product		
	Quantity (t)	:	
	Amount (Rs.)	:	
18	Economic Analysis		
18.1	Total expenditure (Rs.)	:	
18.2	Total returns (Rs.)	:	
18.3	Net returns per acre (Rs.)	:	
18.4	B:C ratio	:	

Contents of flipchart to be used during farmers training


ಬೆಳೆಗಳಲ್ಲಿ ಪ್ರಮುಖ ಪೋಷಕಾಂಶಗಳ ಪಾತ್ರ

ಸಾರಜನಕ

ಪತ್ರಹರಿತ್ತಿನ ಭಾಗವಾಗಿ ಸಸ್ಯದ ಬೆಳವಣಿಗೆಗೆ ನೆರವು


ರಂಜಕ

ಬೇರು, ಬೀಜ ಹಾಗೂ ಹಣ್ಣಿನ ಬೆಳವಣಿಗೆಗೆ ನೆರವು



ಪೊಟ್ಟಾಷಿಯಂ

ಆಹಾರ ಹಾಗೂ ನೀರು ಸಾಗಾಟ ಮತ್ತು ರೋಗ ನಿರೋಧಕ ಶಕ್ತಿ ತುಂಬುತ್ತದೆ



REWARD ಯೋಜನೆ ಜಲಾನಯನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಪ್ರಮುಖ ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 <p>ಸಾರಜನಕ</p>	ಪತ್ರಹರಿತ್ತಿನ ಭಾಗವಾಗಿ ಸಸ್ಯದ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ಹಳೆಯ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು
 <p>ರಂಜಕ</p>	ಬೇರು, ಬೀಜ ಹಾಗೂ ಹಣ್ಣಿನ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ಎಲೆ ಕಪ್ಪಾಗುವುದು, ಕೆಂಪು ಪಟ್ಟಿ ಕಾಣುವುದು
 <p>ಪೊಟ್ಟಾಷಿಯಂ</p>	ಆಹಾರ ಹಾಗೂ ನೀರು ಸಾಗಾಟ ಮತ್ತು ರೋಗ ನಿರೋಧಕ ಶಕ್ತಿ ತುಂಬುತ್ತದೆ	ತುದಿ ಹಾಗೂ ಎಲೆಗುಕ್ಕು ಒಣಗುವುದು, ಕಾಯಿ/ಹೂವು ಉದುರುವುದು



REWARD ಯೋಜನೆ ಜಲಾನಯನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ದ್ವಿತೀಯ ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 <p>ಕ್ಯಾಲ್ಷಿಯಂ</p>	ಬೀಜ ಮೊಳಕೆ ಒಡೆಯಲು ಹಾಗೂ ಬೇರಿನ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ತುದಿ ಒಣಗುವುದು, ಹಣ್ಣು ಕೊಳೆಯುವುದು
 <p>ಮೆಗ್ನೀಷಿಯಂ</p>	ಪತ್ರಹರಿತ್ತಿನ ಭಾಗವಾಗಿ, ಸಸ್ಯದ ಕೊಬ್ಬು ಹಾಗೂ ಪ್ರೋಟೀನ್ ಉತ್ಪಾದನೆಗೆ ನೆರವು	ಎಲೆ ಬಿಳಿಯಾಗುವುದು, ಹಸಿರು ವರಮಂಡಲ ಕಾಣುವುದು, ಕೆಂಪು ಪಟ್ಟಿ ಕಾಣುವುದು
 <p>ಗಂಧಕ</p>	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ, ಕೊಬ್ಬು ಹಾಗೂ ಪ್ರೋಟೀನ್ ಉತ್ಪಾದನೆಗೆ ನೆರವು	ಗಿಡದಲ್ಲಿ ಎಲೆಯ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು



REWARD ಯೋಜನೆ ಜಲಾನಯನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಲಘು ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 <p>ಸತು</p>	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ, ಸಸ್ಯದ ಕೊಬ್ಬಿನ ಅಂಶಗಳನ್ನು ಹಾಗೂ ಹಾರ್ಮೋನ್‌ಗಳನ್ನು ಪರಿವರ್ತಿಸಲು, ಎನ್‌ಜೈಮ್‌ಗಳ ಚಟುವಟಿಕೆಗಳನ್ನು ವರ್ಧಿಸಲು ಸಹಾಯ	ಕಾಂಡ ಕಡ್ಡಿಯಂತಾಗುವುದು, ಗಿಡ್ಡವೆ ಆಂಕರ ಕಡಿಮೆ ಆಗುವುದು, ಎಲೆಗಳು ಒಂದೇ ಕಡೆ ಮುಂದುವರಿಯುವುದು
 <p>ಬೋರಾನ್</p>	ಸಸ್ಯದ ಕೊಬ್ಬಿನ ಅಂಶಗಳನ್ನು ಸಾಗಿಸಲು ಅಂಶಾಂಶ ಗೋಷ್ಠಿಯ ಬೆಳವಣಿಗೆಗೆ, ಕ್ಯಾಲ್ಷಿಯಂ ಹೀರಲು	ತುದಿ/ಮೊಗ್ಗು ಒಣಗುವುದು ಕಾಯಿ/ಬೀಜ ಸಣ್ಣದಾಗಿರುವುದು, ಕಾಯಿ/ಹೂವು ಹೊಡೆಯುವುದು ಹಾಗೂ ಉದುರುವುದು
 <p>ಕಬ್ಬಿಣ</p>	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ, ಉಸಿರಾಟ ಕ್ರಿಯೆಗೆ, ಸಾರಜನಕ ಸೇರಿಕೊಳ್ಳುವಿಕೆಯಲ್ಲಿ ಮಹತ್ವ	ಹಳದಿ ಎಲೆಯಲ್ಲಿ ಹಸಿರು ನದಿಮಂಡಲ ಕಾಣುವುದು, ಎಲೆ ಎಲೆ ಬಿಳಿಯಾಗುವುದು
 <p>ಮ್ಯಾಂಗನೀಸ್</p>	ಸಾರಜನಕ ಹಾಗೂ ಆಹಾರ ಪರಿವರ್ತನೆಯಲ್ಲಿ, ಎನ್‌ಜೈಮ್‌ಗಳ ವರ್ಧಕವಾಗಲು ನೆರವು	ಎಲೆ ಎಲೆ ಬಿಳಿಯಾಗುವುದು, ಬೆಳವಣಿಗೆ ಕುರಿತಾಗುವುದು
 <p>ತಾಮ್ರ</p>	ಪತ್ರಹರಿತ್ತು ಹಾಗೂ ಲಿಗ್ನಿನ್ ತಯಾರಿಕೆಗೆ, ಪ್ರೋಟೀನ್ ಹಾಗೂ ಕಾರ್ಬೋಹೈಡ್ರೇಟ್ ಪರಿವರ್ತನೆಗೆ, ಸಾರಜನಕ ಸೇರಿಕೊಳ್ಳುವಿಕೆಯಲ್ಲಿ ನೆರವು	ಗಿಡದಲ್ಲಿ ಎಲೆಯ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು ಎಲೆಯಲ್ಲಿ ಚುಕ್ಕೆಗಳು ಕಾಣುವುದು



REWARD ಯೋಜನೆ ಜಲಾನಯನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಬೆಳೆಗಳಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಬೋರಾನ್ (B)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕಾರ್ಬೋಹೈಡ್ರೇಟ್
- ರಾಸಾಯನಿಕ ಪದಾರ್ಥಗಳನ್ನು ರಚಿಸಲು ಸಹಾಯಿಸುತ್ತದೆ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಕಡ್ಡಿಣ (Fe)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ರಾಸಾಯನಿಕ ಪದಾರ್ಥಗಳನ್ನು ರಚಿಸಲು ಸಹಾಯಿಸುತ್ತದೆ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಮ್ಯಾಂಗನೀಸ್ (Mn)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಸುಂಕು (Zn)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಮ್ಯಾಗ್ನೀಷಿಯಂ (Mg)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಫಾಸ್ಫರ (P)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಕ್ಯಾಲ್ಷಿಯಂ (Ca)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಗಂಧಕ (S)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಕಾಪರಿ (Cu)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಮೊಲಿಬ್ಡಿನಂ (Mo)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಪೊಟ್ಯಾಷಿಯಂ (K)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ನಾರ್ಜನ (N)

- ಕೆಲವು ಎಲೆಕ್ಟ್ರಾನ್ ಗ್ರಾಹಕರಾದ ದ್ರವ್ಯ ಪರಿವಾಹಕ
- ಕಾಂಪೌಂಡ್ ಕ್ರಿಯೆಯು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

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ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ದುಷ್ಪರಿಣಾಮಗಳು

ಮಣ್ಣು

- ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಅಸಮತೋಲನ ಬಾಂಧವಿ ಪಳೆಗಳಿಗೆ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆ
- ಮಣ್ಣಿನಲ್ಲಿರುವ ಅಪಾಯಕರ ಸೂಕ್ಷ್ಮಾಣು ಜೀವಿಗಳ ಸಂಖ್ಯೆ ಕಡಿಮೆಯಾಗುತ್ತದೆ
- ಮಣ್ಣಿನ ರೂಪದ 6.5 ಕ್ಕಿಂತ ಕಡಿಮೆಯಾಗಿ ಹಳು ಹುಣ್ಣಾಗಿ ಪರಿವರ್ತನೆ
- ಭಾರಿ ಲೋಡದ ಮಣ್ಣುಗಳ ಸೇರುತ್ತವೆ
- ಫೌಜಿಕ ಹಾಗೂ ರಾಸಾಯನಿಕ ಗುಣಗಳ ಎದುರಿಸಿಕೊಂಡು ಬೆಳೆಗಳಿಗೆ ಹಾನಿ

ಅಂತರ್ಜಲ

- ಅಪೋನಿಯಾ, ಕಾರ್ಬನ್ ಡೈ ಆಕ್ಸೈಡ್, ಮೀಥೇನ್ ಮುಂತಾದವುಗಳು ನೀರನ್ನು ಸೇರಿ ಮಂದಗೊಳಿಸುತ್ತವೆ
- ಹೆಚ್ಚಾಗಿ ನೈಟ್ರೇಟ್ ಅಂಶ ನೀರಿನಲ್ಲಿ ಬೆರೆಯುವುದರಿಂದ ಮಕ್ಕಳಲ್ಲಿ Blue Baby Syndrome ಕಂಡುಬರುತ್ತದೆ
- ನೀರಿನಲ್ಲಿ ವಾಚಿ ಬೆಳೆದು (Algae) ಜಲಪರಂಗಳ ಅನಿಲಾಟಕ್ಕೆ ತೊಂದರೆಯಾಗುತ್ತದೆ

ವಾತಾವರಣ

- ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗಿ ಹಸಿರು ಮನೆಮು ಅನಿಲಗಳು (ನೈಟ್ರೋ ಆಕ್ಸೈಡ್, ಅಪೋನಿಯಾ) ವಾತಾವರಣಕ್ಕೆ ಬಿಡುಗಡೆಯಾಗುತ್ತವೆ
- ಭೂಮಿ ಮನೆ ಪರಿಣಾಮ ಹೆಚ್ಚಾಗಿ ವಾತಾವರಣದಲ್ಲಿನ ಶಾಖಮಾನ ಹೆಚ್ಚಾಗುತ್ತದೆ

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LRI ಕಾರ್ಡಿನಿಂದಾಗುವ ಪ್ರಯೋಜನಗಳು

1 ಬಟ್ಟೆಯ ಕೃಷಿ ಉತ್ಪಾದನಾ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೆಚ್ಚಿಸಬಹುದು

2 ಅಧಿಕ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ವೆಚ್ಚವನ್ನು ತಪ್ಪಿಸಬಹುದು

3 ಕೃಷಿ ಮಣ್ಣಿನ ಗುಣಧರ್ಮಗಳನ್ನು ತಿಳಿಯಬಹುದು ಹಾಗೂ ಕೃಷಿ ಭೂಮಿಯ ಗುಣಮಟ್ಟ ಸುಧಾರಿಸಬಹುದು

4 ಕೃಷಿ ಭೂಮಿಗೆ ಸೂಕ್ತವಾದ ಬೆಳೆಗಳ ಆಯ್ಕೆ ಮಾಡಬಹುದು

5 ಮಣ್ಣಿನಲ್ಲಿರುವ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟದ ಆಧಾರದ ಮೇಲೆ, ಬೆಳೆಗಳಿಗೆ ಅಗತ್ಯವಿರುವ ಪೋಷಕಾಂಶಗಳನ್ನು ಸರಿಹೊಂದಿಸಬಹುದು

REWARD ಯೋಜನೆ, ಜಲಾಶಯನ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

LRI ಕಾರ್ಡಿನಲ್ಲಿ ದೊರೆಯುವ ಮಾಹಿತಿ

- 1 ರೈತನ ವಿವರ, ಸರ್ವೆ ನಂಬರ್, ಹಿಸ್ಸಾ ನಂಬರ್, ಎಷ್ಟು ಪ್ರದೇಶ, ಮಳೆಯ ಪ್ರಮಾಣ
- 2 ಮಣ್ಣಿನ ಭೌತಿಕ ಗುಣಧರ್ಮಗಳು (ಅಳಿ, ಕಣರಚನೆ, ಗರಸುತನ, ಇಳಿಜಾರು, ನೀರು ಹಿಡಿದಿಟ್ಟುಕೊಳ್ಳುವಿಕೆ)
- 3 ಕೈಗೊಳ್ಳಬೇಕಿರುವ ಮಣ್ಣು ಮತ್ತು ನೀರಿನ ಸಂರಕ್ಷಣಾ ಕ್ರಮಗಳು
- 4 ಮಣ್ಣಿನಲ್ಲಿನ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟದ ವರ್ಗೀಕರಣ (ಅತೀ ಹೆಚ್ಚು, ಹೆಚ್ಚು, ಮಧ್ಯಮ, ಕಡಿಮೆ, ಅತೀ ಕಡಿಮೆ)
- 5 ಮಣ್ಣಿನಲ್ಲಿನ ಲಘು ಮತ್ತು ಇತರ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟದ ವರ್ಗೀಕರಣ (ಸಾಕಷ್ಟು, ಕಡಿಮೆ)
- 6 ಜಮೀನಿಗೆ ಸೂಕ್ತವಾದ ಬೆಳೆಗಳು (ಹೆಚ್ಚು ಸೂಕ್ತ, ಸೂಕ್ತ, ಅಲ್ಪ ಸೂಕ್ತ ಮತ್ತು ಸೂಕ್ತವಲ್ಲ)
- 7 LRI ಕಾರ್ಡಿನಲ್ಲಿರುವ ಮಾಹಿತಿ ಬಳಸಲು ಮಾರ್ಗಸೂಚಿ

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ಮಣ್ಣಿನ ಫಲವತ್ತತೆಯ ವರ್ಗಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಪೋಷಕಾಂಶಗಳನ್ನು ಸರಿಹೊಂದಿಸುವುದು

ಲಭ್ಯವಿರುವ ಪೋಷಕಾಂಶ	ಅತೀ ಕಡಿಮೆ	ಕಡಿಮೆ	ಮಧ್ಯಮ	ಹೆಚ್ಚು	ಅತೀ ಹೆಚ್ಚು
ಸಾರಜನಕ	<140	140 to 280	281 to 560	561 to 700	>700
ರಂಜಕ	<11.45	11.45 to 22.9	22.91 to 57.25	57.26 to 91.60	>91.60
ಪೊಟ್ಟಿಡ್ಡೆ	<72.3	72.3 to 144.6	144.7 to 337.4	337.5 to 674.8	>674.8
ಸರಿಹೊಂದಿಸುವಿಕೆ	RDF x 1.67	RDF x 1.33	RDF x 1.00	RDF x 0.67	RDF x 0.33

RDF = ಬೆಳೆಗೆ ತಿಳಿದಿರುವ ಮಾತು ಪೋಷಕಾಂಶಗಳು

ಉದಾಹರಣೆ: ಮೇಲಿನ ಕೋಷ್ಟಕದ ಆಧಾರದಂತೆ, ಮಣ್ಣಿನ ಫಲವತ್ತತೆಯ ವರ್ಗೀಕರಣಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಮುಸುಕಿನ ಜೋಳಕ್ಕೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು 60:30:15 ಎಕರೆಗೆ ಕೆ.ಜಿ. ಗಳಲ್ಲಿ ಹಾಗೂ ಗೊಬ್ಬರಗಳನ್ನು ನಿರ್ಧರಿಸುವಿಕೆ

ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟ ಅತೀ ಕಡಿಮೆ ಇದ್ದಾಗ: ರಸಗೊಬ್ಬರಗಳು ಎಕರೆಗೆ ಕೆ.ಜಿ. ಗಳಲ್ಲಿ

ಸಾರಜನಕ - 60 (RDF x 1.67) = 100	ಯೂರಿಯಾ : 217	ಯೂರಿಯಾ : 175
ರಂಜಕ - 30 (RDF x 1.67) = 50	ಸೂಪರ್ ಫಾಸ್ಫೇಟ್ : 313	ಡಿಎಪಿ : 109
ಪೊಟ್ಟಿಡ್ಡೆ - 15 (RDF x 1.67) = 25	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 42	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 42

ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟ ಮಧ್ಯಮ ಇದ್ದಾಗ: ರಸಗೊಬ್ಬರಗಳು ಎಕರೆಗೆ ಕೆ.ಜಿ. ಗಳಲ್ಲಿ

ಸಾರಜನಕ - 60 (RDF x 1.00) = 60	ಯೂರಿಯಾ : 130	ಯೂರಿಯಾ : 105
ರಂಜಕ - 30 (RDF x 1.00) = 30	ಸೂಪರ್ ಫಾಸ್ಫೇಟ್ : 188	ಡಿಎಪಿ : 65
ಪೊಟ್ಟಿಡ್ಡೆ - 15 (RDF x 1.00) = 15	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 25	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 25

ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟ ಅತೀ ಹೆಚ್ಚು ಇದ್ದಾಗ: ರಸಗೊಬ್ಬರಗಳು ಎಕರೆಗೆ ಕೆ.ಜಿ. ಗಳಲ್ಲಿ

ಸಾರಜನಕ - 60 (RDF x 0.33) = 20	ಯೂರಿಯಾ : 44	ಯೂರಿಯಾ : 35
ರಂಜಕ - 30 (RDF x 0.33) = 10	ಸೂಪರ್ ಫಾಸ್ಫೇಟ್ : 63	ಡಿಎಪಿ : 22
ಪೊಟ್ಟಿಡ್ಡೆ - 15 (RDF x 0.33) = 5	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 08	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಟಿಡ್ಡೆ : 08

REWARD ಯೋಜನೆ, ಪರಾವಯವ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಟಿಡ್ಡೆಯಂ
ರಾಗಿ 	20 40	16 20	15 20
ಮುಸುಕಿನ ಜೋಳ 	40 60	20 30	10 15
ನೆಲಗಡಲೆ 	10 10	20 30	10 15
ತೊಗರಿ 	10	20	10
ಸೂರ್ಯಕಾಂತಿ 	15 36	20 36	15 25

ಈ ಏಜ್ಡ್ ಸಂಖ್ಯೆ, ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ
REWARD ಯೋಜನೆ, ಪರಾವಯವ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಟಿಡ್ಡೆಯಂ
ಟೊಮ್ಯಾಟೊ 	100	100	100
ಮೆಣಸಿನಕಾಯಿ 	40 60	20 30	20 30
ಹತ್ತಿ 	32 60	16 30	16 30
ಶುಂಠಿ 	40	20	20
ಅರಿಶಿನ 	60	50	100

ಈ ಏಜ್ಡ್ ಸಂಖ್ಯೆ, ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ
REWARD ಯೋಜನೆ, ಪರಾವಯವ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

REWARD ಯೋಜನೆಯಡಿ ಪೈಲಟ್ ಅಧ್ಯಯನ

ಭೂ ಸಂಪನ್ಮೂಲ ಸಮೀಕ್ಷೆ (LRI) ಆಧಾರಿತ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆ

ಹಿರಿತರ ಪದ್ಧತಿ

- ಕೆಲವು ಕೃಷಿಗಾರರ ಸಾಂಪದ್ಯ ಗಣಿಗಾರ್
- ಕಡಿಮೆ ಪ್ರಮಾಣದ ಪದ್ಧತಿಗಾರ್
- ಕಡಿಮೆಯಲ್ಲಿ ಕಡಿಮೆ ಸಾಂಪದ್ಯದ ಇಂಪೂರಟೆ

ಕಡಿಮೆ ಪದ್ಧತಿ

- ಕಡಿಮೆ ಕೃಷಿಗಾರರ ಸಾಂಪದ್ಯ ಗಣಿಗಾರ್
- ಕಡಿಮೆ ಪ್ರಮಾಣದ ಪದ್ಧತಿಗಾರ್
- ಕಡಿಮೆಯಲ್ಲಿ ಕಡಿಮೆ ಸಾಂಪದ್ಯದ ಇಂಪೂರಟೆ

ಅನುನಿರೀಕ್ಷಿಸಲಾದ ಪದ್ಧತಿ

- ಭೂ ಸಂಪನ್ಮೂಲ ಸಮೀಕ್ಷೆ ಆಧಾರಿತ ಗಣಿಗಾರ್ಗಳ ಬಳಕೆ
- ಸಾಂಪದ್ಯದ ಇಂಪೂರಟೆ ಪರಿಶೀಲನೆ ಮತ್ತು ಕೈಗೊಳ್ಳುವುದು

REWARD ಯೋಜನೆ, ಪರಾವಯವ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

Posters/ charts for display in prominent places in village

ಗೊಬ್ಬರಗಳ ಬಳಕೆಯಲ್ಲಿ ಬದಲಾವಣೆ



ಹಿಂದಿನ ಪದ್ಧತಿ

- ಹೆಚ್ಚಿನ ಪ್ರಮಾಣ ಸಾವಯವ ಗೊಬ್ಬರ
- ಕಡಿಮೆ ಪ್ರಮಾಣ ರಸಗೊಬ್ಬರ
- ಭೂಮಿಯಲ್ಲಿ ಹೆಚ್ಚು ಸಾವಯವ ಇಂಗಾಲ

ಹೆಚ್ಚು ಫಲವತ್ತತೆ



ಈಗಿನ ಪದ್ಧತಿ

- ಕಡಿಮೆ ಪ್ರಮಾಣ ಸಾವಯವ ಗೊಬ್ಬರ
- ಹೆಚ್ಚು ಪ್ರಮಾಣ ರಸಗೊಬ್ಬರ
- ಭೂಮಿಯಲ್ಲಿ ಕಡಿಮೆ ಸಾವಯವ ಇಂಗಾಲ

ಕಡಿಮೆ ಫಲವತ್ತತೆ

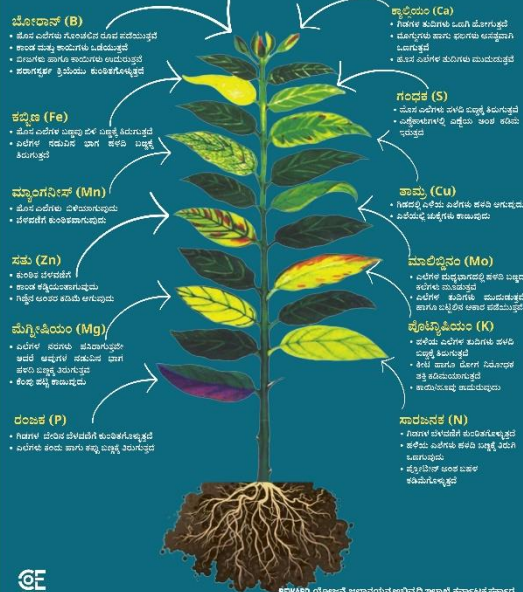


ಅನುಸರಿಸಬೇಕಾದ ಪದ್ಧತಿ

- ಭೂ ಸಂಪನ್ಮೂಲ ಸಮೀಕ್ಷೆ ಆಧಾರಿತ ಗೊಬ್ಬರಗಳ ಬಳಕೆ

ಸಾವಯವ ಇಂಗಾಲ ಹೆಚ್ಚಿಸಲು ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು

ಬೆಳೆಗಳಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆಯ ಲಕ್ಷಣಗಳು



ಬೋರ್ಡಾನ್ (B)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರದಿಂದ ದೂರ ಮಾಡುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ರಾಸಾಯನಿಕ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಕಾಂಕ್ರೀಟ್ ಕ್ರಿಯೆಯು ಕಾರ್ಬೋನೇಟ್ ಅನ್ನು ಕಡಿಮೆ ಮಾಡುತ್ತದೆ

ಕ್ರೋಮಿಯಂ (Cr)

- ಬದಲಿಗೆ ಉಪಯುಕ್ತವಾದ ಉಪಕರಣಗಳನ್ನು ಬಳಸುವುದು
- ಬದಲಿಗೆ ಉಪಯುಕ್ತವಾದ ಉಪಕರಣಗಳನ್ನು ಬಳಸುವುದು

ಮ್ಯಾಂಗನೀಸ್ (Mn)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಬದಲಿಗೆ ಉಪಯುಕ್ತವಾದ ಉಪಕರಣಗಳನ್ನು ಬಳಸುವುದು

ಸೆಸುಮ್ (Zn)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಮ್ಯಾಂಗನೀಸ್ (Mg)

- ಬದಲಿಗೆ ಉಪಯುಕ್ತವಾದ ಉಪಕರಣಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ರಂಜಕ (P)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಬದಲಿಗೆ ಉಪಯುಕ್ತವಾದ ಉಪಕರಣಗಳನ್ನು ಬಳಸುವುದು

ಕ್ಯಾಲ್ಸಿಯಂ (Ca)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಗಂಧಕ (S)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ತಾಮ್ರ (Cu)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಮಾಲ್ಡಿಯೋಮ್ (Mo)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಪೊಟ್ಯಾಷಿಯಂ (K)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಸಾರಜನಕ (N)

- ಹಿರಣಿ ಎಲೆಕ್ಟ್ರಾನ್ ಗೊಬ್ಬರಗಳನ್ನು ಬಳಸುವುದು
- ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು
- ಗಡ್ಡೆ ಅಂಚೆ ಮತ್ತು ಕಾಂಕ್ರೀಟ್ ಬಳಸುವುದು

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಯಾಷಿಯಂ
ರಾಗಿ	20 40	16 20	15 20
ಮುಸುಕಿನ ಬೋಳ	40 60	20 30	10 15
ನೆಲಗಡಲೆ	10 10	20 30	10 15
ತೊಗರಿ	10	20	10
ಸೂರ್ಯಕಾಂತಿ	15 36	20 36	15 25

ಈ ಟಿಪ್ಪಣಿ ಸಂಸ್ಥೆ, ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಯಾಷಿಯಂ
ಟೊಮ್ಯಾಟೊ	100	100	100
ಮೆಣಸಿನಕಾಯಿ	40 60	20 30	20 30
ಹತ್ತಿ	32 60	16 30	16 30
ಶುಂಠಿ	40	20	20
ಅರಿಶಿನ	60	50	100

ಈ ಟಿಪ್ಪಣಿ ಸಂಸ್ಥೆ, ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ

ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ದುಷ್ಪರಿಣಾಮಗಳು

ಮಣ್ಣು



- ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಅಸಮತೋಲನ ಉಂಟಾಗಿ ಬೆಳೆಗಳಿಗೆ ಪೋಷಣ್ಣತಾಂಶಗಳ ಕೊರತೆ
- ಮಣ್ಣಿನಲ್ಲಿರುವ ಉಪಯುಕ್ತ ಸೂಕ್ಷ್ಮಜೀವಿ ಜೀವಿಗಳ ಸಂಖ್ಯೆ ಕಡಿಮೆಯಾಗುತ್ತದೆ
- ಮಣ್ಣಿನ ರಸವೂ 6.5 ಕ್ಷಿಂಶ ಕಡಿಮೆಯಾಗಿ ಹುಳ ಮುಟ್ಟಾಗಿ ಪರಿವರ್ತನೆ
- ಧಾರಿ ವೋಹದ ವಸ್ತುಗಳು ಸೇರುತ್ತವೆ
- ಘೌತಕ ಜೀವಿ ರಾಸಾಯನಿಕ ಗುಣಗಳ ಏರುಪೇರಿನಿಂದ ಬೆಳೆಗಳಿಗೆ ಹಾನಿ

ಅಂತರ್ಜಲ



- ಅಮೋನಿಯಾ, ಕಾರ್ಬನ್ ಡೈ ಆಕ್ಸೈಡ್, ಮೀಥೇನ್ ಮುಂತಾದವುಗಳು ನೀರನ್ನು ಸೇರಿ ಮಲಿನಗೊಳಿಸುತ್ತವೆ
- ಮಣ್ಣಿಗೆ ನೈಟ್ರೇಟ್ ಅಂಶ ಸೇರಿನಲ್ಲಿ ಬೆರೆಯುವುದರಿಂದ ಮಕ್ಕಳಲ್ಲಿ Blue Baby Syndrome ಕಂಟುಬರುತ್ತದೆ
- ನೀರಿನಲ್ಲಿ ಪಾಚಿ ಬೆಳೆದು (Algae) ಒಲಚರಗಳ ಉತ್ಪಾದನೆಗೆ ತೊಂದರೆಯಾಗುತ್ತದೆ

ವಾತಾವರಣ



- ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗಿ ಹಸಿರು ಮನೆಮ ಅರಿವಿಗಳು (ನೈಟ್ರೇಟ್ ಆಕ್ಸೈಡ್, ಅಮೋನಿಯಾ) ವಾತಾವರಣಕ್ಕೆ ಧುಮುಕುತುಂಟಾಗುತ್ತವೆ
- ಹಸಿರು ಮನೆ ಪರಿಹಾಸು ಹೆಚ್ಚಾಗಿ ವಾತಾವರಣದಲ್ಲಿನ ತಾಪಮಾನ ಏಚ್ಚಾಗುತ್ತದೆ



REWARD ಯೋಜನೆ, ಜನಾರಂಭದ ಅರಿವನ್ನಿ ಉಂಟು ಕುರ್ತುಕೂಟದ ಸರ್ಕಾರ

