



University of Agricultural Sciences, Bangalore

Reference Material
on
Application of LRI Approach for Crops Selection,
Nutrient Management and Agro-Advisories under
REWARD Program

August, 2024

Special Officer



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Training Module

- 1. Background:** Land Resource Inventory (LRI) provides cadastral level specific information which is helpful for selection of appropriate crops for a given survey number and crop specific fertilizer recommendations based on the fertility status of the soils. This information is provided to all the farmers in the selected watersheds through distribution of LRI cards. Further, agro-advisories through Varuna Mitra platform, SMS and bulletins are provided to all the farmers. It is important to educate the farmers on effective utilization of information provided in the LRI card for crops selection, nutrient management and crop production utilizing the timely advisories provided.

The major implementation responsibility of REWARD program rests with the Project Implementing Agency (PIA) consisting of ADA, AO, AAO, DPC, Watershed Assistants-WA, LRI Extension Manager, Team Leader of FNGO, FNGO-Training Coordinator/ Watershed Manager, RSK staff, etc., through Watershed Executive Committee (WEC) at the watershed level. Out of these functionaries, the DPC, Watershed Assistants-WA, LRI Extension Manager, Team Leader of FNGO, FNGO-Training Coordinator/ Watershed Manager, will work very closely with the communities, who have diversified educational backgrounds and experience. Hence, they need to be equipped with technological aspects of utilization of information presented in the LRI card for crops selection, nutrient management and agro-advisories. With this background, the training has been scheduled with the following objectives.

- a. To impart skills to field level functionaries working at watershed level under REWARD program on interpretation of information presented in the LRI cards for crops selection and crop wise aligning fertilizers as per LRI information
 - b. To educate the field level functionaries of REWARD program on the techniques of convincing farmers on adoption of LRI recommendations and documenting their adoption status
 - c. To make the field level functionaries to understand approaches followed in generating and disseminating agro-advisories and required action at the field level to make the farmers to adopt the disseminated advisories
- 2. Training participants:** AO/ AAO, District Project Coordinators, Team Leaders-NGO, LRI Extension Managers, Watershed Managers, Watershed Assistants, numbering about 125 will be trained in three batches
 - 3. Duration:** Five days (August 19-23, 2024, August 26-30, 2024, & September 02-06, 2024)
 - 4. Venue:** Centre of Excellence on Watershed Management, UAS, Bangalore, and Villages in Tumkur/ Chamarajanagar Districts
 - 5. Training methods:** Discussions and Exercises

6. Session Plan:

#	Topic	Time	Methods	Resource Person
Day-1				
1	Registration and pre-test	10.00-11.00	Exercise	CoE-WM Staff
2	Understanding status of LRI card distribution and utilization of LRI cards by farmers	11.00-11.30	Group exercise	Nagaraja, N Sagar, R
3	Purpose of LRI Trainings and LRI cards under REWARD	11.30-12.30	PPT Discussion	Geetahalli
4	Role of nutrients in plant growth, ill effects of indiscriminate use of fertilizers.	12.30-15.00	PPT Discussion	Prakash, N B Prakash, S S
5	LRI process and maps related to crop suitability and nutrient management	15.00-16.00	PPT Discussion Exercise	Sathish, A
6	Crops selection as per suitability of land	16.00-17.00	PPT Discussion Exercise	Ramamurthy, V
Day-2				
7	LRI card-importance, contents, and its interpretation	09.00-10.30	PPT Discussion	Rajendra Hegde
8	Fertilizer dosage for major crops and fertilizers adjustment as per the soil fertility status	10.30-13.00	PPT Discussion Exercise	Vasundhara, R
9	LRI based crops selection and improved crop production practices including INM, IPM	14.00-15.30	PPT Discussion	Thimmegowda, M N
10	Approach for farmers' behavioral change towards LRI based fertilizer application	15.30-17.00	PPT Discussion	Nagaraja, N
Day-3				
Methods for changing the behavior of farmers towards LRI based fertilizer application				
11	Focus group discussion	09.00-10.30	PPT Discussion Exercise	Chandregowda, M J
12	Participatory training	10.30-12.00	PPT Discussion Exercise	Nagaraja, N Divyashree, K S
13	PRA tools for understanding village ecosystem, existing approaches in natural resources management and to develop framework for promotion of LRI based approaches	12.00-13.30	PPT Discussion Exercise	Manjunatha, M
14	Case study analysis	14.30-16.00	PPT Discussion Exercise	Nagaraja, N Sagar, R Divyashree, K S

#	Topic	Time	Methods	Resource Person
15	Use of social media	16.00-17.00	PPT Discussion	Raghuprasad
Day-4				
16	Field visit-discussion with farmers involved in pilot study on LRI based fertilizer application and practicing educational game	08.00-17.00	Discussion	Sagar, R Divyashree, K S Manjunatha, M
Day-5				
17	Agro-advisories – approaches followed in generation and dissemination	09.00-10.30	PPT Discussion	Thimmegowda, M N Shivakumar Naiklal, H S
18	Approaches to be followed by the project staff to convince farmers to adopt the advisories sent	10.30-12.00	PPT Discussion Exercise	Nagaraja, N Thimmegowda, M N
19	Documenting the status of adoption of LRI recommendations by the farmers	12.00-13.30	Discussion Exercise	Nagaraja, N Parameshwarappa, K J Kumar Raju
20	SWS wise action plan preparation and presentation by the project staff	14.30-15.30	Discussion Presentation	Prakash, N B Nagaraja, N Kumar Raju
21	Training feedback and evaluation	15.30-16.30	Exercise	CoE-WM Staff

CoE-WM Staff:

CoE-WM Research team: Drs: Divyashree, K. S., Lakshminarayana, S. V., Lingaraj Huggi, Premalatha, K., Pruthviraj, N., Rochana S. Roshan, Sagar, R., Soundarya, H. L., Virupaksha, H. S.

Details of Resource Persons:

Dr. Chandregowda, M. J., Principal Scientist, ATARI, Bangalore
 Dr. Geetahalli, DDA (REWARD), WDD, Bangalore
 Dr. Kumar Raju, B. C., Consultant (Hydrology), WDD, Bangalore
 Dr. Manjunatha, M, Consultant (Capacity Building), WDD, Bangalore
 Dr. Nagaraja, N., Consultant, CoE-WM, GKVK
 Dr. Parameshwarappa, K. J., Consultant (M&E), WDD, Bangalore
 Dr. Prakash, N. B., Dean (Agri.) and Special Officer, CoE-WM, GKVK
 Dr. Prakash, S. S., Former Dean (Agri), CoA, Mandya, and Special Officer, CoE-WM
 Dr. Raghuprasad, Professor & Head, ATIC, GKVK, Bangalore
 Dr. Rajendra Hegde, Principal Scientist, RC-NBSS&LUP, Bangalore
 Dr. Ramamurthy, V., Principal Scientist & Head, RC-NBSS&LUP, Bangalore
 Dr. Sathish, A., Professor of SS&AC, GKVK, Bangalore
 Dr. Shivakumar Naiklal, H. S., Scientific Officer, KSNDCM, Bangalore
 Dr. Thimmegowda, M. N., Professor & Head, Agrometeorology, GKVK, Bangalore
 Dr. Vasundhara, R., Senior Scientist, RC-NBSS&LUP, Bangalore

Chapter-1

Land Resource Inventory (LRI)

Chapter-1 covers a brief description on the process followed in land resource inventory, its importance and outputs available for selection of crops for a given survey number based on land suitability and nutrient management for the selected crops based on soil fertility status of the soil

It is a recognized fact that the factors and processes affecting degradation, productivity and sustainability are very site and location specific. For any meaningful intervention needed for their restoration and management requires site-specific land resource information which is not available at present for major part of the country.

As the land resources are not uniform and vary from field to field in any given landscape, generation of location specific information pertaining to the nature and extent of variability in soil, water availability, topography, land use, and advisories is a prerequisite for successful planning and implementation of development programs by agriculture, horticulture, watershed, forestry, irrigation, and other programs in any area.

The site-specific information can be obtained by conducting Land Resource Inventory. Land Resource Inventory (LRI) is an assessment of the status and changing condition of soil, water and related resources at the field level.

The LRI provides a diagnostic report for taking up appropriate soil and water conservation measures, reclamation of physically/chemically degraded lands/soils, improved crop production and diversification for enhanced productivity and profits and to take up livelihood support activities for the communities.

The LRI parameters considered for assessment are Geology, Soil depth, Soil texture, Soil gravelliness, Soil colour, Slope, Erosion, Drainage & flooding, Soil structure, Available Water Capacity, Land Capability Classification.

The fertility parameters assessed as part of LRI are Organic carbon, EC, pH, Macronutrients (N, P, K), Secondary nutrients (Ca, Mg, S), Micronutrients (Fe, Mn, Zn, B, Cu).

For LRI and hydrological assessments, the map inputs required from the remote sensing application centre include (a) physiography and geology map of watershed, (b) sub-watershed boundary, (c) micro watershed boundary, (d) village boundary, (e) drainages, waterbodies, roads, railways, habitation, (f) cadastral map (survey no plots - 1:7920 scale), (g) grids (points)

at 320 m interval for collection of soil samples, (h) two-meter contour lines overlaid on satellite imagery, (i) satellite imagery (False Color Composite) 5 m resolution. Serial number b to h are to be overlaid on satellite imagery.

The LRI is carried out by conducting a series of activities in a sequential order. These activities can be grouped under three phases namely pre-field activities, field and post field activities phase.

Pre field activities: Under pre field activity phase, most important activity is preparation of base map which is derived from integration and interpretation of cadastral map and satellite imagery.

In the process of LRI assessment, selection and use of appropriate base map is critical for the generation of required data. The cadastral map is the source which can provide all the needed information. The cadastral map provides information on the field boundaries with survey numbers, location of tanks, streams, wells, habitations and other permanent features of an area. Delineation of land forms like hills, uplands, valleys, salt affected areas etc. is the base for LRI work and it is also called as image interpretation. For delineation of various landform features accurately, and to know their extent, high resolution remote sensing data products like Worldview has to be used. Two-meter contour intervals are extracted using Digital Elevation Model (DEM) and the same is overlaid on imagery improves the accuracy of the landform delineation and description at the field level.

Field activities: In the field activities phase, first and foremost action is field traversing for checking the variations in rock types, landforms, soil site characters etc. in the field from the base map and correcting accordingly. The second order action under field activity phase is well inventory and preparation of maps in respect of land use and land cover, existing conservation and water harvesting structures. Third order actions within the field activities phase are collection of soil samples from grid points for fertility analysis, studying soil profiles and site characteristics, collection of samples from master profiles, grouping similar areas based on soil characteristics into mapping units.

Post field activities: The post field activities include finalization of soil map with descriptive legend followed by analysis of soil samples, processing of field data into land capability and suitability groups. The next order activities among post field activities include preparation of conservation plan, crops suitability plan and various thematic maps based on collected and processed data through the GIS platform. Concurrently, in addition to field level data, meteorological data, demographic, socio-economic and farmers' details will also be captured and used appropriately.

After completion of pre field, field and post field activities, the LRI output is presented in the form of LRI atlas for each micro watershed and the same is uploaded to the digital library/portal for its use for generation of DPR. The LRI atlas will provide bundle of details relating to a micro-watershed.

1. Firstly, it provides general description of the micro watershed and cadastral maps as well as satellite imagery.
2. Secondly, the LRI atlas will have maps to highlight physiography and geology of the micro watershed, current land use, location of wells and existing conservation structures.
3. Thirdly, atlas depicts the extent of slope, erosion, texture, drainage, gravelliness etc. as part of the site characteristics of the micro watershed.
4. Fourthly, the LRI atlas will have another important map that is soil phase map. Soil phase means, the soils with same/ similar characteristics will be grouped in to one unit which is also called as soil mapping unit. Soil phases are alpha numerically coded to explain the soil series, texture, slope, erosion, gravelliness, stoniness and rockiness. If a soil phase is coded as **BNKaB1g1St1 R2** first three alphabets **BNK** indicate the soil series, next alphabet **a** indicate texture(sand), next alphabet **B** indicate the slope (1-3%), next numeral **1** indicate erosion(slight), next alpha-numeral **g1** indicate gravelliness (15-35%), next alpha-numeral **St1** indicate stoniness (0.01to 0.1%), alpha numeral **R2** indicate rockiness (10-25%). Utility of soil phase map is to simplify the process of selecting the conservation measures and crops. For example, 500 ha micro watershed area may have 20 soil phases. So, one soil phase will have several survey numbers. If a conservation measure is suggested to a soil phase, it will be the same for all the survey numbers in the micro watershed. Similarly, the crop suitability plan.
5. Fifthly, the LRI atlas will also have maps indicating the land capability classes and soil phase wise proposed conservation and crop plans.
6. Sixthly, the soil fertility maps presented in the LRI atlas indicate the status of macro and micro nutrients, pH, EC and OC to optimize the application of nutrients and to improve the soil properties.

Crop Selection based on LRI data

For selection of suitable crops for the given land, the decision support system (DSS) for the crop suitability is developed. It will guide the implementing personnel of watershed program or extension functionaries of line departments and farmers on the suitability of crops for each parcel of land in the micro watershed.

The process followed in developing DSS on crop suitability is, specific requirements of a crop are compared with the characteristics of land and suitability of the area for the crop is arrived at based on matching. If the land characteristics of an area match with requirements of the selected crop, then area is considered as suitable for crop, otherwise it is grouped as not suitable for the crop.

Site specific land resources database generated through LRI helps to establish the suitability of the resources to any selected crop for the area in an objective manner. The land suitability classification for crops is divided in to four categories, namely orders, classes, subclasses and units.

At the order level, the mapping units are grouped into suitable(S) or not suitable(N) based on kinds of suitability for the selected land use. The orders are divided in to classes based on the degrees of suitability as S1, S2, S3 and N1 and N2 for non-suitability

S1 is considered as highly suitable and land unit having no limitation for sustainable use. S2 is considered as moderately suitable and land unit not having more than three moderate limitations. S3 is considered as marginally suitable and land unit having more than three moderate limitations but not more than two severe limitations. N1 is considered as currently not suitable due to severe limitations, that may be overcome in time. N2 is considered as permanently not suitable due to the constraints which cannot be corrected.

The classes are further divided in to subclasses based on kinds of limitations.

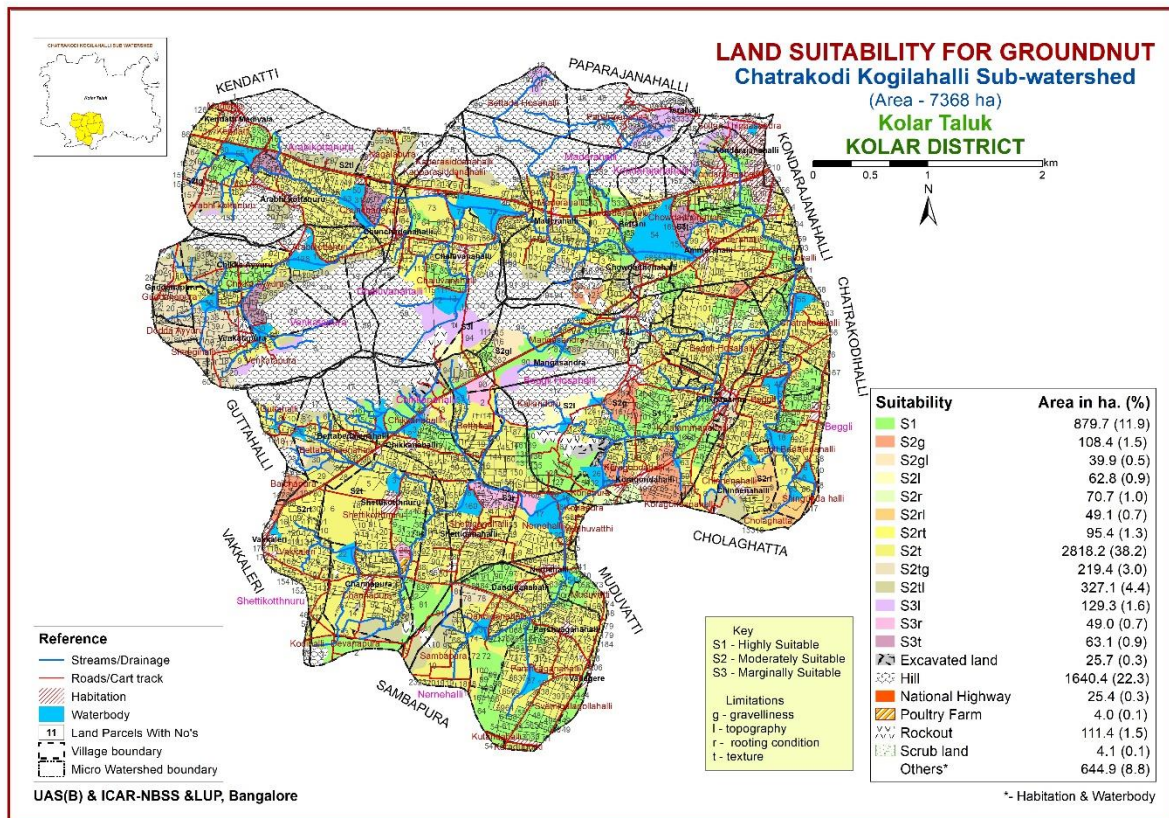
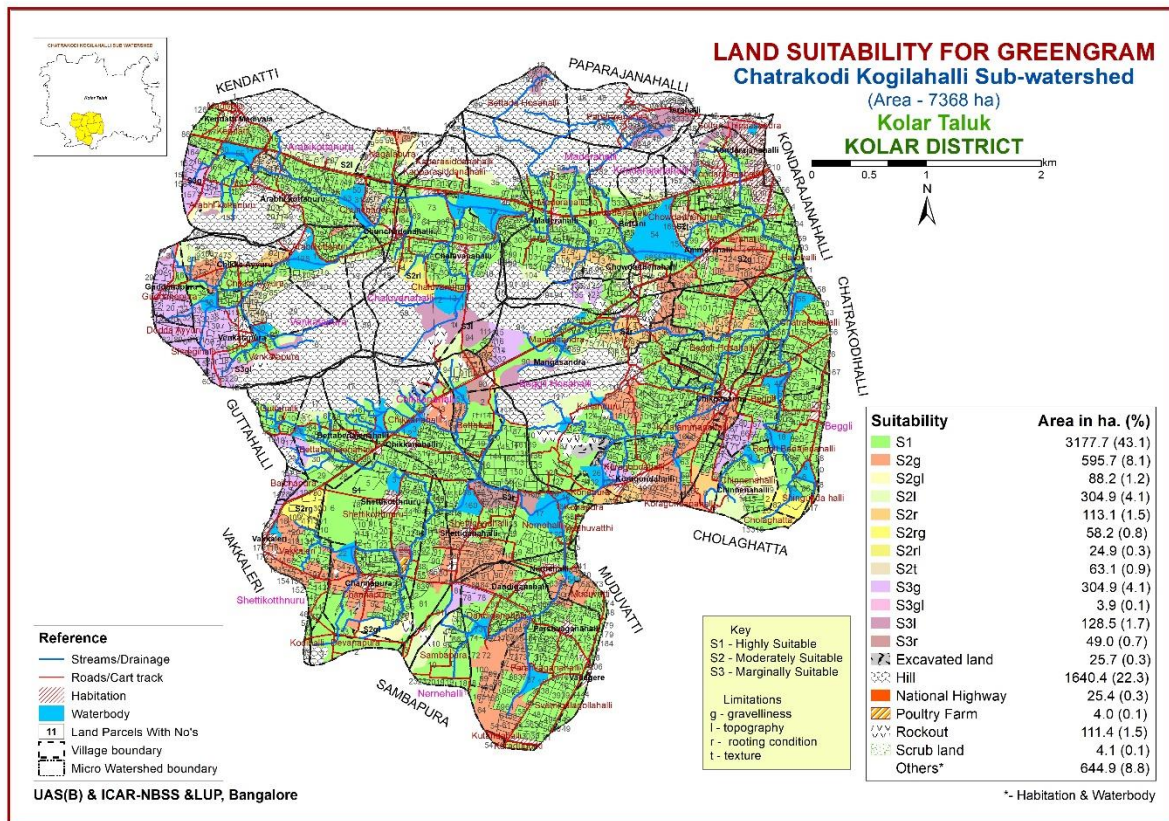
The subclasses are divided into land suitability units based on specific management requirements. The ratings used for defining each class are based on the number and degree of limitations present. The decision criteria considered for development of DSS on crops suitability under Sujala-3 project/ REWARD program are soil depth, gravel content, slope percentage, soil texture and soil drainage. The additional criteria to be considered for crops selection are, soil reaction, salinity, sodicity and length of growing period.

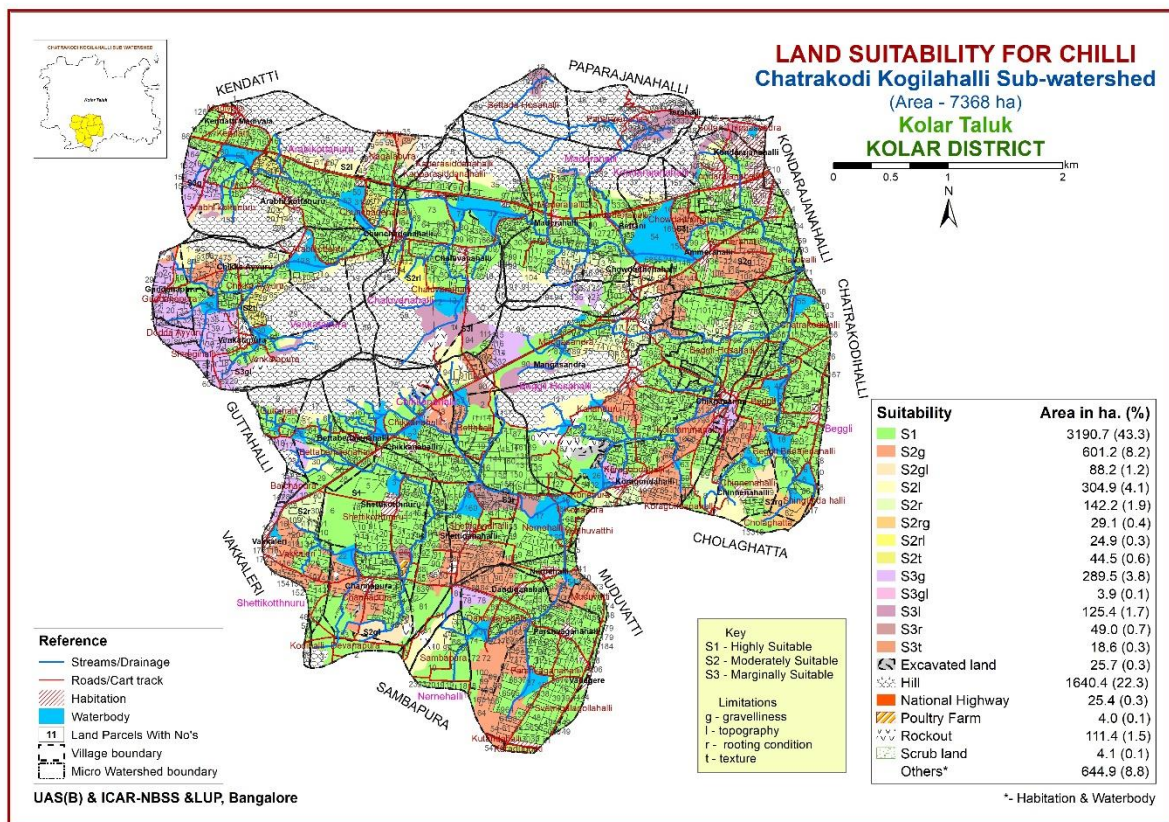
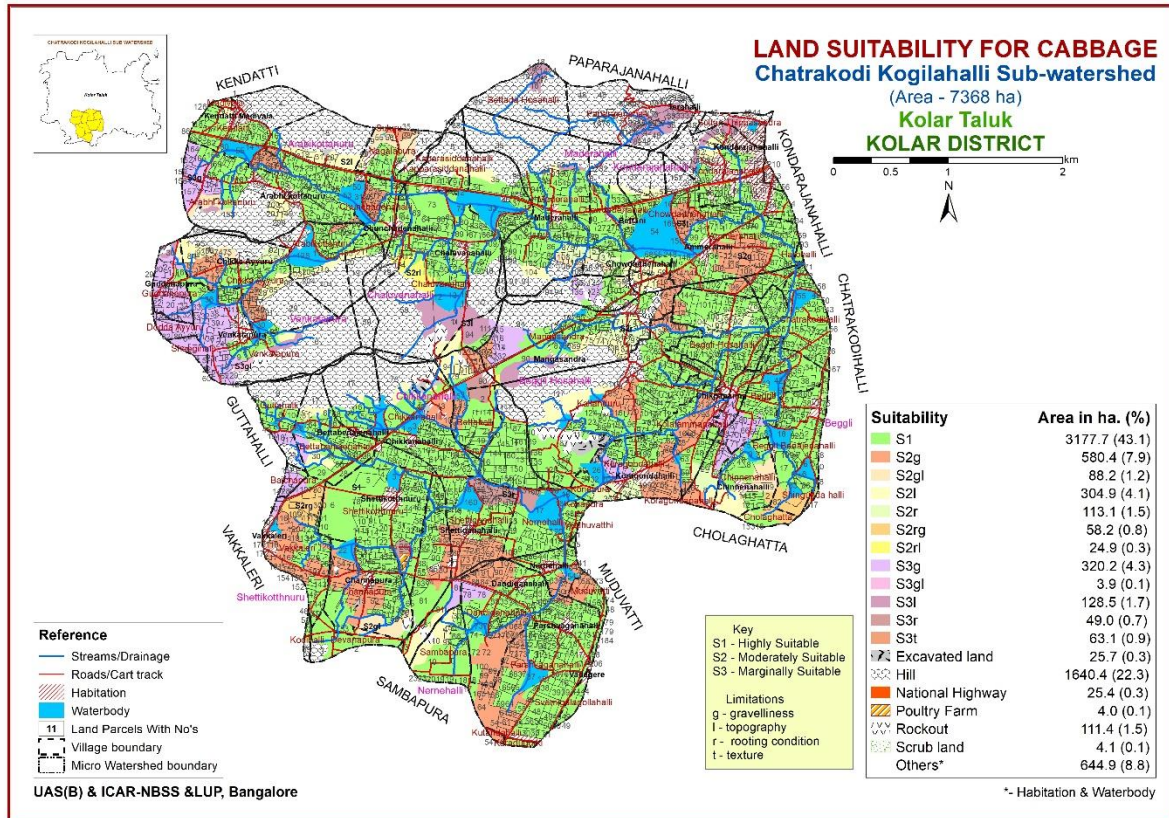
An example pigeon pea crop suitability to a soil phase JDGcA1 is explained as follows:

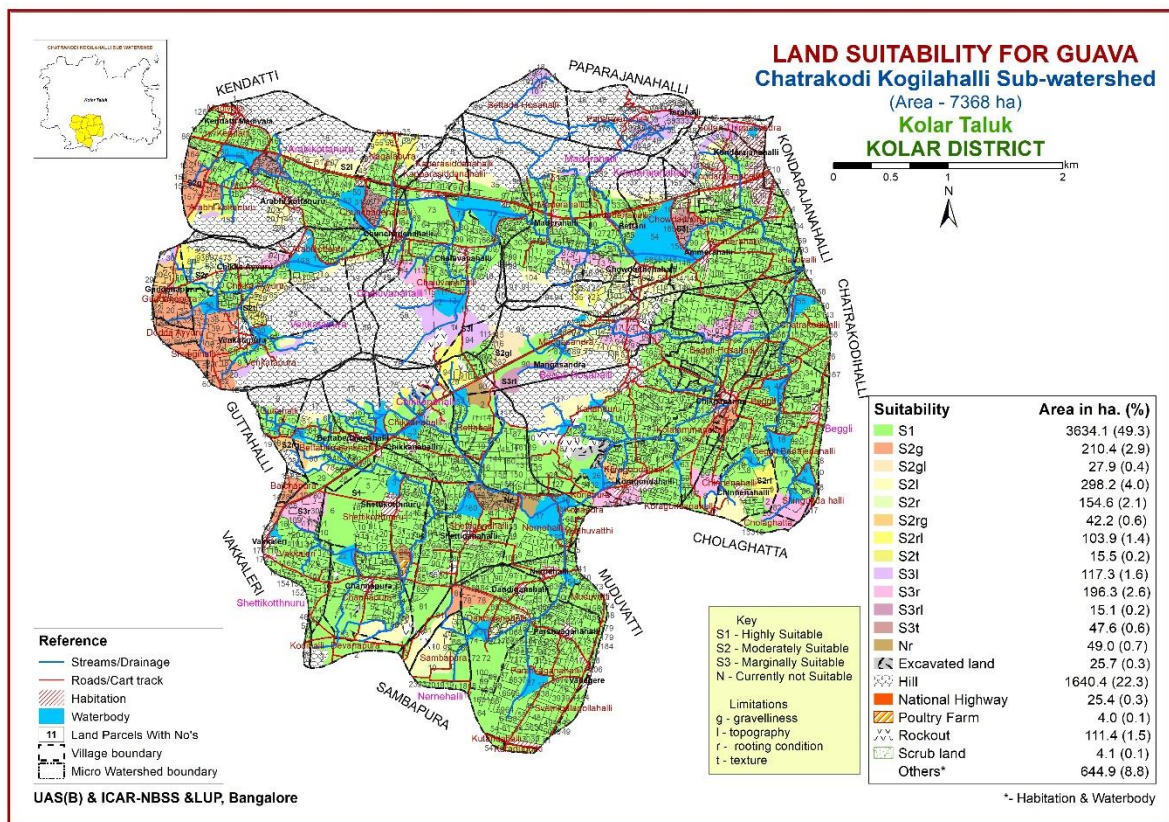
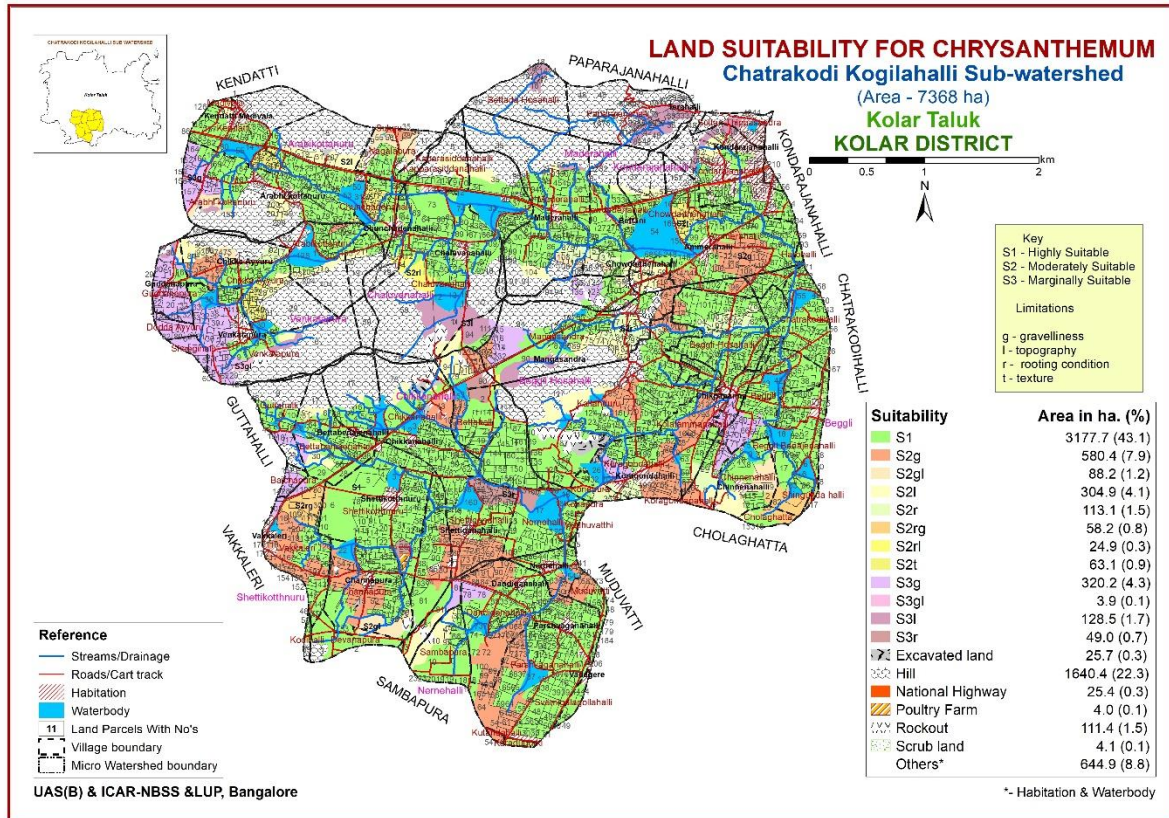
Soil depth is 50- 75 cm (S3), gravel content 8% (S1), soil texture-sandy clay (S1), slope -0-1% (S1), drainage-moderately well (S2).

The inference for the exercise is pigeon pea is marginally suitable to this soil phase as it has rooting limitation due to lesser soil depth and suitability class is abbreviated as S3r considering Liebig's Law of the Minimum.

An example of crop suitability maps are presented below:







LRI based Nutrient Management

Based on LRI information, soil fertility status of each land parcel is classified as very low, low, medium, high and very high in the fertility maps.

Very low: The limits fixed for classifying soils as very low for major nutrients, the available N to be less than 140kg/ha; P₂O₅ to be less than 11.45 kg/ha; and available K₂O to be less than 72.3 kg/ha.

Low: The limits fixed for classifying soils as low for major nutrients, the available N to be in the range of 140-280kg/ha; P₂O₅ to be between 11.45-22.90 kg/ha; and available K₂O to be between 72.3-144.60 kg/ha.

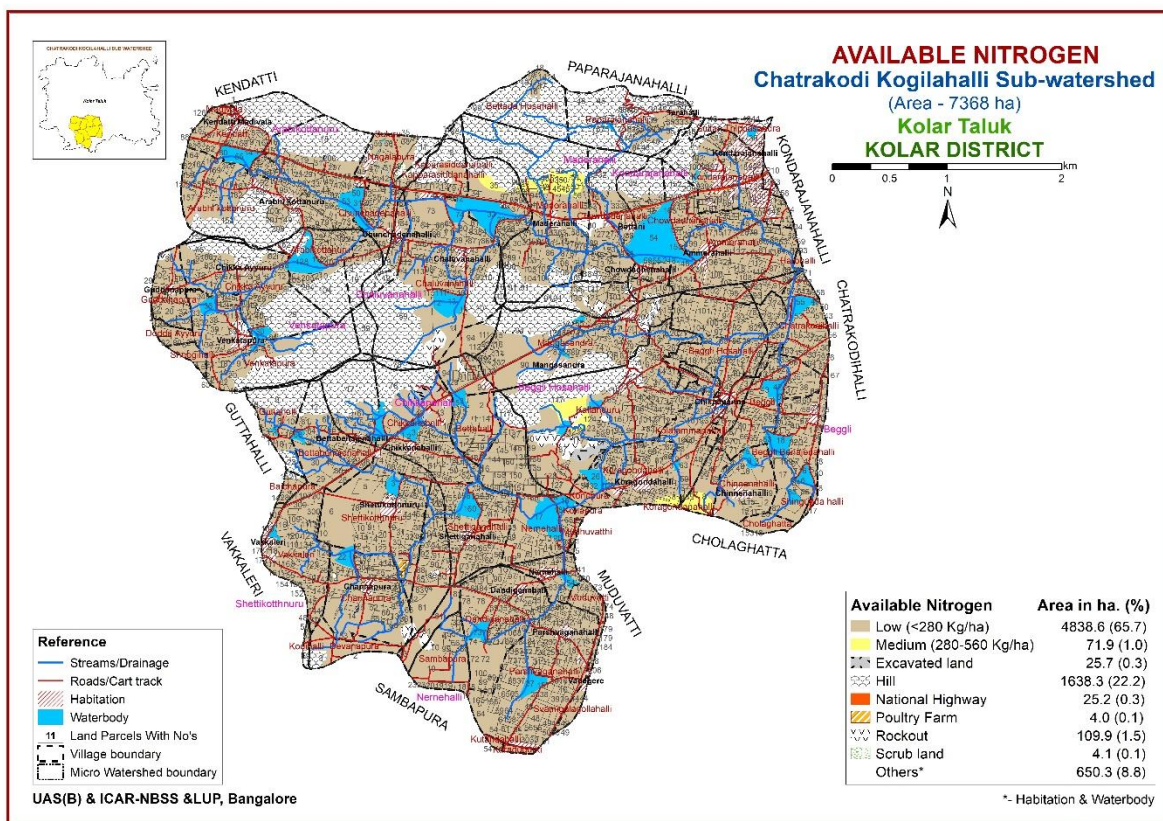
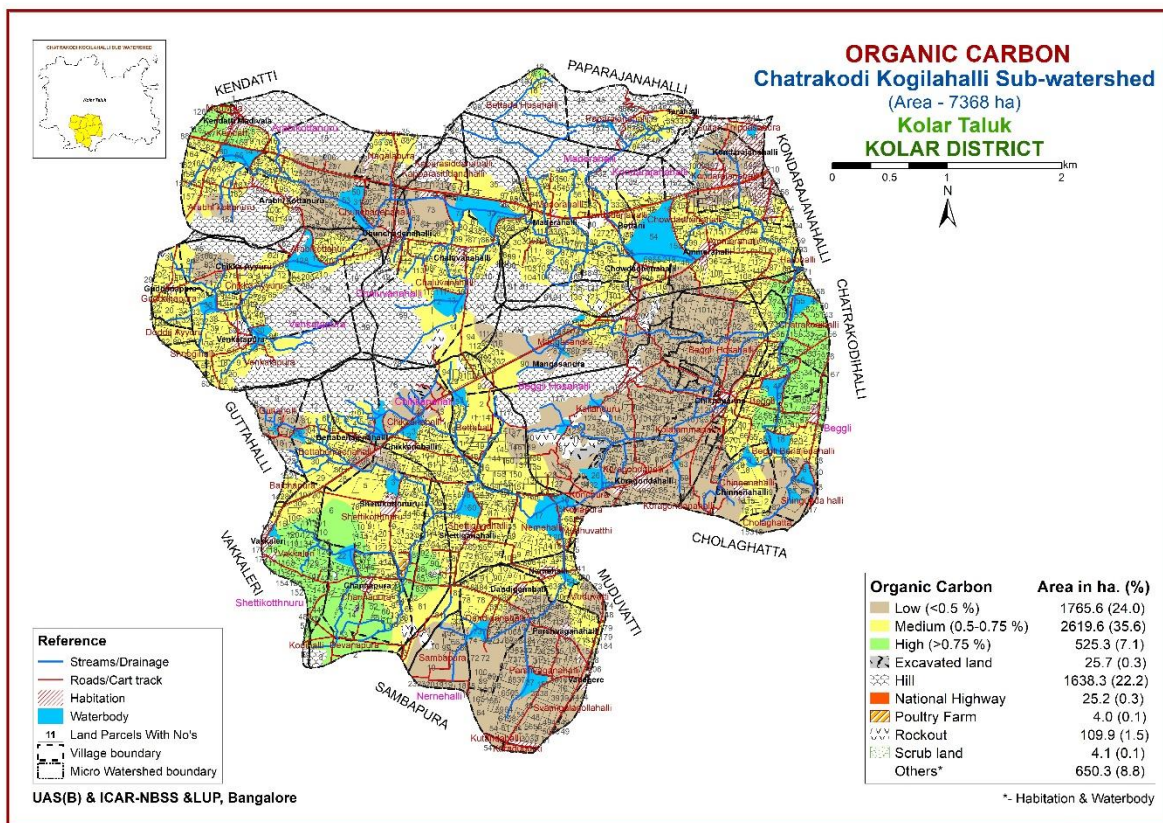
Medium: The limits fixed for classifying soils as medium for major nutrients, the available N to be in the range of 281-560 kg/ha; P₂O₅ to be between 22.91 & 57.25 kg/ha; and available K₂O to be between 144.70 & 337.40 kg/ha.

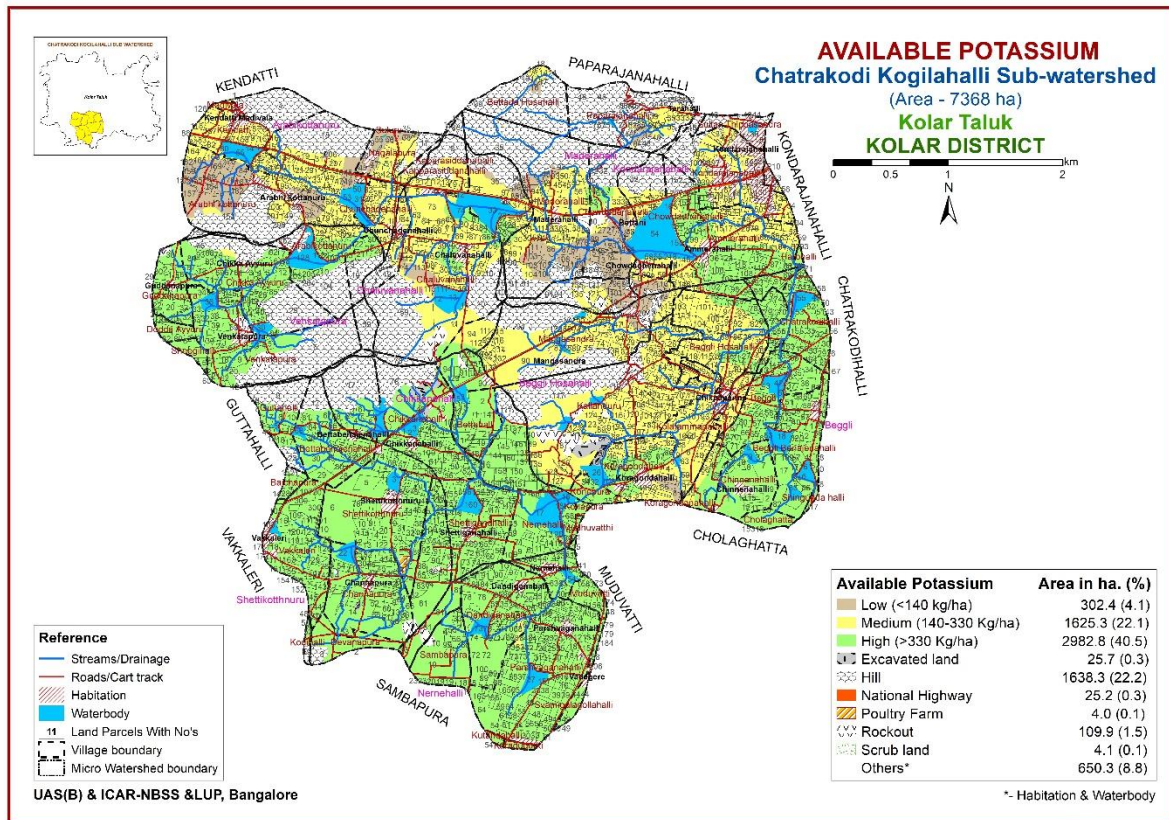
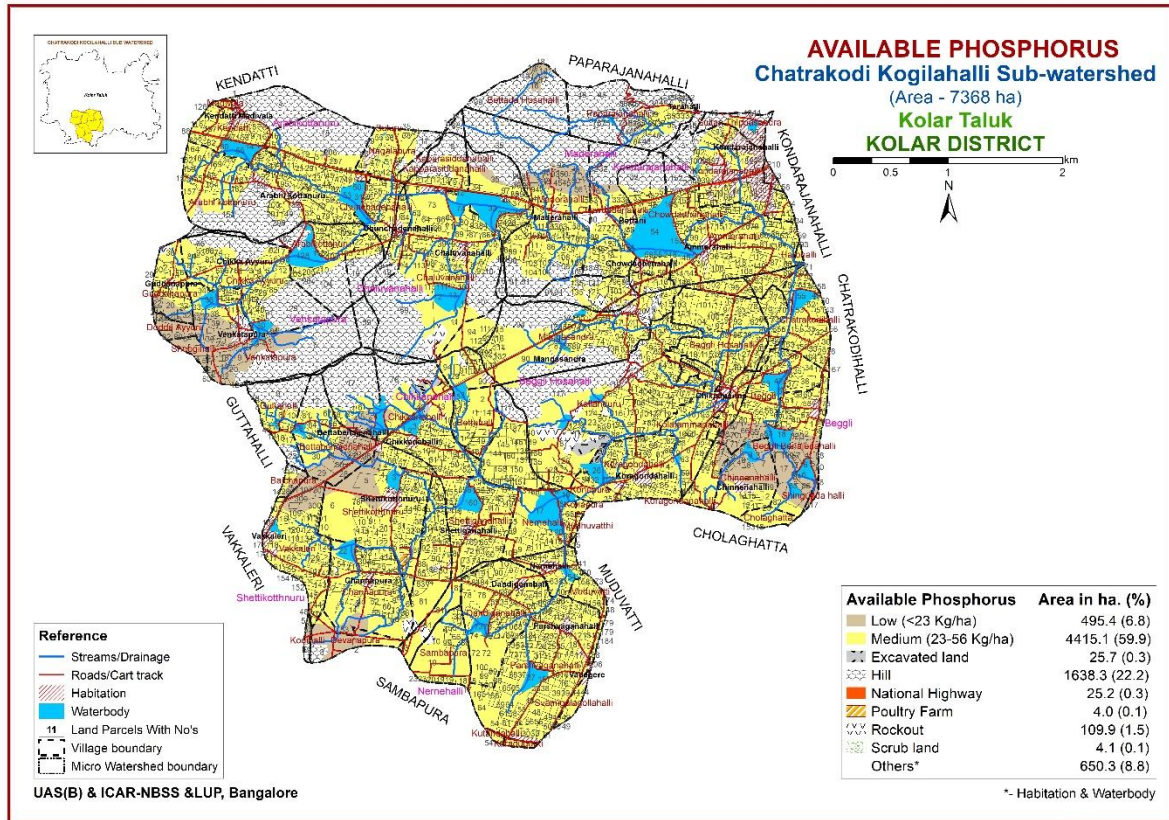
High: The limits fixed for classifying soils as high for major nutrients, the available N to be in the range of 561-700 kg/ha; P₂O₅ to be between 57.26 & 91.60 kg/ha; and available K₂O to be between 337.5 & 674.80 kg/ha.

Very high: The limits fixed for classifying soils as very high for major nutrients, the available N to be more than 700 kg/ha; P₂O₅ to be more than 91.60 kg/ha; and available K₂O to be more than 674.8 kg/ha.

Similarly, the critical limits for micro nutrients are indicated. Based on the micro nutrient status of the soil phase, the micro nutrient fertilizers' recommendations are made. Considering the above criteria, the soil fertility maps are prepared and presented in the atlas.

Example of soil fertility status maps are given below:





Chapter-2

Land Resource Inventory (LRI) Card interpretation

In this chapter, in addition to the concept of land resource inventory card (LRI card), its importance, aligning fertilizers dosages as per the crop need and soil fertility status are described

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
5. Soil nutrient classification for very low, low, medium, high and very high soils
6. 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 Sodis 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 after every 2 years interval.

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

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



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

Land Resource Inventory Card

Farmer's Name	D Sugunamma
Gender: Male/Female	Female
Microwatershed Name	Kamatampalli (4C3D7/01)
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

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.

Dark Green : Very High Rating
Green:High Rating
Yellow:Medium Rating
Orange:Low Rating
Red : Very Low Rating

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	

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	-

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, Brinjal, Cowpea, Groundnut, Maize, Carrot, Bheema 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, Kalabari/Neem, Red gram, Sunflower	Rooting conditions	

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

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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.

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 (P_2O_5), and Potassium (K_2O).

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 P ₂ O ₅	<11.45	11.45 to 22.9	22.91 to 57.25	57.26 to 91.6	>91.60
Available K ₂ O	<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

Chapter-3

Behavioral Change Communication on LRI based Fertilizer Application

This chapter presents, methodological approaches for changing the behavior of farmers towards LRI based nutrient management

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>
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	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>
1. People have made progress and realized the benefits of changed approach	1. Quantification of beneficial effects of LRI based fertilizer application approach
2. Understand that maintaining change will require effort, but aware of its value	2. Conviction to adopt in future
3. Create strategies to prevent relapse	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

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 an 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 threats 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

Teaching aids useful for educating farmers on LRI based nutrient management

The teaching aids which can be used at the village for educating the farmers on LRI based approaches in crop selection and nutrient management are posters, charts, flipchart/ book, game board, etc. The photographs of these teaching aids are given below for the reference by the staff promoting LRI based approaches and to reproduce and use them appropriately during their educational activities in the villages coming under REWARD program.

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



ಪೊಟ್ಯಾಷಿಯಂ

ಆಹಾರ ಹಾಗೂ ನೀರು ಸಾಗಾಟ ಮತ್ತು ರೋಗ ನಿರೋಧಕ ಶಕ್ತಿ ತುಂಬುತ್ತದೆ



REWARD ಯೋಜನೆ, ಜಲಾನಯನ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಪ್ರಮುಖ ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 ಸಾರಜನಕ	ಪತ್ರಹರಿತ್ತಿನ ಭಾಗವಾಗಿ ಸಸ್ಯದ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ಹಳೆಯ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು
 ರಂಜಕ	ಬೇರು, ಬೀಜ ಹಾಗೂ ಹಣ್ಣಿನ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ಎಲೆ ಕಬ್ಬಾಗುವುದು, ಕೆಂಪು ಪಟ್ಟಿ ಕಾಣುವುದು
 ಪೊಟ್ಯಾಷಿಯಂ	ಆಹಾರ ಹಾಗೂ ನೀರು ಸಾಗಾಟ ಮತ್ತು ರೋಗ ನಿರೋಧಕ ಶಕ್ತಿ ತುಂಬುತ್ತದೆ	ತುದಿ ಹಾಗೂ ಎಲೆಸುತ್ತ ಒಣಗುವುದು, ಕಾಯ/ಹೂವು ಉದುರುವುದು



REWARD ಯೋಜನೆ, ಜಲಾನಯನ ಅಭಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ದ್ವಿತೀಯ ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 ಕ್ಯಾಲ್ಷಿಯಂ	ಬೀಜ ಮೊಳಕೆ ಒಡೆಯಲು ಹಾಗೂ ಬೇರಿನ ಬೆಳವಣಿಗೆಗೆ ನೆರವು	ತುದಿ ಒಣಗುವುದು, ಹಣ್ಣು ಕೊಳೆಯುವುದು
 ಮ್ಯಾಗ್ನೀಷಿಯಂ	ಪತ್ರಹರಿತ್ತಿನ ಭಾಗವಾಗಿ, ಸಕ್ಕರೆ, ಕೊಬ್ಬು ಹಾಗೂ ಪ್ರೋಟೀನ್ ಉತ್ಪಾದನೆಗೆ ನೆರವು	ಎಲೆ ಬಿಳಿಯಾಗುವುದು, ಹಸಿರು ನರಮಂಡಲ ಕಾಣುವುದು, ಕೆಂಪು ಪಟ್ಟಿ ಕಾಣುವುದು
 ಗಂಧಕ	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ, ಕೊಬ್ಬು ಹಾಗೂ ಪ್ರೋಟೀನ್ ಉತ್ಪಾದನೆಗೆ ನೆರವು	ಗಿಡದಲ್ಲಿ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು



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ಲಘು ಪೋಷಕಾಂಶಗಳ ಮಹತ್ವ ಮತ್ತು ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

ಪೋಷಕಾಂಶ	ಮಹತ್ವ	ಲಕ್ಷಣಗಳು
 ಸತು	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ ಸೆರೆ-ಕೊಬ್ಬಿನ ಅಂಶಗಳನ್ನು ಹಾಗೂ ಹೆರ್ಮಿಟಿಕ್‌ಗಳನ್ನು ಪರಿವರ್ತಿಸಲು, ಎನ್‌ಜೈಮ್‌ಗಳ ಚಟುವಟಿಕೆಗಳನ್ನು ವರ್ಧಿಸಲು ಸಹಾಯ	ಕಾಂಡ ಕಡ್ಡಿಯಂತಾಗುವುದು, ಗಿಟ್ಟಿನ ಅಂತರ ಬಿಡುಮೆ ಆಗುವುದು, ಎಲೆಗಳು ಒಂದೇ ಕಡೆ ಮುಂದುವರಿಯುವುದು
 ಬೋರಾನ್	ಸಕ್ಕರೆ ಕೊಬ್ಬಿನ ಅಂಶಗಳನ್ನು ಸಾಗಿಸಲು, ಅಂಗಾಂಶ ಗೋಡೆಯ ಬೆಳವಣಿಗೆಗೆ, ಕ್ಯಾಲ್ಷಿಯಂ ಹೀರಲು	ತುದಿ/ಮೊಗ್ಗು ಒಣಗುವುದು ಕಾಯ/ಬೀಜ ಸಣ್ಣದಾಗಿರುವುದು, ಕಾಯ/ಹೂವು ಹೊಡೆಯುವುದು ಹಾಗೂ ಉದುರುವುದು
 ಕಬ್ಬಿಣ	ಪತ್ರಹರಿತ್ತು ತಯಾರಿಕೆಗೆ, ಉಸಿರಾಟ ಕ್ರಿಯೆಗೆ, ಸಾರಜನಕ ಸೇರಿಕೊಳ್ಳುವಿಕೆಯಲ್ಲಿ ಮಹತ್ವ	ಹಳದಿ ಎಲೆಯಲ್ಲಿ ಹಸಿರು ನರಮಂಡಲ ಕಾಣುವುದು, ಎಲೆ ಎಲೆ ಬಿಳಿಯಾಗುವುದು
 ಮ್ಯಾಂಗನೀಸ್	ಸಾರಜನಕ ಹಾಗೂ ಆಹಾರ ಪರಿವರ್ತನೆಯಲ್ಲಿ, ಎನ್‌ಜೈಮ್‌ಗಳ ವರ್ಧಕವಾಗಲು ನೆರವು	ಎಲೆ ಎಲೆ ಬಿಳಿಯಾಗುವುದು, ಬೆಳವಣಿಗೆ ಕುಂಠಿತವಾಗುವುದು
 ತಾಮ್ರ	ಪತ್ರಹರಿತ್ತು ಹಾಗೂ ಲಿಗ್ನಿನ್ ತಯಾರಿಕೆಗೆ, ಪ್ರೋಟೀನ್ ಹಾಗೂ ಕಾರ್ಬೋಹೈಡ್ರೇಟ್ ಪರಿವರ್ತನೆಗೆ, ಸಾರಜನಕ ಸೇರಿಕೊಳ್ಳುವಿಕೆಯಲ್ಲಿ ನೆರವು	ಗಿಡದಲ್ಲಿ ಎಲೆಗಳು ಹಳದಿ ಆಗುವುದು ಎಲೆಯಲ್ಲಿ ಹುಕ್ಕುಗಳು ಕಾಣುವುದು



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ಬೆಳೆಗಳಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆಯ ಲಕ್ಷಣಗಳು

- ಬೋರಾನ್ (B)**
 - ಹೊಸ ಎಲೆಗಳು ಸೀಸಿನಿಂದ ದೂರ ಪರಿಚಯಿಸಿ
 - ಕಾಡು ಮತ್ತು ಕಾಯಿಗಳು ಒಣಗಿರುತ್ತವೆ
 - ರೋಗಗಳ ಹಾನಿ ಸಾಮಾನ್ಯವಾಗಿ ಕಂಡುಬರುತ್ತದೆ
 - ಬದಲಾದ ತಿರುಳು ಮತ್ತು ಹಿರಿಯತನ
- ಕಬ್ಬಿಣ (Fe)**
 - ಹೊಸ ಎಲೆಗಳು ಎಲ್ಲಾ ರೀತಿ ಮೃದ್ಧ ಕೆಲಸುತ್ತವೆ
 - ಎಲೆಗಳ ನಡುವಿನ ಬಣ್ಣ ಕೆಳಕು ಬಣ್ಣಕ್ಕೆ ತಿರುಳುತ್ತವೆ
- ಮ್ಯಾಂಗನೀಸ್ (Mn)**
 - ಹೊಸ ಎಲೆಗಳು ಒಣಗಿರುತ್ತವೆ
 - ಬೇರೂರಿನ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಸುಂಕ (Zn)**
 - ಕುಂಠಿತ ಬೆಳವಣಿಗೆ
 - ಕಾಡು ಕಟ್ಟುಂಟಾಗುತ್ತವೆ
 - ಗಿಡದ ಉದ್ದ ಮತ್ತು ಅಗಲವು ಕಡಿಮೆಯಾಗುತ್ತವೆ
- ಮ್ಯಾಗ್ನೀಷಿಯಂ (Mg)**
 - ಎಲೆಗಳ ಉದ್ದ ಮತ್ತು ಅಗಲವು ಕಡಿಮೆಯಾಗುತ್ತವೆ
 - ಎಲೆಗಳ ಅಗಲವು ಕಡಿಮೆಯಾಗುತ್ತವೆ
 - ಕೆಲವು ಹಸಿ ಕಾಯಿಗಳು
- ರಂಜಕ (P)**
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಎಲೆಗಳ ಕೆಳಭಾಗದಲ್ಲಿ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕ್ಯಾಲ್ಸಿಯಂ (Ca)**
 - ರೋಗ ಹಾನಿಗಳು ಹೊಸ ಎಲೆಗಳಲ್ಲಿ ಕಂಡುಬರುತ್ತವೆ
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಗಂಧಕ (S)**
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಎಲೆಗಳ ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕಾಪರ್ (Cu)**
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಮೊಲಿಬ್ಡಿನಂ (Mo)**
 - ಎಲೆಗಳ ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಎಲೆಗಳ ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಪೊಟ್ಯಾಷಿಯಂ (K)**
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ನಾರಜನಕ (N)**
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
 - ಹೂಗಳು ಬಿಡುವಿಕೆ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

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ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ದುಷ್ಪರಿಣಾಮಗಳು

- ಮಣ್ಣು**
 - ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಅಸಮತೋಲನ ಉಂಟಾಗಿ ಬೆಳೆಗಳಿಗೆ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆ
 - ಮಣ್ಣಿನಲ್ಲಿರುವ ಅನಾಹುತ ಸೂಕ್ಷ್ಮಜೀವಿಗಳ ಸಂಖ್ಯೆ ಕಡಿಮೆಯಾಗುತ್ತವೆ
 - ಮಣ್ಣಿನ ರಸಾಹಾರಿ 6.5 ಕ್ವಿಂಟಲ್ ಕಡಿಮೆಯಾಗಿ ಹಳು ಮಣ್ಣಾಗಿ ಪರಿವರ್ತನೆ
 - ಧಾರಿ ರೋಗದ ವಿಸ್ತಾರವಾಗುತ್ತದೆ
 - ಭೌತಿಕ ಹಾಗೂ ರಾಸಾಯನಿಕ ಗುಣಗಳ ನಷ್ಟವಾಗಿ ಬೆಳೆಗಳಿಗೆ ಹಾನಿ
- ಅಂತರ್ಜಲ**
 - ಅಮೋನಿಯಾ, ಕಾರ್ಬಾನ್ ಡೈ ಆಕ್ಸೈಡ್, ಮೀಥೇನ್ ಮುಂತಾದವುಗಳ ನಿರಂತರ ಸೇರಿ ಮಲಿನ್ಯಗೊಳಿಸುತ್ತವೆ
 - ಹೆಚ್ಚಿನ ನೈಟ್ರೇಟ್ ಅಂಶ ನೀರಿನಲ್ಲಿ ಬೆರೆಯುವುದರಿಂದ ಮಕ್ಕಳಲ್ಲಿ Blue Baby Syndrome ಉಂಟಾಗುತ್ತದೆ
 - ನೀರಿನಲ್ಲಿ ಪಾಚಿ ಬೆಳೆದು (Algae) ಜಲಜೀವಿಗಳ ಅಭಿವೃದ್ಧಿಗೆ ಕೊಂಡರೆಯಾಗುತ್ತವೆ
- ವಾತಾವರಣ**
 - ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗಿ ಹಸಿರು ಮನೆಮನೆ ಅನಿಲಗಳು (ಗ್ರೆನ್‌ಹೌಸ್ ಆಕ್ಸೈಡ್, ಅಮೋನಿಯಾ) ವಾತಾವರಣಕ್ಕೆ ಬಿಡುಗಡೆಯಾಗುತ್ತವೆ
 - ಹಸಿರು ಮನೆ ಮನೆ ಪರಿಣಾಮ ಹೆಚ್ಚಾಗಿ ವಾತಾವರಣದಲ್ಲಿನ ತಾಪಮಾನ ಹೆಚ್ಚಾಗುತ್ತವೆ

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LRI ಕಾರ್ಡಿನಿಂದಾಗುವ ಪ್ರಯೋಜನಗಳು

- ಬೆಳೆಗಳಿಗೆ ಕೃಷಿ ಉತ್ಪಾದನಾ ಸಾಮರ್ಥ್ಯವನ್ನು ಹೆಚ್ಚಿಸಬಹುದು**
- ಅಧಿಕ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ವೆಚ್ಚವನ್ನು ತಪ್ಪಿಸಬಹುದು**
- ಕೃಷಿ ಮಣ್ಣಿನ ಗುಣಧರ್ಮಗಳನ್ನು ತಿಳಿಯಬಹುದು ಹಾಗೂ ಕೃಷಿ ಭೂಮಿಯ ಗುಣಮಟ್ಟ ಸುಧಾರಿಸಬಹುದು**
- ಕೃಷಿ ಭೂಮಿಗೆ ಸೂಕ್ತವಾದ ಬೆಳೆಗಳ ಆಯ್ಕೆ ಮಾಡಬಹುದು**
- ಮಣ್ಣಿನಲ್ಲಿರುವ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟದ ಆಧಾರದ ಮೇಲೆ, ಬೆಳೆಗಳಿಗೆ ಅಗತ್ಯವಿರುವ ಪೋಷಕಾಂಶಗಳನ್ನು ಸರಿಹೊಂದಿಸಬಹುದು**

REWARD ಯೋಜನೆ ಅಧೀನದಲ್ಲಿ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

LRI ಕಾರ್ಡಿನಲ್ಲಿ ದೊರೆಯುವ ಮಾಹಿತಿ

- 1 ರೈತನ ವಿವರ, ಸರ್ವೆ ನಂಬರ್, ಹಿನ್ನಾ ನಂಬರ್, ಎಷ್ಟು ಪ್ರದೇಶ, ಮಳೆಯ ಪ್ರಮಾಣ
- 2 ಮಣ್ಣಿನ ಭೌತಿಕ ಗುಣಧರ್ಮಗಳು (ಆಳ, 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 ಲಭ್ಯ ಮತ್ತು ಇತರೆ ಪೋಷಕಾಂಶಗಳ ಮಟ್ಟದ ವರ್ಗೀಕರಣ (ಸಾಕಷ್ಟು, ಕಡಿಮೆ)
- 6 ಜಮೀನಿಗೆ ಸೂಕ್ತವಾದ ಬೆಳೆಗಳು (ಹೆಚ್ಚು ಸೂಕ್ತ, ಸೂಕ್ತ, ಅಲ್ಪ ಸೂಕ್ತ ಮತ್ತು ಸೂಕ್ತವಲ್ಲ)
- 7 LRI ಕಾರ್ಡಿನಲ್ಲಿರುವ ಮಾಹಿತಿ ಬಳಸಲು ಮಾರ್ಗಸೂಚಿ

REWARD ಯೋಜನೆ ಅಧೀನದಲ್ಲಿ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಮಟ್ಟಿನ ಫಲವತ್ತತೆಯ ವರ್ಗಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಪೋಷಕಾಂಶಗಳನ್ನು ಸರಿಹೊಂದಿಸುವುದು

ಲಭ್ಯವಿರುವ ಪೋಷಕಾಂಶ	ಅತೀ ಕಡಿಮೆ	ಕಡಿಮೆ	ಮಧ್ಯಮ	ಹೆಚ್ಚು	ಅತೀ ಹೆಚ್ಚು
ಪ್ರತಿ ಹೆಕ್ಟೇರ್ ಪ್ರದೇಶದಲ್ಲಿ ಲಭ್ಯವಿರುವ ಪೋಷಕಾಂಶಗಳು ಕೆ.ಜಿ. (kg) ಗಳಲ್ಲಿ					
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
ಪೊಟ್ಯಾಷ್	<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 ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

ಉದಾಹರಣೆ: ಮೇಲಿನ ಕೋಷ್ಟಕದ ಆಧಾರದಂತೆ, ಮಟ್ಟಿನ ಫಲವತ್ತತೆಯ ವರ್ಗಕರಣಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಮುಸುಕಿನ ಜೋಳಕ್ಕೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು 60:30:15 ಎಕರೆಗೆ ಕೆ.ಜಿ. ಗಳಲ್ಲಿ ಹಾಗೂ ಗೊಬ್ಬರಗಳನ್ನು ನಿರ್ದೇಶಿಸುವಿಕೆ

ಮಟ್ಟಿನಲ್ಲಿ 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
ಪೊಟ್ಯಾಷ್ - 15 (RDF x 1.67) = 25	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 42	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 42

ಮಟ್ಟಿನಲ್ಲಿ 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
ಪೊಟ್ಯಾಷ್ - 15 (RDF x 1.00) = 15	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 25	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 25

ಮಟ್ಟಿನಲ್ಲಿ 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
ಪೊಟ್ಯಾಷ್ - 15 (RDF x 0.33) = 5	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 08	ಮ್ಯೂರೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್ : 08

REWARD ಯೋಜನೆ ಅಡಿಯಲ್ಲಿನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಯಾಷಿಯಂ
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 ಬಣ್ಣದ ಸಂಖ್ಯೆ ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ

REWARD ಯೋಜನೆ ಅಡಿಯಲ್ಲಿನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

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 ಬಣ್ಣದ ಸಂಖ್ಯೆ ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ

REWARD ಯೋಜನೆ ಅಡಿಯಲ್ಲಿನ ಅಧಿವೃದ್ಧಿ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

REWARD ಯೋಜನೆಯಡಿ ವೈಲಟ್ ಅಧ್ಯಯನ

ಭೂ ಸಂಪನ್ಮೂಲ ಸಮೀಕ್ಷೆ (LRI) ಆಧಾರಿತ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆ

ಹಿಂಬದಿ ಪದ್ಧತಿ

- ಕೆಲವು ಪ್ರಮಾಣ ಮಾಡುವ ಗೊಬ್ಬರ
- ಕಡಿಮೆ ಫಲಾನುಭವಿ
- ಕಡಿಮೆಯಲ್ಲಿ ಕೆಲವು ಸಾವಿನಿಂದ ಹಣಕಾಸು ಹೆಚ್ಚು ಫಲಾನುಭವಿ

ಈಗಿನ ಪದ್ಧತಿ

- ಕಡಿಮೆ ಪ್ರಮಾಣ ಮಾಡುವ ಗೊಬ್ಬರ
- ಹೆಚ್ಚು ಫಲಾನುಭವಿ
- ಹೆಚ್ಚುಮಟ್ಟಿಗೆ ಕೆಲವು ಸಾವಿನಿಂದ ಹಣಕಾಸು ಕಡಿಮೆ ಫಲಾನುಭವಿ

ಅನುಸರಿಸಬೇಕಾದ ಪದ್ಧತಿ

- ಭೂ ಸಂಪನ್ಮೂಲ ಸಮೀಕ್ಷೆ ಆಧಾರಿತ ಗೊಬ್ಬರಗಳ ಬಳಕೆ
- ಸಾವಿನಿಂದ ಹಣಕಾಸು ಹೆಚ್ಚಿನಂತೆ ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು

REWARD ಯೋಜನೆ ಅಡಿಯಲ್ಲಿನ ಅಧಿವೃದ್ಧಿ 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



ಬೋರ್ (B)

- ಕೆಲವು ಎಲೆಗಳ ನೋಟದಿಂದ ಕಂಡು ಬರಬಹುದು
- ಕಾಂಚಿ ಮತ್ತು ಕಾಯಿಗಳು ಒಡೆಯುತ್ತವೆ
- ರೋಗಗಳ ಹಾಗೂ ಕಾಯಿಗಳಿಂದ ಹಾನಿಯಾಗುತ್ತದೆ
- ಕಾಂಚಿಗಳ ಕ್ರಮವು ಕುಂಠಿತಗೊಳ್ಳುತ್ತದೆ

ಕ್ಯಾಲ್ಸಿಯಂ (Ca)

- ಗಿಣಿಗಳ ಸುಮಾರು ಒಡಗಿ ಬಿಡುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕೆಲವು ಎಲೆಗಳ ತುದಿಗಳು ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಕಬ್ಬಿಣ (Fe)

- ಕೆಲವು ಎಲೆಗಳ ಎಲೆಗಳಿಂದ ಕಂಡು ಬರಬಹುದು
- ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಗಂಧಕ (S)

- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಎಲೆಗಳ ಕಾಯಿಗಳಲ್ಲಿ ಎಲೆಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಮ್ಯಾಂಗನೀಸ್ (Mn)

- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ತಾಮ್ರ (Cu)

- ಗಿಣಿಗಳ ಸುಮಾರು ಒಡಗಿ ಬಿಡುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಸೆಸು (Zn)

- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಮಾಲಿಬ್ಡಮ್ (Mo)

- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಪೊಟ್ಯಾಷಿಯಂ (K)

- ಕೆಲವು ಎಲೆಗಳ ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ರಂಜಕ (N)

- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ
- ಕಾಯಿಗಳು ಹಾನಿ ಹಾಗೂ ಕುಂಠಿತಗೊಳ್ಳುತ್ತವೆ

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

	N ಸಾರಜನಕ	P ರಂಜಕ	K ಪೊಟ್ಯಾಷಿಯಂ
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 ಉಲ್ಲೇಖ ಸಂಖ್ಯೆ 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 ಉಲ್ಲೇಖ ಸಂಖ್ಯೆ ಮಳೆಯಾಶ್ರಿತ ಬೆಳೆಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶ

ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗುವ ದುಷ್ಪರಿಣಾಮಗಳು

ಮಣ್ಣು



- ಮಣ್ಣಿನಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಅಸಮತೋಲನ ಉಂಟಾಗಿ ಬೆಳೆಗಳಿಗೆ ಪೋಷಕಾಂಶಗಳ ಕೊರತೆ
- ಮಣ್ಣಿನಲ್ಲಿರುವ ಲುಪ್ತಯುಕ್ತ ಸೂಕ್ಷ್ಮಜೀವಿಗಳ ಸಂಖ್ಯೆ ಕಡಿಮೆಯಾಗುತ್ತದೆ
- ಮಣ್ಣಿನ ರಸವಾಹ 0.5 ರಿಂದ ಕಡಿಮೆಯಾಗಿ ಹುಳ ಮಣ್ಣಾಗಿ ಪರಿವರ್ತನೆ
- ಭಾರಿ ಲೋಹದ ವಸ್ತುಗಳು ಸೇರುತ್ತವೆ
- ಭೌತಿಕ ಹಾಗೂ ರಾಸಾಯನಿಕ ಗುಣಗಳ ಬದಲಾಗುವುದರಿಂದ ಬೆಳೆಗಳಿಗೆ ಹಾನಿ

ಅಂತರ್ಜಲ



- ಅಪೋನಿಡಾ, ಕಾರ್ಬನ್ ಡೈ ಆಕ್ಸೈಡ್, ಮೀಥೇನ್ ಮುಂತಾದವುಗಳು ನೀರನ್ನು ಸೇರಿ ಮಲಿನಗೊಳಿಸುತ್ತವೆ
- ಹೆಚ್ಚಾಗಿ ನೈಟ್ರೇಟ್ ಅಂಶ ನೀರಿನಲ್ಲಿ ಬಿಡುಬಿಡಾದಿಂದ ಮಕ್ಕಳಲ್ಲಿ Blue Baby Syndrome ಕಂಡುಬರುತ್ತದೆ
- ನೀರಿನಲ್ಲಿ ಪಾಚಿ ಬೆಳೆದು (Algae) ಜಂಜಿರಗಳ ಉಸಿರಾಟಕ್ಕೆ ತೊಂದರೆಯಾಗುತ್ತದೆ

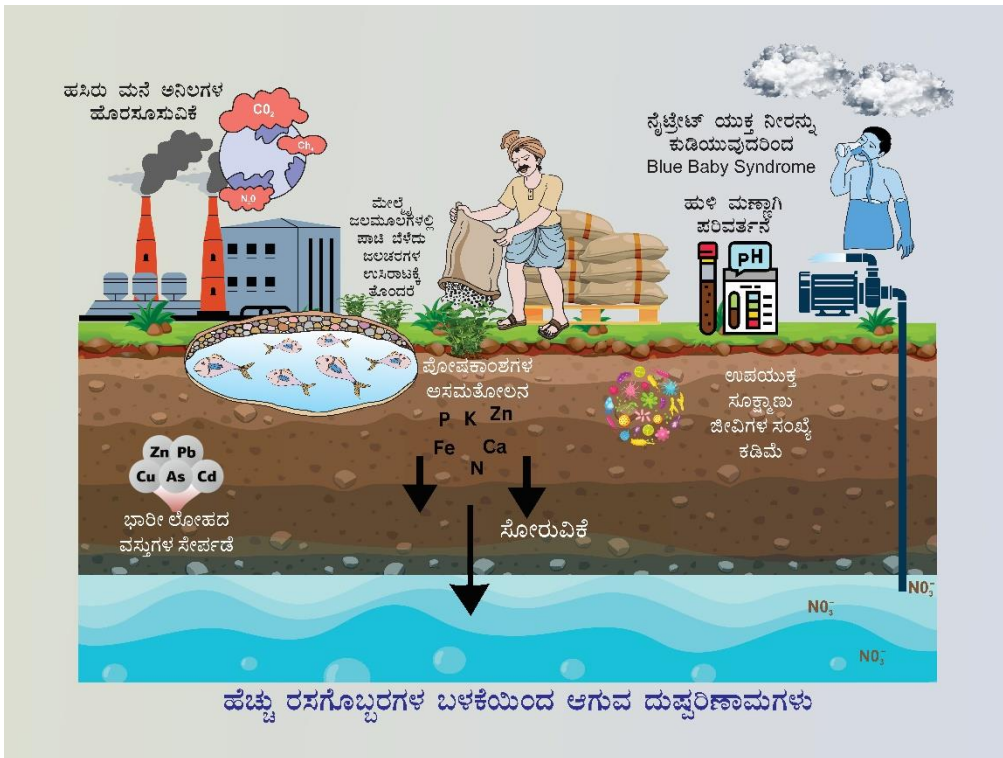
ವಾತಾವರಣ



- ಹೆಚ್ಚುವರಿ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆಯಿಂದಾಗಿ ಹಸಿರು ಮನೆಯ ಅನಿಲಗಳು (ನೈಟ್ರೇಟ್ ಆಕ್ಸೈಡ್, ಅಪೋನಿಡಾ) ವಾತಾವರಣಕ್ಕೆ ಬಿಡುಗಡೆಯಾಗುತ್ತವೆ
- ಹಸಿರು ಮನೆ ಪರಿಣಾಮ ಹೆಚ್ಚಾಗಿ ವಾತಾವರಣದಿಂದಲೇ ತಾಪಮಾನ ಹೆಚ್ಚಾಗುತ್ತದೆ

REWARD ಯೋಜನೆ, ಆಧಾರವರದಿ ಅಧಿವೇಶನ ಅರಣ್ಯ ಇಲಾಖೆ, ಕರ್ನಾಟಕ ಸರ್ಕಾರ

LRI BASED DOSAGE					
CORRECTION FACTOR					
RDF					
CROP DIAGRAM					
FERTILITY STATUS					
	VERY HIGH	HIGH	MEDIUM	LOW	VERY LOW
NUTRIENTS					



Chapter-4

Documentation of status of adoption of LRI based nutrient management by farmers under REWARD program

The template for documenting the status of adoption of LRI based fertilizer management by farmers is presented in this chapter

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

Kharif/ Rabi/ Summer: _____ Year

#	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	Fertility Status of Land (For each of the three nutrients namely N, P and K fertility status under five categories to be captured)			
5	Variety			
6	Duration (days)			
7	Season (Kharif/ Rabi/ Summer)			
8	Type of land (Rainfed/irrigated)			
9	Source of irrigation (activated IF not rainfed - borewell/ tank/ canal/ others)			
10	Cost of seed (including own seed) (Rs.)			
11	Manures and fertilizers			
	11.1. Organic manures (compost/ FYM/ green manure/ tank silt/others)			
	Name			
	Quantity (tons)			
	Cost (Rs.)			
	11.2. Biofertilizers			
	Name			
	Quantity (gms)			
	Cost (Rs.)			
	11.3. Chemical fertilizers			
	Name-1			
	Basal dose qty (kgs)			
	Top dress qty (kgs)			
	Total Quantity (kgs)			
	Total Cost (Rs.)			
	Name-2			
	Basal dose qty (kgs)			
	Top dress qty (kgs)			
	Total Quantity (kgs)			
	Total Cost (Rs.)			
12	Method of fertilizers application (broadcasting/ line/ band/ spot)			
13	Cost of plant protection chemicals (Rs.)			
14	Labour details			
	Own labour (number)			

#	Particulars	Crop-1	Crop2	Crop3
	Cost (Rs.)			
	Hired labour (number)			
	Cost (Rs.)			
	Cost of animal drawn work (Rs.)			
	Cost of mechanized works (Rs.)			
15	Irrigation cost (if purchased/ repairs during crop season/ fuel cost/ electricity) (Rs.)			
16	Other production cost, if any (Rs.)			
17	Total cost of production (Rs.)			
18	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 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					

#	Statement	Strongly Agree	Agree	Indifferent	Disagree	Strongly Disagree
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

Chapter-5

Micro-Watershed Agro-Met Advisory Services (MWAAS)

In this chapter, concept and importance of micro-watershed wise agro-advisories for improved crop production and the process followed for dissemination of advisories under REWARD program are described

Introduction: Agro-met Advisory Services (AAS) are specialized services that provide weather-based agricultural advisories to farmers. These services integrate meteorological data with agricultural practices to offer actionable insights, enabling to make informed decisions regarding real time crop management. The core purpose of AAS is to enhance the resilience of agricultural systems by helping farmers adapt real time good agricultural practices based on weather variability and climate change. These services involve a multidisciplinary approach, combining knowledge from meteorology, agronomy, hydrology, plant protection and economics to offer timely and location-specific guidance on various agricultural activities.

Scope of AAS in rainfed agriculture

The scope of agro-met advisory services is broad, encompassing several critical aspects of agricultural management:

- The advisories encompassed with weather forecasting, provide short, medium, and long-range weather forecasts that help farmers plan agricultural activities like selection of crops & varieties, sowing, irrigation, nutrient, pest management, harvesting etc.
- Agro-met services offer tailored recommendations based on the type of crops being cultivated.
- By monitoring weather conditions that influence the proliferation of pests and diseases, agro-met services can provide early warnings, enabling farmers to take preventive measures.
- Agro-met advisory services play a vital role in managing climate risks by issuing early warnings for extreme weather events such as droughts, floods, and cyclones.
- These services often include decision support tools that help farmers assess the potential impact of weather conditions on their crops and make informed choices regarding agricultural practices. This enables farmers to optimize farm operations and thereby enhance productivity.

Importance in rainfed agriculture

Agriculture is highly dependent on weather and, weather variabilities have significant implications on crop production. Agro-Met advisory Services have emerged as an essential

component of agricultural management, offering numerous benefits to farmers and the broader agricultural community, which are discussed hereunder.

- **Enhancing agricultural productivity through timely crop management:** AAS provide critical information that helps farmers optimize their agricultural practices. For instance, knowing the expected rainfall can guide farmers in deciding the appropriate crop, time for sowing, thereby ensuring better crop. Similarly, accurate temperature forecasts help in determining the timing of irrigation and the application of fertilizers, which can enhance crop yield.
- **Reducing weather-related crop losses:** Weather-related risks, such as droughts, floods and unseasonal rains pose significant challenges to Indian agriculture. AAS help to mitigate these risks by providing early warnings and advisories that allow farmers to take preventive measures. For example, if a forecast predicts heavy rainfall, farmers can delay harvesting to avoid crop damage. Similarly, in the event of a predicted drought, farmers can adjust their irrigation schedules to conserve water. These proactive measures help reduce losses and ensure better outcomes for farmers.
- **Supporting sustainable agriculture:** Sustainable agriculture is crucial for ensuring long-term food security and environmental conservation. AAS promote sustainable practices by advising farmers on the optimal use of inputs such as water, fertilizers, and pesticides. By aligning agricultural activities with weather conditions, these services help minimize the environmental impact of farming, reduce resource wastage and promote the adoption of eco-friendly practices. This is particularly important in the context of climate change, where sustainable farming practices are necessary to adapt to changing weather patterns.
- **Empowering small and marginal farmers:** AAS empower these major farmers group (82%) by providing them with the knowledge and tools needed to make informed decisions based on weather conditions. Access to reliable weather information helps smallholders manage their resources more effectively, improve crop yield and enhance their resilience to climate variability and improve livelihoods.
- **Contributing to climate change adaptation:** Climate change poses a significant threat to Indian agriculture, with increasing temperatures, changing rainfall patterns and more frequent extreme weather events. AAS are vital for helping farmers adapt to these challenges. By providing information on weather trends and climate risks, these services enable farmers to adjust their practices to cope with changing conditions. This includes adopting drought-resistant crop varieties, altering planting schedules, and implementing water conservation measures. Agro-met services thus play a key role in building the resilience of Indian agriculture to climate change.

Components of Agro-Met Advisory Services

AAS developed for a region offer a diverse array of services aimed at helping farmers make informed decisions about their agricultural practices. These services are mainly targeted towards improvisation of crop productivity, managing climate risks, and enhancing the overall resilience of the agricultural sector.

- 1. Weather information (past and forecast):** The cornerstone of agro-met services is weather forecasting, which includes short-range (1-3 days), medium-range (4-10 days), and long-range (monthly and seasonal) forecasts. These forecasts provide critical information on temperature, rainfall, humidity, wind speed, and other weather parameters that directly influence agricultural activities.
- 2. Crop-Specific Advisories:** AAS offer tailored advisories for specific crops, based on the weather forecasts and the crop's growth stage. These advisories include recommendations on the optimal timing for sowing, irrigation schedules, fertilizer application, pest and disease management.
- 3. Pest and Disease Forecasting:** In recent years, pest and disease forecasting has become an integral part of AAS. By analysing weather conditions favourable for the outbreak of pest and diseases, these services provide early warnings to farmers. This allows them to take preventive measures, such as applying pesticides or adopting cultural practices to protect crops.
- 4. Climate Risk Management:** AAS play a crucial role in managing climate risks by providing early warnings for extreme weather events such as droughts, floods, cyclones and heatwaves. These warnings enable farmers to take necessary precautions, such as adjusting their cropping patterns, securing irrigation sources, or harvesting crops early to avoid damage.
- 5. Decision Support Systems (DSS) for Farmers:** AAS are increasingly utilizing Decision Support Systems (DSS) that integrate weather data, crop models, and advisory tools. These systems provide farmers with actionable insights based on real-time weather information. DSS tools are often available through mobile apps and online platforms, making them accessible to a broad range of farmers.

Technologies and tools in agro-met advisory services

Usage of specific technology or tool in the AASs play critical role in the success and effectiveness. By leveraging advancements in meteorology, data analytics and communication technologies, these services provide timely and accurate weather-related information to farmers, helping them make informed decisions.

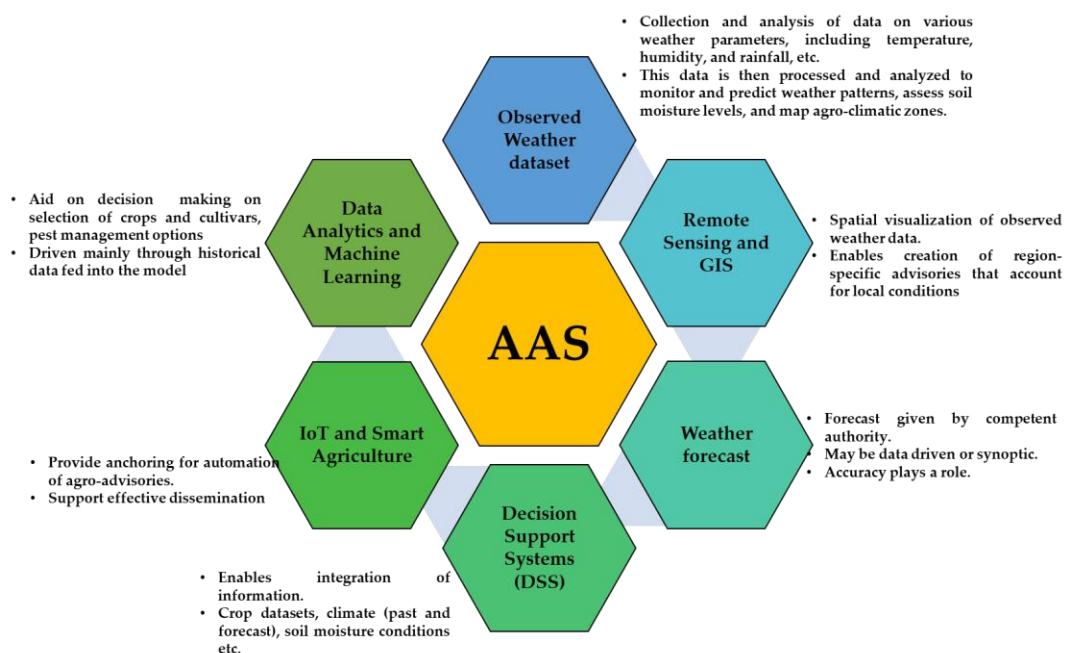


Figure 1: Technology and tools in agro-met advisory services

Micro-watershed level agro-met advisory services (MWAAS)

Karnataka with a second largest area under rainfed farming in India, faces challenges with respect to climate change induced weather aberrations specially the rainfall distribution, affecting sustainable production of crops and livelihood of rainfed farmers. In such situation, AAS play a vital role in day-to-day activities of farming based on realized and forecasted weather. Present benefits of AAS in the country under Gramin Krishi Mausam Sewa (GKMS) project are estimated to be around Rs.42,000 crores per annum (NCAER, 2017). However, the present district level advisory if percolated to GP and/or micro watershed level as envisaged in the project will have further more benefits.

Project is conceptualized to provide AAS at GP / Micro-Watershed level based on medium and short-range weather forecast and LRI database involving State Agriculture Universities and KSNDMC. The project aims to reach 10 lakh ha. under REWARD program and to 28 lakh farmers in the state with the GP / micro-Watershed level weather forecast and advisory. The success of the advisories however rests with per cent usability of weather forecast particularly rainfall. With a net gain of Rs. 8538 per farmer per annum, the overall benefit may work out to be Rs.2390 crores per annum keeping in view of 28 lakh farmers target in the state. With an integrated approach of different forecasts, the present usability can be further improved using LRI information gathered in Sujala-III project for selecting the crop.

Scope of MWAAS in the state

- Timely dissemination of advisories based on weather forecast is key to achieve climate resilient agriculture at finer spatial scale i.e. at a level of micro-watersheds has not been considered yet, providing a huge scope for farmer centric advisories.

- Changed rainfall distribution both spatially and temporally resulted in increased frequency of weather extremes viz., drought or flood or both with in the same season. Several technologies of managing drought / flood are being evolved to minimize the crop losses need to be advocated to farmers.
- Location, soil and crop specific integrated AAS through IVRS, SMS and mobile App to the farmers enable them to take appropriate practices at farm level timely and to take the benefit of favourable weather and to minimize the adverse impact of unfavourable weather.
- These technologies are time and situation specific and should reach at right time. Agro-met advisories are the means for timely delivery of information.
- The success is being documented with increased production and economic status. The benefits can be further improved by downscaling the advisories to micro level and considering the bio-physical resources. Karnataka under Sujala program intend to develop LRI data at soil phases. Advisories at micro level considering the LRI data can help for bringing climate resilience at higher magnitude. Hence, the proposal is conceptualized.

Objectives

- Crop / cropping system recommendation based on LRI and extended range forecast for farmers at Micro-watershed level.
- Crop and soil specific real time contingent practices based on medium and short-range weather forecast.
- Advocating crop nutritional and plant protection schedule for the selected crop considering LRI data and forecasted weather.
- To develop Micro-Watershed Agro-met Advisory Services (MWAAS) dynamic / interactive app using LRI database and general climate.
- Impact assessment of MWAAS on crop performance, climate resilience and farmers income

Methodology

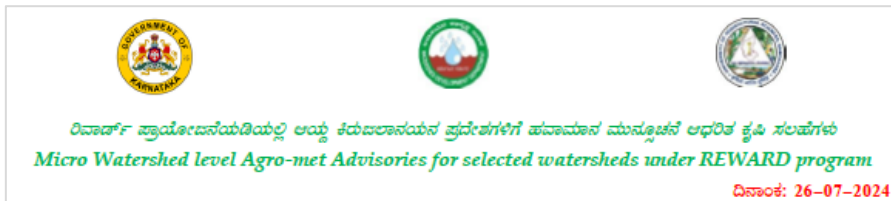
- a. Weather forecast:** Micro-watershed / GP / hobli level weather forecast is generated at KSNDMC in association with IMD / ISRO.
- b. LRI data bank including crops suitability:** WDD supports LRI data from digital library and the major crops of the domain
- c. Agro-Met Advisories:** SAU's prepare the agro-met advisories weekly twice (Tuesday and Friday) considering short / medium range weather forecast for the specified crops on real time basis. The advisories include soil and water conservation, tillage practices, crop and varietal selection, sowing, nutrient management, plant protection, after care, harvesting and post-harvest management practices.
- d. AAS Dissemination:** Agro-Met advisories are disseminated through IVRS (Varunamithra), SMS service, Interactive platform using apps etc by the KSNDMC

The advisories are planned in 3 Phases

- **Phase I:** General advisories will be initiated at micro-watershed level for major crops immediately with SMS and IVRS (Varunamithra) mode
- **Phase II:** The advisories will be customized to farmers scale with the mobile app
- **Phase III:** Automated AAS using models.

Phase I: Issue of general advisories

As an inception, general advisories based on the crop and cropping systems information, past weather data and forecasted weather are initiated at micro-watershed level for major crops. The advisories were shared to LRI managers through WhatsApp and were in turn shared to farmers through groups created in each micro-watershed.



ಆಕ್ಕಲಾಮರ (ಚಾಮರಾಜನಗರ) ಉಪಜಲಾನಯನ ಪ್ರದೇಶಕ್ಕೆ ಬೆಳೆವಾಡು ಕೃಷಿ ಸಲಹೆಗಳು

ಕ್ರ. ಸಂ.	ಕಿರುಜಲಾನಯನ ಪ್ರಮುಖ ಬೆಳೆ	ಸಲಹೆ	
1.	ಅಣ್ಣೂರು	ಜೋಳ	<ul style="list-style-type: none"> • ತೋರಿಯಲ್ಲಿ ಸಾಲಿನ ಮಧ್ಯದ ಮಣ್ಣನ್ನು ಬಿರುಹಾಕುವುದು.
2.	ಬನ್ನಿಶಲಮರ	ಜೋಳ	<ul style="list-style-type: none"> • ಮಣ್ಣಿನ ತೇವಾಂಶ ಜೋಳದ ಬಿತ್ತನೆಗನುಗುಣವಾಗಿರುವುದರಿಂದ ಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು.
3.	ಬೆಟ್ಟಪಳ್ಳಿ	ಜೋಳ	<ul style="list-style-type: none"> • ಲಗಾಗಲ ಬಿತ್ತನೆಯಾಗಿರುವ ಸ್ಥಳಗಳಲ್ಲಿ ಕಳೆ ನಿಯಂತ್ರಣ ಕೈಗೊಂಡು ಅಧಿಕವಾಗಿರುವ ಸಸ್ಯಗಳನ್ನು ತೆಗೆದುಹಾಕಿ ಸಮಾನಾಂತರ ಸಸ್ಯಸಂಖ್ಯೆಯನ್ನು ಕಾಪಾಡಿಕೊಳ್ಳುವುದು.
4.	ಚಿಕ್ಕತುಮ್ಮರ	ಜೋಳ, ತೋಗರಿ	<ul style="list-style-type: none"> • ಕಳೆದ ನಾಲ್ಕೈದು ದಿನಗಳಿಂದ ಉತ್ತಮ ಮಳೆಯಾಗುತ್ತಿರುವುದರಿಂದ ಮಧ್ಯಮಾವಧಿ ತೋಗರಿ ಬೆಳೆಯ ಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು.
5.	ಕಂದಗಲ್	ಜೋಳ	<ul style="list-style-type: none"> • ಅತಿ ತೀವ್ರತೆಯ ಮಳೆಯಿಂದ ಜಮೀನಿನ ಬದುಗಲು ಹಾನಿಗೊಳಗಾಗಿದ್ದಲ್ಲಿ ದುರಸ್ತಿ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳುವುದು.
6.	ಹೊಸಪಳ್ಳಿ	ಜೋಳ	<ul style="list-style-type: none"> • ಮಳೆ ನೀರಿನ ಸಂರಕ್ಷಣೆಗೆ ಬದು ಹಾಗೂ ಕೃಷಿ ಹೊಂಡಗಳನ್ನು ಸುಸ್ಥಿತಿಯಲ್ಲಿ ಕಾಪಾಡಿಕೊಳ್ಳಬೇಕು.
7.	ತಿಲಗೆರೆ	ತೆಂಗು, ಬಾಳೆ, ಜೋಳ, ತೋಗರಿ	<ul style="list-style-type: none"> • ಅಡಿಕೆ ಮತ್ತು ತೆಂಗಿನಲ್ಲಿ ಕಳೆ ನಿರ್ವಹಣೆಗೆ ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು. • ತೋರಿಯಲ್ಲಿ ಸಾಲಿನ ಮಧ್ಯದ ಮಣ್ಣನ್ನು ಬಿರುಹಾಕುವುದು. • ಬಾಳೆಯಲ್ಲಿ ಅತಿ ತೀವ್ರತೆಯ ಮಳೆಯಿಂದ ಉಂಟಾಗಬಹುದಾದ ಹಾನಿಯನ್ನು ತಪ್ಪಿಸಲು ಅಧಾರ ಒದಗಿಸುವುದು. • ಮಣ್ಣಿನ ತೇವಾಂಶ ಜೋಳದ ಬಿತ್ತನೆಗನುಗುಣವಾಗಿರುವುದರಿಂದ ಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು. • ಕಳೆದ ನಾಲ್ಕೈದು ದಿನಗಳಿಂದ ಉತ್ತಮ ಮಳೆಯಾಗುತ್ತಿರುವುದರಿಂದ ಮಧ್ಯಮಾವಧಿ ತೋಗರಿ ಬೆಳೆಯ ಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು. • ಇನ್ನೂ ಬಿತ್ತನೆಯಾಗದ ಸ್ಥಳಗಳಲ್ಲಿ ಭೂಮಿ ಹದಗೊಳಿಸಿ ಸಾಧ್ಯವಾದರೆ ಹಸಿರೇ ಗೊಬ್ಬರದ ಬೆಳೆಗಳನ್ನು ಭೂಮಿಗೆ ಸೇರಿಸಿ ಸಿದ್ಧಪಡಿಸಿಟ್ಟುಕೊಳ್ಳುವುದು. • ಅತಿ ತೀವ್ರತೆಯ ಮಳೆಯಿಂದ ಜಮೀನಿನ ಬದುಗಲು ಹಾನಿಗೊಳಗಾಗಿದ್ದಲ್ಲಿ ದುರಸ್ತಿ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳುವುದು. • ಮಳೆ ನೀರಿನ ಸಂರಕ್ಷಣೆಗೆ ಬದು ಹಾಗೂ ಕೃಷಿ ಹೊಂಡಗಳನ್ನು ಸುಸ್ಥಿತಿಯಲ್ಲಿ ಕಾಪಾಡಿಕೊಳ್ಳಬೇಕು.
8.	ತಿಂಡನಮರ	ಅಡಿಕೆ, ತೆಂಗು, ಜೋಳ	<ul style="list-style-type: none"> • ಅಡಿಕೆ ಮತ್ತು ತೆಂಗಿನಲ್ಲಿ ಕಳೆ ನಿರ್ವಹಣೆಗೆ ಕ್ರಮ ಕೈಗೊಳ್ಳುವುದು. • ತೋರಿಯಲ್ಲಿ ಸಾಲಿನ ಮಧ್ಯದ ಮಣ್ಣನ್ನು ಬಿರುಹಾಕುವುದು. • ತೆಂಗಿನಲ್ಲಿ ಅಣಬೆ ರೋಗ ಕಂಡು ಬಂದಲ್ಲಿ 30 ಮಿ. ರೀ. ಫೈಫಾಲ್ ಅಥವಾ 1.5 ಮಿ.ರೀ. ಅರಿಯೋಫಂಟಿಸೋಲ್ ದ್ರಾವಣವನ್ನು ಸುಮಾರು 3 ಅಡಿ ಅಳದಲ್ಲಿ ವೃತ್ತಾಕಾರವಾಗಿ ಕಂಡ ತೆಗೆದು ಸುರಿಯಬೇಕು. • ಮಣ್ಣಿನ ತೇವಾಂಶ ಜೋಳದ ಬಿತ್ತನೆಗನುಗುಣವಾಗಿರುವುದರಿಂದ ಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು. • ಇನ್ನೂ ಬಿತ್ತನೆಯಾಗದ ಸ್ಥಳಗಳಲ್ಲಿ ನಂತರ ಭೂಮಿ ಹದಗೊಳಿಸಿ ಸಾಧ್ಯವಾದರೆ ಹಸಿರೇ ಗೊಬ್ಬರದ ಬೆಳೆಗಳನ್ನು ಭೂಮಿಗೆ ಸೇರಿಸಿ ಸಿದ್ಧಪಡಿಸಿಟ್ಟುಕೊಳ್ಳುವುದು. • ಅತಿ ತೀವ್ರತೆಯ ಮಳೆಯಿಂದ ಜಮೀನಿನ ಬದುಗಲು ಹಾನಿಗೊಳಗಾಗಿದ್ದಲ್ಲಿ ದುರಸ್ತಿ ಕ್ರಮಗಳನ್ನು ಕೈಗೊಳ್ಳುವುದು. • ಮಳೆ ನೀರಿನ ಸಂರಕ್ಷಣೆಗೆ ಬದು ಹಾಗೂ ಕೃಷಿ ಹೊಂಡಗಳನ್ನು ಸುಸ್ಥಿತಿಯಲ್ಲಿ ಕಾಪಾಡಿಕೊಳ್ಳಬೇಕು.

Figure 2: General micro-watershed level advisories prepared based on general information in Phase I of the project

Phase II: Farmer scale customized advisories

Crop and farmer specific advisories on crop-management practices based on the prevailing and forecasted weather will be provided. Advisories will be customized to farmers’ field scale with the mobile app.

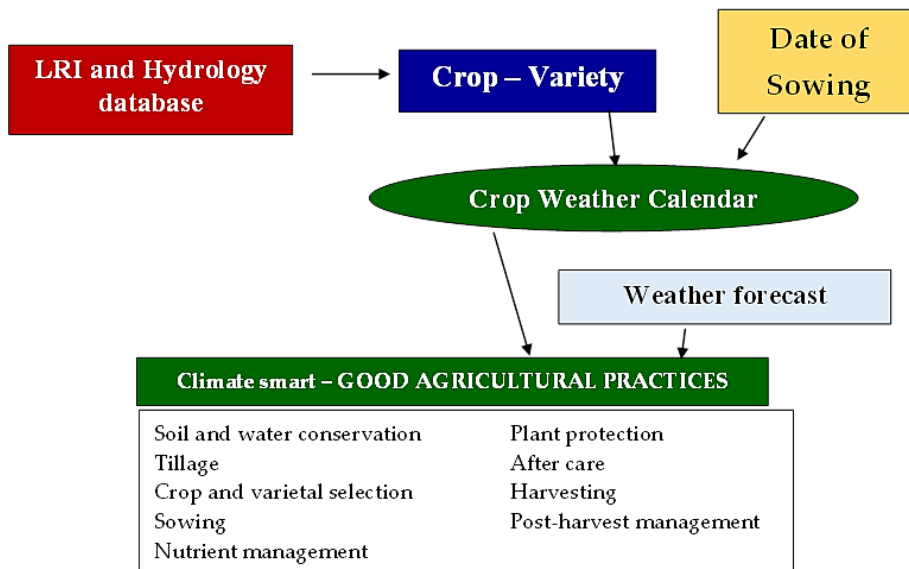


Figure 3: Pathway of information collection and farmer scale advisory issued

These farmer scale customized advisories are issued in the form of bulletins and automatically pop-ups in the CRM portals of the dissemination partner i.e. KSNDMC.

General bulletins:

- Contain information on suitable crop and cropping system, varieties for that piece of land and length of growing period available based on which the long, medium and short duration variety is recommended, and further good agricultural practices (GAPs) for raising of the recommended crops/ cropping systems with higher productivity.
- These bulletins will be shared via WhatsApp groups involving LRI managers and through them shared to local farmers’ groups.

ತೋಗು

- ಬಿತ್ತನೆ ಮಾಡುವ ಮೊದಲು ಭೂಮಿಯನ್ನು ಚೆನ್ನಾಗಿ 1-2 ಬಾರಿ ಉಳುಮೆ ಮಾಡಿ, ಶಿಫಾರಸ್ಸು ಮಾಡಿದ ಕೊಟ್ಟಿಗೆ/ಕಾಂಪೋಸ್ಟ್ ಗೊಬ್ಬರವನ್ನು(3 ಟನ್/ಎಕರೆ) ಬಿತ್ತನೆಯ 2-3 ವಾರಗಳ ಮುಂಚೆ ಮಣ್ಣಿಗೆ ಸೇರಿಸುವುದು
- 5-6 ಕೆ.ಜಿ./ಎಕರೆ ಬಿತ್ತನೆ ಬೀಜಗಳನ್ನು 3-4 ಅಡಿ ಸಾಲುಗಳ ಅಂತರದಲ್ಲಿ ಬಿತ್ತನೆ ಮಾಡಿ ಭೂ.ಸಂ.ಆ. ಆಧಾರಿಸಿ ಶಿಫಾರಸ್ಸು ಮಾಡಲಾದ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆ + ಜೈವಿಕ ಗೊಬ್ಬರಗಳ ಬಳಕೆ ಮಾಡುವುದು. (ರೈಚೋಬಿಯಂ, ರಂಜಕ ಕರಗಿಸುವ ಬೀವಾಣುಗಳ ಬಳಕೆ).
- ಬೀಜೋಪಚಾರ: ಪ್ರತಿ ಕೆ.ಗ್ರಾಂ ಬಿತ್ತನೆ ಬೀಜಕ್ಕೆ 3 ಗ್ರಾಂ ಶಿಲೀಂಧ್ರ ಮಿಶ್ರಣವಾದ ಕಾರ್ಬೆಂಡಜಿಂ ತೇ.12 + ಮ್ಯಾಂಕೋಜೆಬ್ ತೇ.64 ನಿಂದ ಬೀಜೋಪಚಾರ ಮಾಡುವುದು ಮತ್ತು 1 ಕೆ.ಗ್ರಾಂ ಟ್ರೈಕೋಡರ್ಮವನ್ನು 200 ಕೆ.ಗ್ರಾಂ ಕೊಟ್ಟಿಗೆ ಗೊಬ್ಬರಕ್ಕೆ ಬೆರೆಸಿ ಬಿತ್ತನೆಗೆ ಮುಂಚಿತವಾಗಿ ಸಾಲಿನಲ್ಲಿ ಹಾಕಿ ನಂತರ ಬಿತ್ತನೆ ಮಾಡುವುದರಿಂದ ಸೊರಗು ರೋಗವನ್ನು ಹತೋಟಿಯಲ್ಲಿ ಇಡಬಹುದು. ರೋಗ ನಿರೋಧಕ ತಳಿಗಳಾದ ಬಿ.ಆರ್.ಜಿ. 5 ಅಥವಾ ಮಾರುತಿ (ಐ.ಸಿ.ಪಿ. 8863) ತಳಿಗಳನ್ನು ಬಳಸಬಹುದು
- ಹವಾಗುಣಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಬಿತ್ತಿದ 35-40 ದಿನಗಳೊಳಗೆ ಮಣ್ಣು ಏರುಹಾಕುವುದು, 2-3 ಬಾರಿ ಅಂತರ ಬೇಸಾಯದ ಮೂಲಕ ಕಳೆ ನಿರ್ವಹಣೆ ಮಾಡುವುದು.
- ನೀರಾವರಿ ಅನುಕೂಲವಿದ್ದು ಹೆಚ್ಚಿನ ಇಳುವರಿ ಪಡೆಯಲು, ಭೂಮಿಯಲ್ಲಿನ ತೇವಾಂಶಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಬೆಳೆಯ ಮುಖ್ಯ ಹಂತಗಳಾದ ಹೂ ಹಾಗೂ ಕಾಳುಕಟ್ಟುವ ಸಮಯದಲ್ಲಿ ಎರಡು ಬಾರಿ ನೀರು ಕೊಡುವುದರಿಂದ ಅಧಿಕ ಇಳುವರಿ ಪಡೆಯಬಹುದು.
- ಬೆಳೆಯ 60-65 ದಿನಗಳಲ್ಲಿ ಗಿಡದ ಕುಡಿಗಳನ್ನು ಚಿವುಟುವುದು
- ಅಧಿಕ ಮಳೆಯಾದಲ್ಲಿ ಸಾಲಿನ ಮಧ್ಯದ ಮಣ್ಣನ್ನು ಗಿಡದ ಬುಡಕ್ಕೆ ಏರುಹಾಕಿ, ಬಸಿಗಾಲುವೆ ನಿರ್ಮಿಸಿ ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು.
- ಹೂ ಬಿಡುವ ಸಂದರ್ಭದಲ್ಲಿ ಪಲ್ಸ್ ಮ್ಯಾಜಿಕನನ್ನು 10 ಗ್ರಾಂ/ಲೀ. ನೀರಿನಲ್ಲಿ ಬೆರೆಸಿ ಸಿಂಪಡಿಸುವುದು.
- ಕಾಯಿಕೊರಕ ಹುಳುವಿನ ಪರಿವೀಕ್ಷಣೆಗಾಗಿ ಎಕರೆಗೆ 4-5 ಮೋಹಕ ಬಲೆಗಳನ್ನು ಬಳಸುವುದು. 20 ದಿನಗಳಿಗೊಮ್ಮೆ ಮೋಹಕ ವಸ್ತು (ಲ್ಯೂರ್) ಬದಲಿಸುವುದು. ಬಲೆಗಳನ್ನು ವೀಕ್ಷಿಸಿದಾಗ ಒಂದು ದಿನಕ್ಕೆ ಒಂದು ಬಲೆಯಲ್ಲಿ 5 ಅಥವಾ ಹೆಚ್ಚಿನ ಪತಂಗಗಳು ಕಂಡುಬಂದರೆ ಸೂಕ್ತ ಹತೋಟಿಗೆ ಮುಂದಾಗುವುದು.
- ಬೆಳೆ ಮೊಗ್ಗು ಮತ್ತು ಹೂವಿನ ಹಂತದಲ್ಲಿದ್ದಾಗ ಎಕರೆಗೆ 200 ಎಲ್.ಇ ನಂಜು ರೋಗಾಣು ಗಳನ್ನು (ಹೆಚ್.ಎ.ಎನ್. ಪಿ. ಐ) 400 ಲೀಟರ್ ನೀರಿನಲ್ಲಿ ಸೇರಿಸಿ ತೇ. 0.1 ಟಿ-ಪಾಲ್ ಮತ್ತು ತೇ. 0.5ರ ಬೆಲ್ಲದ ಪಾಕವನ್ನು ಬೆರೆಸಿ ಸಾಯಂಕಾಲದ ಸಮಯದಲ್ಲಿ ಸಿಂಪಡಿಸುವುದರಿಂದ ಕಾಯಿಕೊರಕ ಮರಿ ಹುಳುಗಳಿಗೆ ನಂಜಾಣು ರೋಗ ತಗುಲಿ ತಲೆ ಕೆಳಗಾಗಿ ನೇತಾಡುತ್ತಾ ಸಾಯುತ್ತವೆ.
- ಚೆಂಡುಹೂವು ಬೆಳೆಯ ಸುತ್ತಲೂ ಗಡಿ ಬಲೆ ಬೆಳೆಯಾಗಿ ಬೆಳೆಯುವುದರಿಂದ ತೋಗರಿಗೆ ಕೀಟಭಾದೆ ಕಡಿಮೆಮಾಡಬಹುದು.
- ಮಳೆಯ ಮುನ್ಸೂಚನೆಯಾಧಾರಿತ ಬೆಳೆಯನ್ನು ಕೊಯ್ಲು ಮಾಡುವುದು. ಮುಂಗಾರು ಮುಂಚಿತವಾಗಿ ಕೊನೆಗೊಂಡು ಬೆಳೆಯ ಕೊನೆ ಹಂತದಲ್ಲಿ ಬರ ಬಂದಲ್ಲಿ, ಹಸಿಕಾಯಿಯನ್ನು ತರಕಾರಿಯಾಗಿ ಕಟಾವು ಮಾಡುವುದು
- ಬೆಳೆ ಕಟಾವಾದ ನಂತರ ಭೂಮಿಯನ್ನು ಆಳವಾಗಿ ಉಳುಮೆ ಮಾಡುವುದರಿಂದ ಕಾಯಿಕೊರಕ ಹುಳುವಿನ ಕೋಶಗಳನ್ನು ನಾಶಪಡಿಸಿದಂತಾಗುತ್ತದೆ ಹಾಗೂ ಬೆಳೆಯಲ್ಲಿ ಪಕ್ಷಿಗಳನ್ನು ಆಕರ್ಷಿಸಲು ಮತ್ತು ಪಕ್ಷಿಗಳು ಕೂರಲು ಬೆಳೆಗಿಂತ ಎತ್ತರವಾಗಿ ಕವಲೊಡೆದ ರೆಂಬೆಗಳನ್ನು ಹೊಲದಲ್ಲಿ ನೆಡುವುದು.

Template on general bulletin issued on pigeonpea crop

IVRS advisories:

- In order to disseminate an interactive type of advisory to the farmer under aberrant climatic conditions a call centre has been established at KSNDC, where the agricultural graduates are hired to respond for the queries from farmers.
- They are equipped with a Customized Relationship Management (CRM) portal, backed up with farmers' details (location information, LRI information, crops cultivated, date of sowing of the crop, etc.)

Phase III: Automated AAS using models

- Good agricultural practices are simulated for different scenarios of realized and forecasted weather integrating LRI in Phase II. Updating and automation will be done with AI/ML platform in Phase III.
- During the start of each growing season, a template for collecting information on crops and cultivars, date of sowing, etc will be shared to LRI managers and the information is gathered and vetted by KSNDMC and SAUs (UASB and UASD).
- The vetted information is utilized for database creation for automation of the dissemination of advisories in the SMS format.
- As in IVRS, a set of criteria for automated advisory dissemination through SMS, especially during critical stages during aberrant weather conditions has to be simulated and the automation of the SMSs made.
- The SMSs will be shared to the individual farmer if and only if the criteria for that particular crop such as growth stage, previous week rainfall and forecast information, necessity of the intervention etc.
- Some of the critical operations being insensitive for weather forecast and soil moisture content, needs to be provided to farmer, are shared irrespective of soil moisture content and weather conditions.

Conclusion and way forward

The agro-ecosystem being multi-factor dependent production system, highly prone to vulnerability due to aberrations. Climatic conditions being major one being able to alter the system for a maximal extent, needs be monitored and taken care to reduce its impact on agriculture. Systematic study of such changes in climatic conditions is important, on the other hand, the dissemination or creation of awareness about the changes is important for taking precautionary measures. In this view, present project has been rolled out in the micro-watersheds of southern and north interior Karnataka through watershed development department, GoK. The project targets consortium efforts of Watershed Development Department, Revenue Department (KSNDMC) and SAUS (UAS-Bangalore and UAS-Dharwad) for providing comprehensive, timely advisories based on inputs from multi-disciplinary sources like soil, crop information from WDD, Weather information from KSNDMC and advisory for those conditions from SAUs. The application of novel technologies like IVRS, social media (WhatsApp) and SMS etc. has enabled the fast and uninterrupted dissemination of advisories, and efforts are being made to make further improvements on the same.

Table 1: Finalized advisories for finger millet crop.

ಬಿತ್ತನೆ ದಿನಾಂಕ	ತಳಿಗಳು	ಬಿತ್ತನೆ ನಂತರದ ದಿನಗಳ ಸಂಖ್ಯೆ	ಬೆಳೆಯ ಹಂತ	ಹಿಂದಿನ ವಾರದ ಹವಾಮಾನ: ಮಳೆ: ವಾಡಿಕೆ, ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ, ವಾಡಿಕೆಗಿಂತ ಹೆಚ್ಚು	ಮುಂದಿನ ವಾರದ ಮುನ್ಸೂಚನೆ: ಮಳೆ: ಇದೆ, ಇಲ್ಲ	ಸಲಹೆಗಳು	
ಜೂನ್ - ಜುಲೈ	ಇಂಡಾಫ್-8, ಎಮ್ ಆರ್-1, ಎಮ್ ಆರ್-6, ಎಲ್-5, ಕೆ ಎಮ್ ಆರ್-301 (ದೀರ್ಘಾವಧಿ ತಳಿಗಳು 120 ರಿಂದ 130 ದಿನಗಳು)	0-5	Germination (ಮೊಳಕೆಯೊಡೆಯುವಿಕೆ)	ವಾಡಿಕೆ	ಇದೆ	8 ಕೆ.ಜಿ./ಎಕರೆ ಬಿತ್ತನೆ ಬೀಜಗಳನ್ನು 1 ಅಡಿ ಸಾಲುಗಳ ಅಂತರದಲ್ಲಿ ಬಿತ್ತನೆ ಮಾಡುವುದು. ಭೂ.ಸಂ.ಅ. ಅಧಾರ್‌ನಿರೀಕ್ಷಾರನ್ನು ಮಾಡಲಾದ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆ + ಜೈವಿಕ ಗೊಬ್ಬರಗಳ ಬಳಕೆ (ರೈಬೋಬಿಯಂ, ರಂಜಕ ಕರಗಿಸುವ ಬೇವಾಣೆಗಳ ಬಳಕೆ).	
ಜುಲೈ-ಆಗಸ್ಟ್	ಜಿಪಿಯು-28, ಜಿಪಿಯು-66, ಎಮ್ ಎಲ್-365, ಇಂಡಾಫ್-5, ಕೆಎಮ್‌ಆರ್-204 (ಮಧ್ಯಮಾವಧಿ ತಳಿಗಳು 106 ರಿಂದ 120 ದಿನಗಳು)	05-12	Establishment (ಮೊಳಕೆ ಹೊರಹೊಮ್ಮುವಿಕೆ)	ವಾಡಿಕೆ	ಇದೆ		
ಆಗಸ್ಟ್-ಸೆಪ್ಟೆಂಬರ್	ಇಂಡಾಫ್-9, ಜಿಪಿಯು-45, ಜಿಪಿಯು-28, ಜಿಪಿಯು-48 (ಅಲ್ಪಾವಧಿ ತಳಿಗಳು 95 ರಿಂದ 105 ದಿನಗಳು)			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದೆ	ಮಳೆಯ ಮುನ್ಸೂಚನೆಗನುಸಾರ ಮರುಬಿತ್ತನೆ ಕೈಗೊಳ್ಳುವುದು	
Crop: Finger Millet	ಪೂರ್ವ ಸಿದ್ಧತೆ: 1. ಭೂಮಿಯನ್ನು 1-2 ಬಾರಿ ಉಳುಮೆ ಮಾಡುವುದು 2. ಕೂಬ್ಬೆ ಗೊಬ್ಬರವನ್ನು (3 ಬಸ್/ಎಕರೆ)ಗೆ 3-4 ವಾರ ಬಿತ್ತನೆಗೆ ಮುಂಚಿತವಾಗಿ ಮಣ್ಣಿಗೆ ಸೇರಿಸುವುದು 3. ಪೂರ್ವ ಮುಂಗಾರಿನ ತೇವಾಂಶದಾನಾಂತರ ಏಪ್ರಿಲ್-ಮೇ ತಿಂಗಳಲ್ಲಿ ಹಸಿಲೆ ಗೊಬ್ಬರವಾಗಿ ಅಪ್‌ಸೇಟು, ಪುರುಳಿ ಅಥವಾ ಅಲಸದೆನ್ನು ಬಿತ್ತುವುದು	.12-22	Vegetative stage (ಬೆಳವಣಿಗೆ ಹಂತ)	ವಾಡಿಕೆ	ಇದೆ	ಪಚ್ಚುಗಿರುವ (4 ಅಂಗುಲ ಅಂತರಕ್ಕೆ ಒಂದರಂತೆ) ಗಿಡಗಳನ್ನು ತಗದಿಹಾಕುವುದು. ಎಲೆ ಬಂಕರೋಗ ಹಾಗೂ ಕುತ್ಸಿಗ ರೋಗ ಕಂಡು ಬಂದಲ್ಲಿ ಮ್ಯಾಂಕೋಜೆಬ್ 75 ಡಬ್ಲ್ಯೂ.ಎ. 2 ಗ್ರಾಂ/ಲೀ ಅಥವಾ ಎಡಿಪೆನ್‌ಫಾಸ್ 50 ಇ.ಸಿ. 1 ಮಿ. ಲೀ/ಲೀ ನನ್ನು 200 ಲೀ. ನೀರಿನಲ್ಲಿ ಬೆರೆಸಿ ಸಿಂಪರಣೆ ಮಾಡುವುದು	
				ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದೆ	ಸಸ್ಯ ಸಂಖ್ಯೆ ತೇ70 ರಕ್ಕಿಂತ ಕಡಿಮೆಯಿದ್ದಲ್ಲಿ ಮರುಬಿತ್ತನೆ ಕೈಗೊಳ್ಳಲು ಯೋಚಿಸುವುದು	
				ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಸಾಧಾರಣ ಸಸ್ಯಸಂಖ್ಯೆಯಿದ್ದಲ್ಲಿ ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು (ಹಾಯಿ / ತುಂತುರು ನೀರಾವರಿ).	
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದೆ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆ	ಇದೆ	ಬಿತ್ತಿದ 30-35 ದಿನಗಳೊಳಗೆ ಅಂತರಬೀಜಾಯದ ಮೂಲಕ ಕಳೆ ನಿರ್ವಹಣೆ ಮತ್ತು ಭೂ.ಸಂ.ಅ. ಅಧಾರ್‌ನಿರೀಕ್ಷಾರನ್ನು ಮೇಲುಗೊಬ್ಬರ ಕೊಡುವುದು. ಕಾಂಡಕೊರಕ ಅಥವಾ ಸಸ್ಯವೇನು ಕಂಡುಬಂದಲ್ಲಿ ಕ್ಲೋಸೆಥಿರಿಪಾಸ್ 20 ಇ. ಸಿ. 2 ಮಿ. ಲೀ/ಲೀ ನನ್ನು 250 ಲೀ ನೀರಿನಲ್ಲಿ ಬೆರೆಸಿ ಸಿಂಪರಣೆ ಮಾಡುವುದು
					ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದೆ	ಬಿತ್ತಿದ 30-35 ದಿನಗಳೊಳಗೆ ಕಳೆ ನಿರ್ವಹಣೆ ಮತ್ತು ಅಂತರ ಬೇಸಾಯ ಕೈಗೊಳ್ಳುವುದು.
					ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಸಾಧ್ಯವಿದ್ದಲ್ಲಿ ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು. ಮಣ್ಣಿನ ತೇವಾಂಶವನ್ನು ಉಳಿಸಿಕೊಳ್ಳಲು ಅನುಪಯುಕ್ತ ಸಸ್ಯದ ಭಾಗಗಳನ್ನು ಮಣ್ಣಿನ ಮೇಲೆ ಹೊದಿಸುವ ರೀತಿ ಹಾಕುವುದು.
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದೆ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆ	ಇದೆ	ತೇ 1 ರ (10ಗ್ರಾಂ ಪ್ರತಿ ಲೀ ನೀರಿಗೆ) ಪುಟ್ರಿಯಂ ಸಿಂಪಡಿಸುವುದು
					ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದೆ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.
					ವಾಡಿಕೆ	ಇದೆ	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದೆ	ಸಾಧ್ಯವಿದ್ದಲ್ಲಿ ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು.		
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.		
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದೆ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.		
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.		
			ವಾಡಿಕೆ	ಇದೆ			
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದೆ	ಅತೀ ಬರ ಸ್ಥಿತಿಯಲ್ಲಿ ಬೆಳೆಯನ್ನು ಮೇವಿಗಾಗಿ ಕಟಾವು ಮಾಡುವುದು.		
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದೆ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು. ಗಿಡಗಳು ನೆಲಕ್ಕುಳುಕುವುದನ್ನು ತಡೆಯಲು ಕೂಡಿಸಿ ಕಟ್ಟುವುದು.		
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಗಿಡಗಳು ನೆಲಕ್ಕುಳುಕುವುದನ್ನು ತಡೆಯಲು ಕೂಡಿಸಿ ಕಟ್ಟುವುದು.		
			Harvest (ಕೊಯ್ಯುವ ಹಂತ)			ಕಾಳು ಮಾಗಿದ ನಂತರ, ಮಳೆಯ ಮುನ್ಸೂಚನೆಯಾಧಾರಿತ ಕಟಾವು ಮಾಡುವುದು	

Table 1: Finalized advisories for pigeonpea crop.

ಬಿತ್ತನೆ ದಿನಾಂಕ	ತಳಿಗಳು	ಬಿತ್ತನೆ ನಂತರದ ದಿನಗಳ ಸಂಖ್ಯೆ	ಬೆಳೆಯ ಹಂತ	ಹಿಂದಿನ ವಾರದ ಹವಾವಾಸನ: ಮಳೆ: ವಾಡಿಕೆ, ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ, ವಾಡಿಕೆಗಿಂತ ಹೆಚ್ಚು	ಮುಂದಿನ ವಾರದ ಮುನ್ಸೂಚನೆ: ಮಳೆ: ಇಲ್ಲ, ಇಲ್ಲ	ಸಲಹೆಗಳು
ಮೇ-ಜುಲೈ	ಬಿ ಆರ್ ಜಿ-1,2,3,5 ಟಿ ಟಿ ಬಿ - 7, ಐ.ಸಿ.ಸಿ 7035, ಹೆಚ್. ವೈ 3ನಿ	0-10	Germination (ಮೊಳಕೆಯೊಡೆಯುವಿಕೆ)	ವಾಡಿಕೆ	ಇದ	5-6 ಕೆ.ಜಿ./ಎಕರೆ ಬಿತ್ತನೆ ಬೀಜಗಳನ್ನು 3-4 ಅಡಿ ಸಾಲುಗಳ ಅಂತರದಲ್ಲಿ ಬಿತ್ತನೆ ಮಾಡುವುದು. ಭೂ.ಸಂ.ಆ. ಆಧಾರಿಸಿ ಶಿಫಾರಸ್ಸು ಮಾಡಲಾದ ರಸಗೊಬ್ಬರಗಳ ಬಳಕೆ + ಜೈವಿಕ ಗೊಬ್ಬರಗಳ ಬಳಕೆ (ರೈಷೋಬಿಯಂ, ರಂಜಕ ಕರಗಿಸುವ ಜೀವಾಣುಗಳ ಬಳಕೆ).
	ಪೂರ್ವ ಸಿದ್ಧತೆ: 1. ಭೂಮಿಯನ್ನು 1-2 ಬಾರಿ ಉಳುಮೆ ಮಾಡುವುದು	10-25	Establishment (ಮೊಳಕೆ ಹೊರಹೊಮ್ಮುವಿಕೆ)	ವಾಡಿಕೆ	ಇದ	ಮೂಳಕ ಬಾರದಿರುವ ಜಾಗಗಳಲ್ಲಿ ಬಿತ್ತನೆ ಮಾಡುವುದು
ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ				ಇದ		
ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ				ಇಲ್ಲ	ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು.	
ವಾಡಿಕೆಗಿಂತ ಹೆಚ್ಚು				ಇದ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.	
				ವಾಡಿಕೆಗಿಂತ ಹೆಚ್ಚು	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.
Crop: Pigeonpea	25-50	Vegetative development (ಬೆಳವಣಿಗೆ ಹಂತ)	ವಾಡಿಕೆ	ಇದ	ಬಿತ್ತನೆ 35-40 ದಿನಗಳೊಳಗೆ ಮಣ್ಣು ಏರುಹಾಕುವುದು, ಅಂತರ ಬೇಸಾಯದ ಮೂಲಕ ಕಳೆ ನಿರ್ವಹಣೆ, ಸಾಧ್ಯವಾದಲ್ಲಿ ಗಿಡದ ತುದಿಗಳನ್ನು ಚಿವುಟುವುದು. ಗೂಡು ಮಾರು ಹುಳುವಿನ ಬಾಧೆ ಕಂಡು ಬಂದಲ್ಲಿ ಲೀ. ನೀರಿಗೆ 2 ಗ್ರಾಂ ಮಿಥೇನೇಮ್ 40 ಎಸ್.ಒ ಕೀಟನಾಶಕವನ್ನು ಸಿಂಪಡಿಸುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದ	ಸಸ್ಯಸಂಖ್ಯೆ ಶೇ 50 ಕ್ಕಿಂತ ಕಡಿಮೆಯಿದ್ದಲ್ಲಿ ಮರುಬಿತ್ತನೆ ಮಾಡುವುದು. ಹೆಚ್ಚಾಗಿದ್ದಲ್ಲಿ ತುಂತುರು ನೀರಾವರಿ ಮೂಲಕ ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು. ಬಂಜೆ ರೋಗ ಕಂಡುಬಂದಾಗ ರೋಗ ಖೇಡಿತ ಗಿಡಗಳನ್ನು ಕಿತ್ತು ಸುಡುವುದು. ಲೀ. ನೀರಿಗೆ 2.0 ಮಿಲಿ. ಫೆನಾಜಾಕ್ಟಿನ್ ಸೇರಿಸಿ ಸಿಂಪರಣೆ ಮಾಡುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.	
			ವಾಡಿಕೆ	ಇದ	ಭೂ.ಸಂ.ಆ. ಆಧಾರಿಸಿ ಶಿಫಾರಸ್ಸು ಮಾಡಲಾದ ಸಾರಜನಕ ಪ್ರಮಾಣದ ಮೇಲುಗೊಬ್ಬರವನ್ನು ಹೂಬಿಡುವ ಪ್ರಾರಂಭಿಕ ಹಂತದಲ್ಲಿ ಕೊಡುವುದು. ಕಾಯಿಕೊರಕ ಹುಳು ಕಂಡುಬಂದರೆ ಲೀ. ನೀರಿಗೆ 0.5 ಮಿಲಿ. ಇಂಡಾಕ್ಸಿಕಾರ್ಬ್ 14.5 ಎಸ್.ಒ. ಅಥವಾ 2 ಮಿಲಿ. ಕ್ಲೋರೋಪೈರಿಫಾಸ್ 20 ಇಸಿ. ಸೇರಿಸಿ ಸಿಂಪಡಿಸುವುದು. ಸೊರಗು ರೋಗ ಕಂಡು ಬಂದಲ್ಲಿ: ಕಾರ್ಬೆಂಡಜಿಂ 1 ಗ್ರಾಂ/ಲೀ. ನೀರಿಗೆ ಸೇರಿಸಿ ಸುರಿಸುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದ	ಕಳೆಗಳನ್ನು ಕಿತ್ತು ಸಾಲುಗಳ ಮಧ್ಯೆ ಹೂಡಿಕೆಹಾಕುವುದು.	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು. ಕಳೆಗಳನ್ನು ಕಿತ್ತು ಸಾಲುಗಳ ಮಧ್ಯೆ ಹೂಡಿಕೆಹಾಕುವುದು.	
	ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದ	ಸಾಲಿನ ಮಧ್ಯದ ಮಣ್ಣನ್ನು ಗಿಡಗಳ ಬುಡಕ್ಕೆ ಏರುಹಾಕಿ ಬಿಸಿಗಾಲುವೆ ನಿರ್ಮಿಸಿ ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು.			
	ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.			
	50-90	Flowering (ಹೂಬಿಡುವ ಹಂತ)	ವಾಡಿಕೆ	ಇದ	ಕಾಯಿನೋ ಹಾನಿ ಕಂಡುಬಂದಲ್ಲಿ ಲೀ. ನೀರಿಗೆ 0.2 ಗ್ರಾಂ ಥಿಯಾಮಿಥಾಕ್ಸಾಮ್ 25 ಡಬ್ಲ್ಯೂ.ಒ + 10 ಗ್ರಾಂ ಬೆಲ್ಲ ಸೇರಿಸಿ ಸಿಂಪಡಿಸುವುದು	
			ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದ		
ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ			ಇಲ್ಲ	ಸಂರಕ್ಷಣಾ ನೀರಾವರಿ ಕೊಡುವುದು.		
ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ			ಇದ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.		
90-130	Grain filling (ಕಾಳು ಕಟ್ಟುವ ಹಂತ)	ವಾಡಿಕೆ	ಇದ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.		
		ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದ			
		ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದ			
		ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ			
130-180	Maturity (ಕಾಳು ಮಾಗುವ ಹಂತ)	ವಾಡಿಕೆ	ಇದ			
		ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇದ	ಹಸಿರು ಕಾಯಿಗಳನ್ನು ಕೊಯ್ಲು ಮಾಡುವುದು		
		ವಾಡಿಕೆಗಿಂತ ಕಡಿಮೆ	ಇಲ್ಲ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಲ್ಲದಂತೆ ಬಿಸಿಯುವುದು.		
		ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇದ	ಜಮೀನಿನಲ್ಲಿ ನೀರು ನಿಂತಿದ್ದರೆ ಬಿಸಿಯುವುದು.		
	ವಾಡಿಕೆಗಿಂತ ಅಧಿಕ	ಇಲ್ಲ				
harvest ಕಟಾವು ಹಂತ				ಮಳೆಯ ಮುನ್ಸೂಚನೆಯಾಧಾರಿತ ಕೊಯ್ಲು ಮಾಡುವುದು		

Table 2: Finalized SMS formats for different Agri. and Horti. crops of southern Karnataka

Agricultural crops:

<i>Crop</i>	<i>Crop duration</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Water holding capacity</i>	<i>Suggestions/Recommendations</i>
Ragi/Finger millet	-45	Normal			Selection of best suitable crop (based on LRI)
	-40	Normal			Grow green manure crops like sunhemp, horsegram or cowpea and incorporate them within 45-50 days
	-20				Plough the land 1-2 times
	0-5	Normal	Yes		Sow 8 kg of seeds per acre along with incorporating fertilizers into the soil
	6-10	Above normal	Yes	High	Drain out excess rainwater from the field
	25-30	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	31-40	Below normal	No	Low	Provide Lifesaving irrigation
	90-110	Below normal	No	Low	
	90-110	Above normal	Yes	High	Tying up to avoid crop lodging
	111-120				Suitable time for harvest
Redgram/Pigeon pea	-40	Normal			Selection of best suitable crop (based on LRI)
	-20				Preparedness: Plough the land 1-2 times
	0-10	Normal	Yes		Sow 5-6 kg of Rhizobium treated seeds per acre along with incorporating fertilizers into the soil
	31	Normal	Yes		Earthing up to create drainage channels
	32				Placing of 4-5 pheromone traps
	35				Nipping
	80-100	Below Normal	No	Low	Provide Lifesaving irrigation
	130-180	Below Normal	No	Low	Harvest for vegetable purpose
	180-210				Suitable time for harvest

Crop	Crop duration	Previous week rainfall (Above normal, Normal, Below normal)	Upcoming week rainfall (Yes, No)	Water holding capacity	Suggestions/Recommendations
Maize					Preparedness: 1. Plough the land 1-2 times, 2. Grow green manure crops like sunhemp, horsegram or cowpea and incorporate them within 45-50 days
	0-4	Normal	Yes		Sow 6 kg of seeds per acre along with incorporating fertilizers into the soil
	5-10	Above normal	Yes	High	Drain out excess rainwater from the field
	25-35	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	90-110	Below Normal	No	Low	Harvest the crop for fodder purpose
	110-120				Suitable time for harvest
Groundnut					Preparedness: 1. Plough the land 1-2 times
	0-7	Normal	Yes		Sow 45 kg of Rhizobium treated seeds per acre along with incorporating fertilizers into the soil
	25-27	Normal	Yes		Earthing up to create drainage channels
	28-30	Normal	Yes		Apply 200 kg gypsum per acre
	35-50	Below Normal	No	Low	Provide Lifesaving irrigation
	100-110	Normal	Yes		Harvest green pods when moisture is present
	120				Suitable time for harvest
Sunflower					Preparedness: 1. Plough the land 1-2 times, 2. Grow green manure crops like sunhemp, horsegram or cowpea and incorporate them within 45-50 days
	0-4	Normal	Yes		Sow 2 kg of Azotobacter treated seeds per acre along with incorporating fertilizers into the soil
	30-35	Normal	Yes		Earthing up to create drainage channels

Crop	Crop duration	Previous week rainfall (Above normal, Normal, Below normal)	Upcoming week rainfall (Yes, No)	Water holding capacity	Suggestions/Recommendations
	36-45	Normal	Yes		Spray 0.2 % Borax
	46-55	Below Normal	No	Low	Provide lifesaving irrigation
	110.120				Suitable time for harvest
Horsegram, Cowpea, Field bean					Preparedness: 1. Plough the land 1-2 times
	0-5	Normal	Yes		Sow 10-12 kg of Rhizobium treated seeds per acre along with incorporating fertilizers into the soil
	30-35	Normal	Yes		Earthing up to create drainage channels
	36-45	Below Normal	No	Low	Provide lifesaving irrigation
	65-75	Below Normal	No	Low	Harvest for vegetable purpose
	76-95				Suitable time for harvest
Fox tail millet, Kodo millet, Little millet, Proso millet, Barnyard millet, Brown top millet					Preparedness: 1. Plough the land 1-2 times
	0-5	Normal	Yes		Sow 4-5 kg of seeds per acre along with incorporating fertilizers into the soil
	6-10	Above Normal	Yes	High	Drain out excess rainwater from the field
	25-30	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	31-40	Below Normal	No	Low	Provide Lifesaving irrigation
	90-100	Below Normal	No	Low	Harvest for fodder purpose
	90-100	Above Normal	Yes	High	Tying up to avoid crop lodging
	110-120				Suitable time for harvest
Greengram					Preparedness: 1. Plough the land 1-2 times
	0-10	Normal	Yes		Sow 6-8 kg of Rhizobium treated seeds per acre along with incorporating fertilizers into the soil

Crop	Crop duration	Previous week rainfall (Above normal, Normal, Below normal)	Upcoming week rainfall (Yes, No)	Water holding capacity	Suggestions/Recommendations
	30-35	Normal	Yes		Earthing up to create drainage channels
	45-50	Below Normal	No	Low	Provide lifesaving irrigation
	70-80	Below Normal	No	Low	Harvest for vegetable purpose
	90-100				Suitable time for harvest
Blackgram					Preparedness: 1. Plough the land 1-2 times
	0-10	Normal	Yes		Sow 6-8 kg of Rhizobium treated seeds per acre along with incorporating fertilizers into the soil
	30-35	Normal	Yes		Earthing up to create drainage channels
	45-50	Below Normal	No	Low	Provide lifesaving irrigation
	90-100				Suitable time for harvest
Cotton					Preparedness: 1. Plough the land 1-2 times. 2. Grow green manure crops like sunhemp, horsegram or cowpea and incorporate them within 45-50 days
	0-5	Normal	Yes		Sow 0.5 kg of seeds per acre along with incorporating fertilizers into the soil
	30-32	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	33-35	Normal	Yes		Placing 4-5 Pheramone traps
	80-100	Below Normal	No	Low	Provide lifesaving irrigation
	80-100	Above Normal	Yes	High	Drain out excess rainwater from the field
	120-140	Below Normal	No	Low	Provide lifesaving irrigation
	180-200				Suitable time for harvest
Sorghum					Preparedness: 1. Plough the land 1-2 times

Crop	Crop duration	Previous week rainfall (Above normal, Normal, Below normal)	Upcoming week rainfall (Yes, No)	Water holding capacity	Suggestions/Recommendations
	0-4	Normal	Yes		Sow 3 kg of seeds per acre along with incorporating fertilizers into the soil
	5-10	Above Normal	Yes	High	Drain out excess rainwater from the field
	25-35	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	90-110	Below Normal	No	Low	Harvest for fodder purpose
	111-120				Suitable time for harvest
Paddy	Days after transplanting				Preparedness: 1. Prepare Levelled puddled land 2. Transplant 20-25 days seedlings along with fertilisers incorporation
	25-35	Normal	Yes		Intercultivation for Weed management and top dressing of nitrogenous fertilisers
	51-60	Normal	Yes		Top dressing of nitrogen and potassic fertilizers
	66-90	Above Normal	Yes	Low	Drain out more than 2-inch rain water in field
	91-110	Below Normal	No	Low	Provide lifesaving irrigation by irrigating upto 2 inch of water
	111-120	Above Normal	Yes	High	Drain out more than 2-inch rain water in field
	121-130				Suitable for harvest
Aerobic rice					Preparedness: 1. Plough 1-2 times and level the land 2. Grow green manure crops like sunhemp, horsegram or cowpea and incorporate them within 45-50 days
	0-12	Normal	Yes		Sow 25 kg of seeds per acre along with incorporating fertilizers into the soil
	13-30	Normal	Yes	High	Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	31-55	Above Normal	Yes		Drain out excess rainwater from the field

<i>Crop</i>	<i>Crop duration</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Water holding capacity</i>	<i>Suggestions/Recommendations</i>
	56-80	Below Normal	No	Low	Provide lifesaving irrigation
	81-95	Below Normal	No	Low	Provide lifesaving irrigation
	96-120	Above Normal	Yes	High	Drain out excess rainwater from the field
	121-125				Suitable time for harvest
Sugarcane					Preparedness: 1. Plough the land 2-3 times 2. Planting setts in 3 feet distance rows along with fertilisers incorporation
	30-45	Normal	Yes		Intercultivation for Weed management and top dressing of nitrogenous fertilisers
	70-80	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	105-120	Normal	Yes		Intercultivation along with top dressing of recommended dose of nitrogenous fertilizers
	150-210	Below Normal	No	Low	Provide lifesaving irrigation
	211-260	Above Normal	Yes	High	Drain out excess rainwater from the field
	290-320				Suitable time for harvest

Horticulture crops:

<i>Crop</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Crop duration</i>	<i>Advisories</i>
Tomato	Normal	Yes	30 days after transplanting	Staking operation
	Normal	Yes	40 days after transplanting	Install 15 yellow sticky traps per acre
			45 days after transplanting	Apply recommended pesticides for leaf curl virus and sucking pests
Brinjal	Normal	Yes	30 days after transplanting	Staking operation
	Normal	Yes	40 days after transplanting	Installation of 15 yellow sticky traps per acre
	Normal	Yes	45 days after transplanting	Application of recommended pesticides for little leaf virus and sucking pests
	Normal	Yes	50 days after transplanting	Application of recommended fungicides for shoot and stem borer
Chilli	Normal	Yes	30 days after transplanting	Staking operation
	Normal	Yes	40 days after transplanting	Installation of 15 yellow sticky traps per acre
	Normal	Yes	45 days after transplanting	Application of recommended pesticides for leaf curl virus and sucking pests
Potato	Normal	Yes	25 days after sowing	Spray recommended pesticides for sucking pests
	Normal	Yes	30 and 45 days after sowing	Spraying of Arka vegetable special
	Normal	Yes	45 days after sowing	Intercultural operation and earthing up
	Normal	Yes	50 days after sowing	Suitable measures for late blight
Onion	Normal	Yes	30 days after sowing	Earthing up
	Normal	Yes	35 days after sowing	Installation of 2 pheromones traps per acre
	Normal	Yes	45 days after sowing	Intercultural operation and spraying of 1% boron and 100 ppm gibberellic acid
French bean	Normal	Yes	30 days after sowing	Staking for pole type beans

Crop	Previous week rainfall (Above normal, Normal, Below normal)	Upcoming week rainfall (Yes, No)	Crop duration	Advisories
	Normal	Yes	35 days after sowing	Spray recommended pesticides for sucking pests
Sweet potato	Normal	Yes	40 days after sowing	Intercultivation and top dressing of nitrogen fertilizer and earthing up
	Normal	Yes	120 days after sowing	Installation of 10 pheromones traps per hectare
Cabbage	Normal	Yes	20 days after sowing	Installation of 10 pheromones traps per hectare
	Normal	Yes	30 days after sowing	Intercultivation and top dressing of nitrogen fertilizer and earthing up
Pumpkin	Normal	Yes	25 days after sowing	Spraying of 250 ppm ethrel at 2 to 4 leaf stage
	Normal	Yes	30 days after sowing	Spraying of Arka vegetable special
Mango	Normal	Yes	01/06 - 04/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
	Normal	Yes	05/06 - 07/06	Spray Arka mango special
	Normal	Yes	07/07 - 10/07	Prune the trees
	Normal	Yes	24/12 - 27/12	1. Spray Arka mango special. 2. Installation of 10 pheromones traps per hectare
Banana	Bunch development	Normal	38 weeks after planting	Give support to the plants
		Normal	42 weeks after planting	Denavelling
Jackfruit	Less than normal	No	25/02 - 28/02	Mulch the tree basins using dried leaves
	Normal	Yes	01/06 - 04/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Grapes	Normal	Yes	01/04 - 05/04	Prune the vines (Summer pruning) and apply recommended dose of fertilizers and mulch the soil using dried leaves

<i>Crop</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Crop duration</i>	<i>Advisories</i>
	Normal	Yes	08/04 - 10/04	Application of recommended fungicides for powdery mildew and downy mildew
	Normal	Yes	01/10 - 05/10	Prune the vines (Winter pruning)
Guava	Less than normal	No	01/03 -05/03	Mulch the soil using dried leaves
	Normal	Yes	01/06 - 04/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
	Normal	Yes	08/10 - 10/10	For the control of bronzing, spray 0.5 % DAP and zinc sulphate
Sapota	Less than normal	No	01/03 - 05/03	Mulch the soil using dried leaves
	Normal	Yes	01/06 - 05/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Papaya	Less than normal	No	01/03 - 05/03	Soil mulching using dried leaves
	Normal	Yes	01/04 - 05/04	For virus management. 1. Installation of 10 yellow sticky traps per acre. 2. Application of 5 % neem oil
	Normal	Yes	01/06 -05/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Papaya	Normal	Yes	01/03 - 04/03	Prune the trees and mulch the soil using dried leaves
	Normal	Yes	01/06 - 04/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Pomegranate	Less than normal	No	01/03 - 04/03	Soil mulching using dried leaves
	Normal	Yes	07/03 - 10/03	Application of recommended pesticides for fruit borer
	Normal	Yes	01/06 - 04/06	Intercultivation and application of fertilizers

<i>Crop</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Crop duration</i>	<i>Advisories</i>
	Normal	Yes	05/06 - 08/06	Sowing of green manure crops like cowpea, horse gram after cultivation and incorporating it to the soil after 45 days of sowing
	Normal	Yes	01/09 - 04/09	Spray 2.5 ml/l of ethrel 39 % S L
	Normal	Yes	01/10 - 04/10	Pruning
Coconut	Normal	Yes	01/03 - 04/03	Soil mulching using coconut fronds and coconut husk
	Normal	Yes	01/04 - 04/04	For rugose whitefly management. 1. Installation of 10 yellow sticky traps per acre. 2. Application of 5 % neem oil
	Normal	Yes	01/06 - 04/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Arecanut	Less than normal	Yes	01/03 - 04/03	Provide shade for new plantations
	Normal	Yes	01/06 - 04/06	Intercultural operation and application of fertilizers
	More than normal	Yes	05/06 - 10/06	Application of 1 kg phosphate fertiliser and 2 kg neem cake per palm for control of yellow leaf disease of arecanut
	Normal	Yes	01/10 - 04/10	Intercultural operation and application of fertilizers
	More than normal	Yes	05/10 - 10/10	Suitable measures for the control of leaf spot
Cashewnut	Normal	Yes	08/02 - 12/02	Soil mulching using dried leaves
	Normal	Yes	01/6 - 05/06	Prune the trees
	Normal	Yes	06/6 - 10/06	Plough the land and sow green manure crops like sunhemp, cowpea, horse gram and incorporate it to the soil after 45 days of sowing
Black pepper	Normal	Yes	01/06 - 05/06	Intercultivation and application of fertilizers
	Normal	Yes	01/08 - 05/08	Intercultivation and application of fertilizers

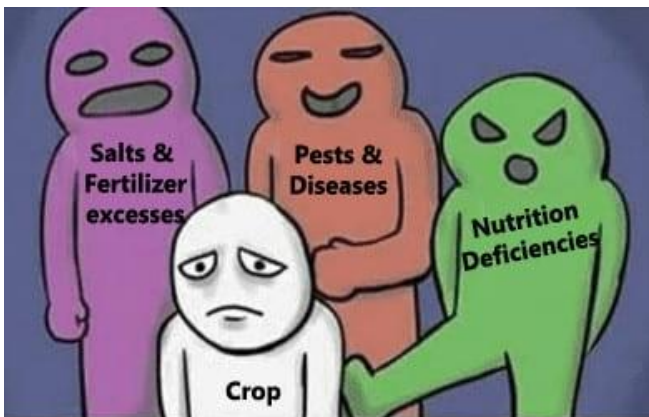
<i>Crop</i>	<i>Previous week rainfall (Above normal, Normal, Below normal)</i>	<i>Upcoming week rainfall (Yes, No)</i>	<i>Crop duration</i>	<i>Advisories</i>
	Normal	Yes	06/08 - 08/09	Prune the supportive trees to manage shade
Cardamom	Normal	Yes	01/03 - 05/03	Soil mulching using dried leaves
	Normal	Yes	01/05 - 05/05	Uncover the flower bunches to facilitate pollination by honey bees
	Normal	Yes	01/06 - 05/06	Pruning of shade trees
Ginger & Turmeric	Growth stage	Normal	30 days after planting	Intercultivation and application of fertilizers and earthing up

Chapter-6

Major nutrients, their role and deficiency symptoms in crop

This chapter provides information on the nutrients required for crop growth and productivity and their deficiency symptoms, ill effects of indiscriminate use of chemical fertilizers as well as dosage of nutrients for important crops

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.

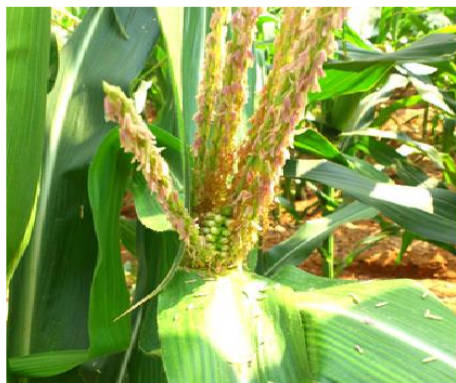


8. Zinc (Zn): A Guardian for Growth

- **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 on 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.

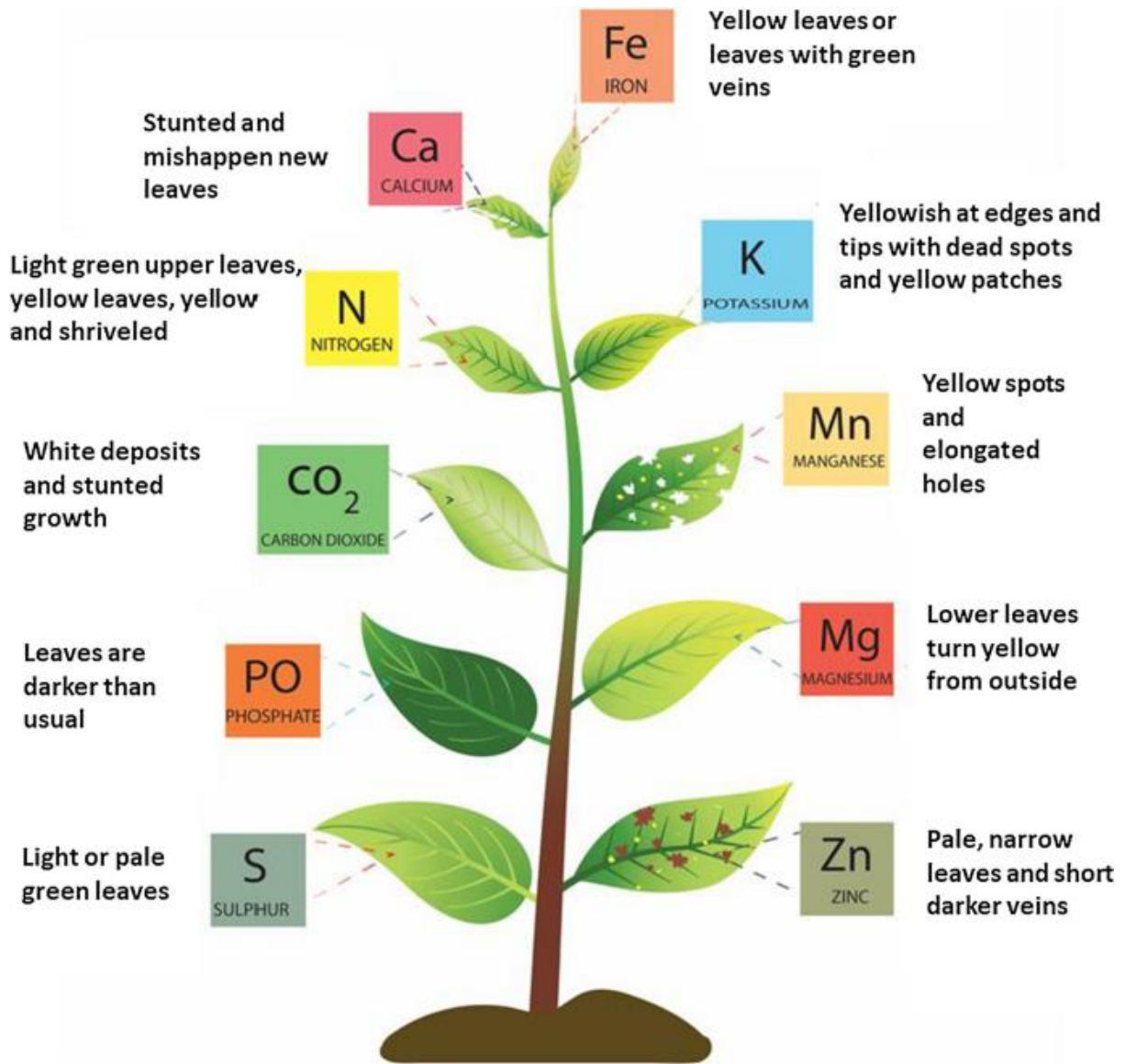
- **Deficiency Symptoms:** Early signs of manganese deficiency include yellowing or mottling of younger leaves, with brown spots potentially developing later. Stunted growth and delayed maturity are also common symptoms. Grey Speck also called as grey stripe, grey spot or dry spot in oats, pahla blight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

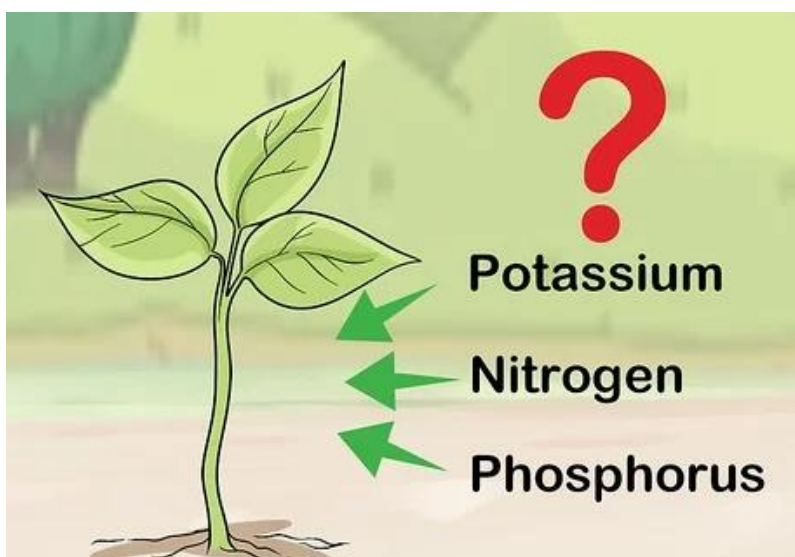
- **Function:** Boron is like a skilled architect for plants. It plays a vital role in cell wall development, influencing the structure and integrity of plant tissues. Boron is also crucial for seed formation and proper flower and fruit development.
- **Deficiency Symptoms:** Boron deficiency can manifest 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.

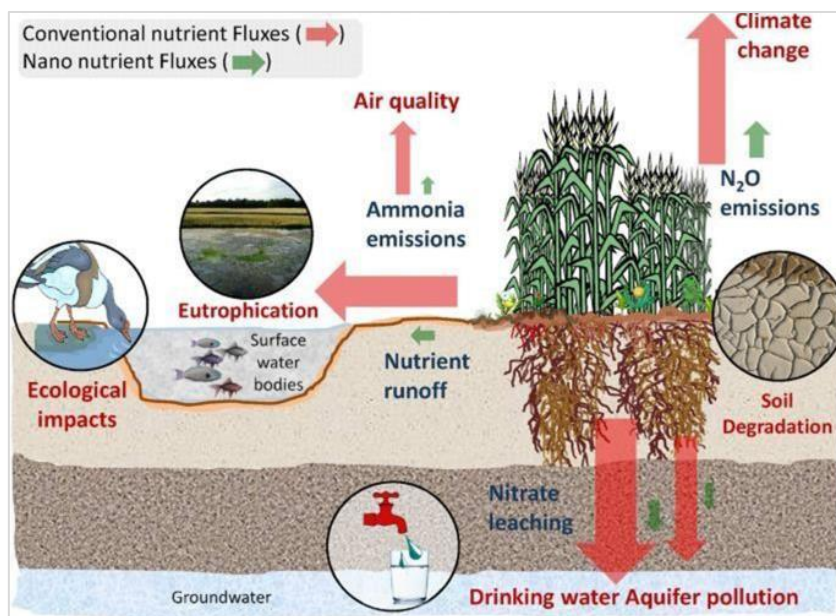


Crop	Nitrogen (N)	Phosphorus (P)	Potash (K)
	(kg/acre)		
Finger Millet	(20) 40	(16) 20	(15) 20
Maize	(40) 60	(20) 30	(10) 15
Pigeon Pea	(10)	(20)	(10)
Groundnut	(10)	(20) 30	(10) 15
Sunflower	(15) 36	(20) 36	(15) 25
Tomato	100	100	100
Chilli	(40) 60	(20) 30	(20) 30
Cotton	(32) 60	(16) 30	(16) 30
Ginger	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 (N₂O), a potent greenhouse gas that contributes to climate change. Additionally, excessive nitrogen application can lead to ammonia (NH₃) 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

ಬೆಳೆಗಳಿಗೆ ಶಿಫಾರಸ್ಸು ಮಾಡಿರುವ ಪೋಷಕಾಂಶಗಳು

ಬೆಳೆ	ಸಾ	ರಂ	ಪೊ	ಸತು	ಇತರೆ
ಹೈಬ್ರಿಡ್ ಜೋಳ					
ನೀರಾವರಿ	60	30	15	-	-
ಮಳೆಯಾಶ್ರಿತ	40	20	10		
ಹಿಂಗಾರಿ ಜೋಳ	20	10	0	-	-
ಮುಸುಕಿನ ಜೋಳ					
ನೀರಾವರಿ	60	30	16	4	-
ಮಳೆಯಾಶ್ರಿತ	40	20	10	4	-
ರಾಗಿ					
ನೀರಾವರಿ	40	20	20	5	4 ಕಿ.ಗ್ರಾಂ ಬೋರಾಕ್ಸ್
ಮಳೆಯಾಶ್ರಿತ	20	16	15	-	
ನವಣೆ	16	16	0	-	-
ಹಾರಕ	8	8	0	-	-
ಸಾಮೆ	8	8	0	-	-
ತೊಗರಿ	10	20	10	6	8 ಕಿ.ಗ್ರಾಂ ಗಂಧಕ
ಹೆಸರು	10	20	20	-	-
ಉದ್ದು	10	20	10	-	-
ಹಲಸಂದೆ	10	20	10	-	-
ಕಡಲೆ					
ನೀರಾವರಿ	10	20	20	-	-
ಮಳೆಯಾಶ್ರಿತ	5	10	10		
ಅವರೆ	10	20	10	-	-
ಹುರುಳಿ	10	15	10	-	-
ಶೇಂಗಾ					
ನೀರಾವರಿ	10	30	15	4	4 ಕಿ.ಗ್ರಾಂ ಬೋರಾಕ್ಸ್ 500 ಕಿ.ಗ್ರಾಂ/ಹೆ ಜಿಪ್ಸಂ
ಮಳೆಯಾಶ್ರಿತ	10	20	10		
ಸೂರ್ಯಕಾಂತಿ					
ನೀರಾವರಿ	36	36	25	4	6 ಕಿ.ಗ್ರಾಂ ಬೋರಾಕ್ಸ್
ಮಳೆಯಾಶ್ರಿತ	15	20	15		
ಎಳ್ಳು	15	10	10	-	-
ಹರಳು	15	15	10	-	-
ಹತ್ತಿ	60	30	30	-	-
ಕಬ್ಬು	100	40	50	-	-

ತರಕಾರಿ ಮತ್ತು ಹೂವಿನ ಬೆಳೆಗಳು (ಕಿ.ಗ್ರಾಂ/ಎಕರೆಗೆ)	ಸಾ	ರಂ	ಪೊ
ಟೊಮ್ಯಾಟೋ	100	100	100
ಬದನೆ	50	40	20
ಆಲೂಗಡ್ಡೆ	50	40	50
ಮೆಣಸಿನಕಾಯಿ	40	20	20
ಎಲೆಕೋಸು	60	40	50
ಹೂಕೋಸು	60	40	50
ಗೆಡ್ಡೆಕೋಸು	60	40	50
ಸೌತೇಕಾಯಿ	24	20	32
ಹೀರೇಕಾಯಿ	20	20	20
ಕಲ್ಲಂಗಡಿ	40	30	40
ಕರಬೂಜ	40	30	20
ಬೆಂಡೆ	50	30	25
ತಿಂಗಳ ಹುರುಳಿಕಾಯಿ	25	40	30
ತರಕಾರಿ ಅಲಸಂದೆ	10	30	24
ಅವರೆಕಾಯಿ	10	20	10
ಚವಳಿಕಾಯಿ	10	30	24
ನುಗ್ಗೆ	20	50	12
ಮೂಲಂಗಿ	20	40	20
ಕ್ಯಾರೆಟ್	20	20	20
ಬೀಟ್‌ರೂಟ್	30	40	24
ಕೊತ್ತಂಬರಿ	14	14	24
ಕರಿಬೇವು (ಗ್ರಾಂ/ಗಿಡಕ್ಕೆ)			
ಒಂದನೇ ವರ್ಷ	50	25	25
ಎರಡನೇ ವರ್ಷ	150	37	37
ಮೂರನೇ ವರ್ಷ	300	50	50
ಗುಲಾಬಿ (ಗ್ರಾಂ/ಗಿಡಕ್ಕೆ)	10	10	15
ಮಲ್ಲಿಗೆ (ಗ್ರಾಂ/ಗಿಡಕ್ಕೆ)			
1-2 ವರ್ಷ	30	60	60
3-5 ವರ್ಷ	60	120	120
5 ವರ್ಷಗಳ ನಂತರ	120	240	240
ಸೇವೆಂತಿಗೆ	40	60	40
ಚೆಂಡುಹೂವು	90	24	24
ಕನಕಾಂಬರ	40	24	24
ಅರಿಶಿಣ	60	50	100
ಶುಂಠಿ	40	20	20

ವಿವಿಧ ರಸಗೊಬ್ಬರಗಳಲ್ಲಿ ಪೋಷಕಾಂಶಗಳ ಪ್ರಮಾಣ

ರಸಗೊಬ್ಬರಗಳು	ಪೋಷಕಾಂಶಗಳ ಪ್ರಮಾಣ
ಯೂರಿಯಾ	46% ಸಾರಜನಕ
ಅಮೋನಿಯಂ ಸಲ್ಫೇಟ್	20.6% ಸಾರಜನಕ, 24% ಗಂಧಕ
ಕ್ಯಾಲ್ಸಿಯಂ ಅಮೋನಿಯಂ ನೈಟ್ರೇಟ್	25% ಸಾರಜನಕ, 8.1% ಸುಣ್ಣ
ಸಿಂಗಲ್ ಸೂಪರ್ ಫಾಸ್ಫೇಟ್	16% ರಂಜಕ, 12% ಗಂಧಕ, 20% ಸುಣ್ಣ
ಮ್ಯೂರೈಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್	58-60% ಪೊಟ್ಯಾಷಿಯಂ
ಸಲ್ಫೇಟ್ ಆಫ್ ಪೊಟ್ಯಾಷ್	48-50% ಪೊಟ್ಯಾಷಿಯಂ 18% ಗಂಧಕ
ಡಿ.ಎ.ಪಿ	18% ಸಾರಜನಕ 46% ರಂಜಕ
ಮೆಗ್ನೀಷಿಯಂ ಸಲ್ಫೇಟ್	9.6% ಮೆಗ್ನೀಷಿಯಂ 13% ಗಂಧಕ
ಸತುವಿನ ಸಲ್ಫೇಟ್	21% ಸತು, 11% ಗಂಧಕ
ಕಬ್ಬಿಣದ ಸಲ್ಫೇಟ್	18.5% ಕಬ್ಬಿಣ
ಮ್ಯಾಂಗನೀಸ್ ಸಲ್ಫೇಟ್	33% ಮ್ಯಾಂಗನೀಸ್
ತಾಮ್ರದ ಸಲ್ಫೇಟ್	24% ತಾಮ್ರ
ಬೋರಾಕ್ಸ್	10.5% ಬೋರಾನ್
ಅಮೋನಿಯಂ ಮಾಲಿಬ್ಡೇಟ್	54% ಮಾಲಿಬ್ಬಿನಂ
ಜಿಪ್ಸಂ	13-18% ಗಂಧಕ 22% ಸುಣ್ಣ
ಕೃಷಿ ಸುಣ್ಣ	33% ಸುಣ್ಣ
ಡೋಲೋಮೈಟ್	21% ಸುಣ್ಣ 13.9% ಮೆಗ್ನೀಷಿಯಂ
ಕ್ಯಾಲ್ಸಿಯಂ ನೈಟ್ರೇಟ್	19% ಸುಣ್ಣ
ಶಿಲಾರಂಜಕ	33% ಸುಣ್ಣ