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CROP PRODUCTION TECHNOLOGY

UNIT 3

CROP MANAGEMENT

4	Potassium Schoenite ($K_2SO_4.MgSO_4.6H_2O$)	22to24%

Micro nutrient fertilizers

Sixteen elements are essential for plant growth out of these Fe, Zn, Mn, Cu, B, Mo, Cl are required in small quantities. They are called tertiary or micro nutrient. The average concentration of these nutrient in soil are Mn 1000 ppm, Cl 480 ppm, Zn 80 ppm, Cu 70 ppm, B 10 ppm, Mo 2 to 3 ppm, iron 140 ppm.

BIO-FERTILIZERS

Bio-fertilizers are the preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulolyotic micro- organisms used for application to seed or composting areas with the objective of increasing the numbers of such micro-organisms and accelerating those microbial processes which augment the availability of nutrients that can be easily assimilated by plants.

Microbial Inoculants: - In soil the activities of Nitrogen fixation, mobilization of plant nutrients and degradation of ligno- cellulotic wastes are being carried out by a large number of micro-organisms. Artificially multiplied cultures of selected micro-organisms augment the natural recycling of organic resources. There are different types of microbial inoculants.

Nitrogen fixers

1. Symbiotic:-Rhizobium, inoculants for legumes.
2. Non-symbiotic:-For cereals, millets, and vegetables.
    a. Bacteria:-
        i. Aerobic:-Azatobacter, Azomonas, Azospirillum.
        ii. Anaerobic:-Closteridium, chlorobium
        iii. Facultative anaerobes-Bacillus, Eisherichia
    b. Blue green algae-Anabaena, Anabaenopsis, Nostoe
3. Phosphate solubilizing micro-organisms.
4. Cellulolytic and lignolytic micro-organisms.
5. Sulphur dissolving bacteria.
6. Azolla.

1. Rhizobium Inoculant

Agronomic importance: - Response to Rhizobium inoculation has been amply demonstrated with most of the legumes-ahar, urd, mung, gram, soybean, etc. Besides, legume cultivation also leaves behind a naturally nitrogen enriched soil for subsequent cultivators...

2. Azotobacter Inoculants

Crop response: -Azotobacter inoculants on onion, wheat, rice, brinjal, tomato, cabbage, sugarcane, oat, barely, maize, potato can increase 7-12 % crop yields. Azotobacter spp. Increase plant yield primarily by fixing molecular nitrogen in soil, but it is also reported to synthesize auxins, vitamins, growth substances and antifungal antibiotics, which have beneficial effects of this bacterium on seed germination etc.

3. Azospirillum Inoculants

Occurrence in soil:- Soil pH in range of 5.6- 7.2 registers Azospirillum activity with optimum at 6.7 to 7.0; below pH 5.6 the soil is devoid of Azospillium and presence of organic matter in soil generally favours multiplication of this bacterium. Powdered and sterilized FYM+soil, FYM alone or FYM+charcoal are used as carriers.

4. Blue Green Algal Inoculants:

The inoculants are specially recommended for paddy crop grown in wet land conditions which also favour the growth of blue green algae. These algae also possess photosynthetic activity. Besides they excrete vitamin B_{12}, auxins and ascorbic acid which contribute to growth of rice plants.

5. Azolla- an Organic Manure

Methods of application: - It is applied as green manure prior to rice planting and as dual cropping with rice, when fern grows side by side with paddy.

Cropresponse:-Soilapplicationismorebeneficialthandualculturemethod; 10 tonnes fresh Azolla/ha is equivalent to 25-30 kg N/ha and increasing application rate from 5-20 tonnes/ha has direct response in grain yield of paddy.

6. Mycorrhizae (VAM)

Vesicular Arbiscular Mycorrhizae is a fungi used as biofertilizer. Mycorrhizae symbiosis is an intimate association between plant root system and soil fungi. The plant provides energy to fungi and in turn the fungi absorbs the P, Cu, Zn and B from surrounding are and supply to the plant through it's hypae.

TIME, METHODS OF APPLICATION OF FERTILIZERS AND FERTIGATION SCHEDULE TIME AND METHOD OF FERTILIZER APPLIC ATION

The fertilizer should be applied in the soil in such a way that it serves the plant to the best advantage. Fertilizers are applied by different methods mainly for three purposes.

1. To make the nutrients easily available to crops.
2. To reduce fertilizer losses and for ease of application
3. Crops and varieties differ for methods of application.

A. TIMEOFAPPLICATIONOFMANURESAND FERTILIZERS

1. Before the preparatory tillage

Bulky organic manures, green manures and soil amendments are applied

before preparatory tillage for thorough mixing with the soil.

2. Basal dressing

Application of manures and fertilizers before last ploughing or before sowing/planting

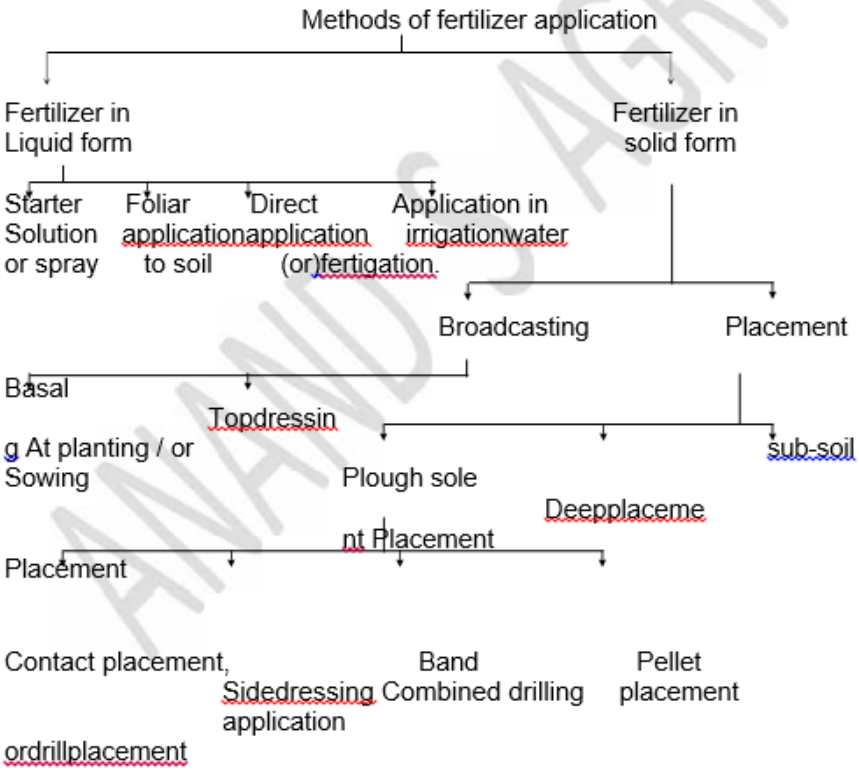
3. At the time of sowing/planting

Concentrated organic manures, readily soluble and highly mobile fertilizers and starter dose of N fertilizers are applied at this time.

4. Topdressing

It is the application of manures and fertilizers to the established crop within the crop duration. Top dressing may be done to the soil or the foliage. Split application of N and K is applied in this way.

B.METHOD OF FERTILIZER APPLICATION



Methods of fertilizer application

I. Soil Application

Application of fertilizer uniformly on the soil surface is known as broadcasting of fertilizers. This is done either before sowing of the crop (basal application) or in the standing crop(topdressing).This is the most widely practiced method in India due to ease in application.

Band Placement:

Application of fertilizers in narrow bands beneath and by the side of the crop rows is known as band placement of fertilizers. Band placement is done under the following situations:

1. When crop needs initial good start.
2. When soil fertility is low.
3. When fertilizer material react with soil constituent leading to unavailability
4. Where volatilization losses are high

Point Placement:

Placement of fertilizers near the plant either in a hole or in a depression followed by closing or covering with soil is known as point placement of fertilizers. It is adopted for top dressing of nitrogenous fertilizers in widely spaced crops.

II. Sub Soil Placement:

It refers to the placement of fertilizers in the sub-soil with the help of high power machinery.

Application to Plant Root

Dipping:

The roots of the seedlings are dipped in nutrient solution before transplanting. In soils deficient in phosphorus, roots of rice seedlings are dipped in phosphorus slurry before planting.

Root Feeding:

This method is popularly followed in coconut plantation. Active roots are selected and are dipped into nutrient solution in a poly bag, which is tied to the root. In a day or two the nutrient solution is absorbed by the root system.

Foliar Spray:

Application of fertilizers to foliage of the crop as spray solution is known

as foliar application of fertilizers. This method is not a substitute for soil application but only a supplement to it. This method is most suited for application of micronutrients, required in small quantities. When deficiency symptoms are visible, nutrients can be sprayed as mid-term correction.

N Fertigation

Urea is well suited for injection in micro irrigation system. It is highly soluble and dissolves in non- ionic form, so that it does not react with other substances in the water. Also urea does not cause precipitation problems. Urea, ammonium nitrate, ammonium sulphate, calcium ammonium sulphate, calcium ammonium nitrate are used as nitrogenous fertilizers in drip fertigation.

P fertigation

Application of phosphorus to irrigation water may cause precipitation of phosphate salts. Phosphoric acid and mono ammonium phosphate appears to be more suitable for fertigation.

K fertigation

Application of K fertilizer does not cause any precipitation of salts.Potassium nitrate, Potassium chloride, Potassium sulphate and mono potassium phosphate are used in drip fertigation.

Micronutrients

Fe, Mn, Zn, Cu, B, Mo could be used as micro nutrients in drip fertigation.

Fertilizers commonly recommended for fertigation

Fertilizer	**N**	**P_2O_5**	**K_2O**
Ammonium nitrate	34	0	0
Ammonium sulphate	21	0	0
Urea	46	0	0
Mono-ammonium phosphate (MAP)	12	61	0
Di-ammonium phosphate (DAP)	18	46	0
Potassium chloride	0	0	60
Potassium nitrate	13	0	44
Potassium sulphate	0	0	50
Mono potassium phosphate	0	52	34
PHOSPHORIC ACID	0	52	0

3.2.3.2. FERTIGATION SCHEDULES FOR SOME SAMPLE CROPS

1. FERTILIZATION OF COTTON:

Plant population:60,000-90,000plants/ha.

Expected yield: 4.0 MT/ha of lint.
Recommended average rates of nutrients (Kg/Ha):

N	P_2O_5	K_2O
200-235	80-110	200-250

Fertigation (to be applied during 90 irrigation da

Growth stage	Nutrient demand ---------kg/ha/day-------			Recommended fertilizers ---------kg/ha/day-------		
	N	PO 25	KO 2	Multi-K	MAP	AN
Vegetative development	0.03-0.1	0.02-0.07	0.03-0.05	0.06-0.12	0.03-0.12	0.05-0.25
First flower upto two Weeks after flowering	0.25-0.35	0.09-0.18	0.23-0.28	0.5-0.6	0.15-0.30	0.5-0.7
Boll development	0.6	0.18-0.09*	0.7-0.28*	1.5-0.6*	0.3-0.15*	1.2-1.4

2. FERTILIZATION OF PAPAYA:

Cultivar: Solo.
Plant population: 1,800–2,000plants/ha.

Recommended average rates of nutrients according to the plantatio

Tree age	Nutrient requirement ers (Kg/Ha)			Recommended fertilizer (Kg/Ha)		
	N	P_2O_5	K_2O	Multi-K	MAP	AN
2-6months	10-20	35-45	10-20	22-43	60-75	0-15
6-12 months	40-60	90-115	25-50	55-110	150-190	45-65
1-2years	60-80	125-150	90-120	195-260	205-250	30-50
Over2 years	80-100	60-150	100-150	220-330	100-250	120-180

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3. A COMPLETE FERTILIZATION PROGRAM FOR ONION

Fertigation

Weeks after transplanting	Nutrient requirements				Recommended fertilizers		
	N	P_2O_5	K_2O	Ca	Multi-K	AN	CN
	----------Kg/Ha-----------				----------Kg/Ha-------		
2-6	14			0.9		40	4.5
8-12	6.5		23		50		

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CROP PROTECTION INCLUDING MANAGEMENT OF WEEDS, PESTS AND PATHOGENS

WEED and WEED MANAGEMENT

What is weed?

Weed is a plant which is not wanted in a particular environment. It is otherwise called 'plant out of place'

- Example
  - If rice is cultivated any other crop is called weed

General characters of weed

- They are mostly grasses
- They have more adaptability than cultivated crops
- They compete with crops plants for resources
  - Water, nutrients, light and space

Management of weeds may be classified into:

1. Mechanical methods
2. Cultural methods
3. Chemical methods and
4. Biological methods

Mechanical methods of weed control

- It is by means of tools and implements
  - Ploughing
  - Hand hoeing and weeding
  - Digging and removing
  - Using sickles to cut
- **Merits**
  - Safe to environment
  - Does not involve any skill
- **Demerits of Mechanical Method**
  - Labour consuming
  - Possibility of damaging crop

Cultural methods of weed control

- It is by proper crop cropping systems and crop rotations
- Summer ploughing
- Mulching
- Blind tillage

Chemical methods of weed control

Herbicide: It is a chemical used to kill some targeted plants.

METHODSOFAPPLICATION

- Spraying

- Broadcasting

Biological methods of weed control

- Use of living organisms viz.,insects, disease organisms, herbivorous fish, snails or even competitive plants for the control of weeds is called biological control.
- In biological control method, it is not possible to eradicate weeds but weed population can be reduced.
- Examples of biological control
  - Water hyacinth is controlled by **Haycinth** moth
  - Opuntia is controlled by **scale insects**
  - Parthenium is by **Zygogramma beetle**

PEST MANAGEMENT

1. CULTURAL METHODS

- Intercropping
- Planting dates and crop duration
- Planting density
- Water management
- Crop rotation

2. PHYSICAL METHODS

Modification of physical factors in the environment to minimize pest problems

- Sun drying
- Collection & Destruction

3. MECHANICAL METHODS

- Light trap

- Yellow sticky traps

Biological Control

- Any condition under which or practice where by activity of a pest/pathogen is reduced by any other living organism
  - Parasitoids–wasp
  - Predators–grass hopper

DISEASE MANAGEMENT IN AGRICULTURE CULTURAL METHODS

1. Clean Seed
2. Field Sanitation
   - Removal of diseased plant debris, burning and keeping the field clean is the best known method for eradicating the source of inoculum.
3. Selection of field
   - The sick soil in which the soil borne inoculums persists should not be selected for the ensuing cropping season.
4. Plant spacing
5. Flooding
6. Deep ploughing
7. Fertilization
8. Rouging

Roughing is removing suspected plant which has infection by visual identification.

9. Amount of irrigation

PHYSICAL METHODS

1. Soil solarisation

- Clear polyethylene placed over moist soil, during summer days raises the temperature at the top 5cm of soil to as high as 52^0C. The increased soil temperature from solar heat, known as solarization inactivates many soil borne pathogens and reduces the inoculums and the potential for disease-examples

2. Burning trashes

- Burning of rice stubble's and straw effectively reduce stem rot.

3. Soil mulching and polyethylene traps

- Vertical, sticky, yellow polyethylene sheets erected along the edges of susceptible crops attract a considerable number of aphids which stick to the plastic, reducing the amount of virus inoculums reaching the crop.

CHEMICAL METHOD

- A variety of chemicals are available that have been designed to control plant diseases by inhibiting the growth of or by killing the disease- causing pathogens. Chemicals used to control bacteria (bactericides), fungi (fungicides), and nematodes (nematicides) may be applied to seeds, foliage, flowers, fruit, or soil.

INTEGRATED WATER, NUTRIENT, PEST MANAGEMENT

INTEGRATED WATER MANAGEMENT(IWM)

Integration of all possible means by which the crop water requirement is fully satisfied with minimum loss to the natural water resources but highly efficient to attain the potential crop yield.

Importance of IWM

- Crop production purely depends upon water to meet the food demand of growing population
- Share of water to agriculture is shrinking owing to urbanization and industrialization
- Loss caused by excess or deficit irrigation is extreme
- Hence it is the responsibility of the present generation to use the water judiciously by producing crop per drop of water
- It is the ultimate aim to increase the WUE
- It is by:
-

Strategies for IWM

- Surface
- Sub-surface
- Pressurized irrigation
    - Drip irrigation
    - Sprinkler irrigation

3.4.2.INTEGRATED NUTRITION MANAGEMENT(INM)

What is importance of going for INM?

Increasing the use of chemical fertilizers to increase food and fibre production is the concern since:

- Soils which receive plant nutrients only through chemical fertilizers have started

declining in crop yield

- The decline in productivity can be attributed to the appearance of deficiency in secondary and micronutrients
- The physical condition of the soil is deteriorated due to long term use of chemical fertilizers, especially the nitrogenous fertilizers

Strategies for INM

- Organic nutrients
- Inorganic nutrients

INTEGRATED PEST MANAGEMENT

Integrated Pest Management (IPM) is an ecosystem approach to crop production and protection that combines different management strategies and practices to grow healthy crops and minimize the use of pesticides **Integrated Pest Management (IPM)** means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with agro-ecosystems and encourages natural pest control mechanisms. As per FAO

Goal of IPM:

- To control pests and not to eradicate entire population
- Treatments are **not** made according to a predetermined schedule
  - Based on results of monitoring
- Treatments are chosen & timed
  - Most effective & least disruptive to natural pest controls

Strategies for IPM

- Physical and mechanical
- Cultural
- Biological
- Chemical

TYPES AND METHODS OF HARVESTING

Harvest

It is an operation done either by cutting, plucking, picking, digging or a combination of more than one of these methods, for removing the economic part from the matured plant.

Pulses,cotton–Picking
Maize,Bhendi,vegetables–Plucking Flower (all) – Plucking Tuber crops–Digging
Sugarcane – Cutting

Harvesting can be done only after assessing maturity. In general maturity means there is no more addition of source of sink (economic portion).