RVS AGRICULTURAL COLLEGE

(AFFILIATED TO TAMIL NADU AGRICULTURAL UNIVERSITY, COIMBATORE-3)

AGR 301
Practical Crop Production - I (Kharif crop) (0+2)

PRACTICAL MANUAL CUM RECORD

3rd B.Sc, (Hons.) (Agriculture)

DEPARTMENT OF AGRONOMY

RVS AGRICULTURAL COLLEGE

(AFFILIATED TO TAMIL NADU AGRICULTURAL UNIVERSITY, COIMBATORE-3)

2022

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CERTIFICATE

Certified that this is the bonafide record of work done by _____ ID. No.:_____ in AGR 301 Practical Crop Production - I (Kharif crop) (0+2) course of 2021-22 academic year.

Course Teacher **External Examiner**

CONTENT

S.No	Date of exercise	Title	Date of submission	Remarks	Signature
1 & 2		Study of rice ecosystems, climate, weather, seasons and varieties of Tamil Nadu			
3 & 4		Selection of nursery area, preparation of nursery, application of manures and fertilizer to nursery			
5 & 6		Acquiring skill in seed treatment, seed soaking and incubation, nursery sowing and management			
7 & 8		Study and Practice of main field preparation and puddling operations			
9 & 10		Practicing of field preparatory operations - sectioning of field bunds and plastering, leveling and basal application of fertilizers			
11 & 12		Practicing transplanting techniques in lowland rice			
13& 14		Estimation of plant population and acquiring skill in gap filling and thinning			
15 & 16		Study of weeds and weed management in rice			
17 & 18		Study and practice of green manuring and bio-fertilizer application in rice			
19 & 20		Acquiring skill in nutrient management and practicing top dressing techniques			
21 & 22		Study of water management practices for lowland rice			
23 & 24		Observation of insect pests and diseases and their management			
25 & 26		Recording growth and other related characters of rice			
27 & 28		Estimation of yield and yield parameters in rice			
29 & 30		Harvesting and threshing			
31 & 32		Cleaning, drying and calculating yield of produce			
33		Working out cost of cultivation and economics			

Ex.No:1&2 Study of rice ecosystems, climate, weather, seasons and varieties
Date: of Tamil Nadu

I. Systems of rice cultivation

Rice is being cultivated under **puddled** and **un-puddled lowland** situations

1. Upland Cultivation:

A). Dry Cultivation (Rainfed rice)/Dry seeded upland rice

It is practiced in all rice growing state in India but is mainly confined to tracts, which get adequate rain either by the South West Monsoon (SWM) or North East Monsoon (NEM) or both and do not have adequate irrigation facilities. Upland rainfed rice cultivation is commonly practiced in hilly areas and coastal belts. This system of rice cultivation is there in areas with high rainfall (like Assam and NE frontiers of India) where the land is sloppy and terraced and there is no possibility for bunding to stagnate the water. Grain yield is poor due to loss of nutrients and soil mainly caused by water erosion. Moisture availability is mostly at saturation or at wet range. There is very limited area in Dharmapuri district, Tamil Nadu.

B). Semi Dry Cultivation

In this system, seeds are sown as a dry crop and converted into wet crop after the feeder tanks are filled with monsoon rains or assured irrigation from canal after 30-45 days of dry situation

2. Lowland Cultivation:

In this system, rice is grown under wet condition i.e. under submerged conditions. There are two methods of cultivation.

A). Direct Seeding

Sprouted seeds are sown on puddled soil either by broadcasting or by row seeding (using drum seeder). This method is practised in some areas where water scarcity is a big problem.

B). Transplanting

Seedlings are raised on the seedbed before they are planted in the main field. This method is practised widely in areas where water is abundant.

In command areas, the farmers are practice the transplanting of rice.

3. Deep water rice cultivation exists in certain pockets of Nagapattinam and Tiruvarur districts particularly during NE monsoon with heavy downpour.

II. Climate

- Altitude : Sea level to 3000 m,
- Short day plant
- Hot and humid climate.
- High RH and sunshine hrs and assured water supply
- Average temp : 21-37 ^{0}C, blooming : 26.5 to 29.5^{0}C Ripening : 20-25^{0}C

III. Varieties and seasons

Classification of Varieties

I. Based on duration

a. Short duration :

Varieties that will come harvest within 100-120 days

e.g. ADT 36, ADT 37, ADT 41, (JJ 92) ADT 42, ADT 43, ADT (R) 45, ADT (R) 47, ADT (R) 48, IR 50, IR 64, ASD 16, ASD 17, ASD 18, ASD 20, TKM 9, TKM 11, TKM 12, TPS 1, MDU 1, MDU 5, PMK 1, PMK 2, PMK 3, CO 47, PY 5, ADRH 1, CO RH 1 (MGR), ADTRH 1, IET 144, CO RH 3, CO 51

b. Medium duration : 120 – 140 days.

e.g. ADT 38, ADT 39, ADT 40, ADT (R) 46, ADT (R) 49, MDU 3, MDU 4, IR 20, IR 36, TPS 2, TPS 3, Bhavani, White Ponni, CO 43, CO 45, CO 46, ASD 19, TKM 10, TRY 1, TRY (R) 2, CORH 2, TPS 2, CO RH 4, CO 50

c. Long duration : Above 140 days

e.g. CR 1009 (Ponmani), ADT 44, Paiyur 1, AU 2, PY 4 (Jawahar), ADT (R)50

II. Based on photosensitivity:

a. Photo sensitive e.g. Jaganath, Jeeraga Samba b. Photo insensitive

III. Based on season:

Month of sowing	Season	Duration of the variety
Dec-Jan	Navarai / Kodai	Below 120 days
April-May	Sornavari	Below 120 days
May-June	Kar	Below 120 days
June-July	Kuruvai	Below 120 days
July-Aug	Early samba	130-135 days
August	Samba	Above 130 days
Sep- Oct	Late samba/ Thaladi	130-135 days
Nov -Dec	Late thaladi	115-120 days

Seasons and Varieties of Tamil Nadu

S.No	*Season*	*District*	*Varieties*	*Period*	*Remarks*
1.	Sornavari	Chengalpattu	TKM 9, ASD 16, 17, 18, ADT 37, IR 50, IR 64, ADT 41	April – May	First season short duration varieties
2.	Kar	Tirunelveli, Madurai Dharmapuri, Kanyakumari, Tuticorin, Salem, Periyar, Coimbatore	ADT 36, ASD 16, ASD 17, ASD 18, IR 50, IR 64	May – June	First season short duration varieties
3.	Kuruvai	Trichy, Tanjore, Pudukkottai	IR 50, TKM 9, ADT 36, IR 64, ADT 37,	June - July	First season short

			ASD 16, ASD 18		duration varieties
4.	Samba	Chengalpattu, North Arcot, South Arcot, Trichy, Tanjore, Pudukottai, Madurai.	Ponmani, IR 20, CO 43, ADT 39, ADT 40, MDU 4, Paiyur 1, White Ponni	July - August	First season short duration varieties
5.	Late samba	Chengalpattu, Trichy, Tanjore, Pudukottai, Periyar	ADT 39, CO 43, White ponni	Sept. – Oct.	Medium duration varieties
6.	Thaladi	Madurai, Coimbatore Trichy, Tanjore, Pudukottai, Periyar	MDU 2, 3, 4, ADT 38, 39, IR 64, CO 43, 45, ASD 16, 18, Ponmani, White Ponni	Sept. – Oct.	Medium duration varieties
7.	Pishanam	Tirunelveli, Tuticorin, Kanyakumari	White Ponni, TPS 2, ASD 18, IR 20, CO 45, ADT 39, 40, ADT 37, ASD 16, 17, 18	Oct. – Nov.	Short duration varieties
8.	Late Pishanam	Tirunelveli, Tuticorin, Kanyakumari	ADT 37, ASD 16, 17, 18	Oct. – Nov.	Short duration varieties
9.	Navarai or kodai	Chengalpattu, South Arcot, Trichy, Salem, Madurai Dharmapuri, Coimbatore, Periyar Madurai	IR 50, ADT 37, ADT 39, ASD 16, 18, IR 64	Dec. – Jan.	Short duration varieties

Questions

1. List out the rice varieties grown in the College farm.
2. Write about special features of the variety that you have grown?
3. Collect the details of latest rice varieties released from TNAU (last 5 years)
4. Mention the districts of Tamil Nadu where semi dry rice cultivation is followed.

Ex.No:3&4 Selection of nursery area, preparation of nursery, application
Date: of manures and fertilizer to nursery

Selection of nursery area

- Select the nursery nearer to water source.
- The land should be fertile, free of excess salts and other soil problems.
- Light soils are most suitable.
- Land should be free from weeds.
- Proper drainage facilities.

Nursery preparation

- Select 20 cents (800m^2) of land to provide seedlings per one hectare.
- Flood the land one or two days before ploughing and allow the water to soak in. Keep the field under shallow submergence (2cm)
- Before ploughing allow water to a depth of 2.5 cm. Plough and bring the land to puddle condition.

Formation of seedbeds

- Mark out plots 2.5 metres width and 16m length (representing one cent) with channels 30 cm wide in between plots.
- Level the surface of the seedbed so that the water drains into the channel.
- Collect the mud from the channel and spread on the seeds beds or drag a heavy stone along the channel to lower it so that the seedbed is at a higher level.

Application of manures and fertilizer to nursery

- Application of organic manure: Apply 1000 kg of FYM or compost to 20 cents nursery before ploughing.
- Application of DAP: Before last puddling apply 40 kg of DAP and if not readily available, apply straight fertilizers 16 kg of urea and 120 kg of super phosphate. Basal application of DAP is recommended when the seedlings are to be pulled out in 20-25 days after sowing. If seedlings are to be pulled out after 25 days, application of DAP is to be done 10 days prior to pulling out.

Advantages of phosphorus application:

- Root growth is stimulated. Seedlings absorb and store phosphorous and utilise it even in later stages of crop growth.
- In the event of DAP application to nursery, it is sufficient to apply 30% of recommended P as per soil test is applied to the main field and higher yield can be realised.
- Application of phosphorus to nursery is very economical.

Top dressing with fertilizers :

If the seedlings show symptoms of nitrogen deficiency and if growth is not satisfactory, apply urea @ 500 g/cent of nursery, 7-10 days prior to pulling. If DAP applied 10 days prior to pulling out, urea application is not necessary.

Types of nursery

a. Dry / Semi dry nursery
b. Wet nursery
c. Dapog nursery

Methods of raising rice seedlings

Following are three popular methods:

1. Wet-bed method:

The bed is prepared 25 to 30 days before planting. The field is ploughed once and harrowed twice or thrice until the soil becomes well puddle. The beds are made slightly raised of to one to one and a half metres in width and conveniently large in size with drainage channels in between the bed. The total area of nursery should be 500-800 square metres for planting one hectare area. This type of bed is suited only in the areas where assured irrigation facilities are available. Controlled irrigation is essential so that the beds are constantly kept moist, but not flooded for the first few days. The beds must not be allowed to dry because they develop cracks and the seedlings are spoiled. This method keeps down the weeds in the nursery.

2. Dry bed method:

This method is adopted in high rainfall areas having no irrigation facilities but due to high rainfall water logging is an anticipated problem during the season. Preferably light soils are chosen for the purpose. The land is ploughed, harrowed and levelled (but never puddle). Thus the soil is pulverised in absence of water and raised beds of 8-10 cm height, 1-1.5 m width and 8-10 m length are made with 30 cm wide drainage channels between the beds. On an average 50-60 such beds are needed to supply seedlings sufficient for planting one hectare area.

3. Dapog method:

This method is prevalent in Philippines and Japan and it has been introduced in India very recently, though it has not gained popularity. In this method the seedlings are raised without contact with soil which is ready for transplanting on 12^{th} day. Well compacted seed- beds, concrete floor, wooden planks or tray can be used and the surface is covered with polythene sheets. The sprouted seeds are broadcasted uniformly at the rate of 1.5 kg per sq. m. area or 50 times of the test weight/sq. m of the variety to be used. The beds are kept moist constantly and pressed slightly 2-3 times a day with a smooth wooden plank for the first 3 days, so that the roots remain in contact with water. When the seedlings attain 2 cm height a constant film of water should be maintained.

In about 12 days time the roots are well developed and are entangled with one another so that the nursery can be cut into strips and rolled like a mat and then transported to the planting site easily. Seedlings of 1 sq. m. area can be transplanted in 200 sq. m. area. The seedlings raised by Dapog method establish immediately and the crop flowers 4 days earlier than the normal transplanted crop. The additional advantages are at the event of drought or failure of irrigation system when transplanting of over-aged seedlings cannot be done, the Dapog offers a good scope to get another lot of fresh seedlings within 12 days time. Dapog beds never need any seed-bed preparation, it does not need any fertilizer nor other chemicals for raising the seedlings, the

labour cost in seedling uprooting, as in other methods, is saved as the whole mat of seedlings over polythene is lifted, rolled and straight way transported to the transplanting site where the seedlings are split and transplanted. But the seed rate is exceptionally high (2.5 times more than other methods), seedlings being very small cannot be transplanted in presence of even slight water in the field which becomes unavoidable sometimes.

Dapog Nursery

- Separate beds are prepared with channel all round. The beds are one metre wide, 8 metre long and 10 cm high.
- The surface of the bed is packed tightly and kept at uniform level.
- The beds are covered with polythene sheet. Sand or ash upto a thickness of 2.5 cm is spread on the beds.
- The beds are soaked in water for 12 hours and kept for sprouting 24 hours.
- The pre-germinated seeds are sown in sand or ash media uniformly at one grain thickness. Seed rate is one kg m^{-2} of nursery area.
- The seeds are covered with gunnies for the first three days and kept moist by watering with rose can thrice a day. Both in the morning and evening the germinated seeds are gently pressed with bare hand so that the root system may not be exposed.
- The channels around the beds are filled with water upto the brim.
- After the days when the critical period of germination is over, the gunnies covered on the seeds are removed and one cm of water is maintained in the nursery for the rest of the period by raising the edges of the nursery beds under polythene sheet with mud watering with rose can both in the morning and evening..
- From the eight day after sowing, ammonium sulphate dissolved in water at the rate of 28 g for 4 lit is applied to the seedlings on alternate days upto the 16^{th} day. Hence the seedlings grow tall, healthy and robust.

Advantages

- The height of the seedlings can be increased to facilitate easy handling at the time of transplantation.
- The seedlings can be planted in the field with advantage even when there is water up to a depth of 4 cm or more
- The seedlings will be more healthy and robust and can withstand rough handling at the time of pulling and transplanting, just as in the ordinary method.
- When the seedlings are raised in sand or ash medium, there is no difficulty in pulling the seedlings and wash out the sand and ash.

Questions

1. Write details of mat nursery that you have prepared?
2. What is the purpose of raising seedlings in the nursery?

Ex.No:5&6 Acquiring skill in seed treatment, seed soaking and incubation, Date: nursery sowing and management

Good quality seed

Seed is a matured ovule consisting of an embryonic plant together with a store of food, all surrounded by a protective coat. The term quality refers to viability, vigour, uniformity and structural roundness apart from genetic and physical purity of seed.

Seed Dormancy

Dormancy of seeds refers to the inability or failure of a perfectly matured seed to germinate even when placed under conditions favourable for germination. This is generally termed as the resting period of the seed. The seeds are found to be dormant for 2 to 6 weeks. Some late varieties of rice are found to be dormant for 3-4 months. Generally 60 days after harvest, rice seeds can be used for sowing.

How to break the seed dormancy

a. Soak the seeds 0.2% Ethylene chlorohydrins or 0.25% Sodium hypochlorite for 24-72 hrs for deeply dormant seeds.
b. Hot water treatment at 50^{o} C for 24 hrs was effective for slightly dormant seeds.

Seed Rate

It vary according to a) Spacing
b) Duration and
c) Type of cultivation

Upland Rice

A seed rate of 75 to 100 kg / ha is enough for direct sowing.

Lowland

a. Direct sowing: The treated seeds are sown at the rate of 80-100 kg directly on puddled field.
b. Transplanting: Seedlings are raised in the seedbed and transplanted in the puddled field. According to duration the seed rate will vary.

Short duration : 60 kg/ha

Medium duration : 40 kg/ha

Long duration : 30 kg/ha

SRI : 7.5 kg/ha

Seed Treatment

Dry seed treatment:

a. Mix any one of the following fungicides at 2 g/kg of seed. Thiram, Captan, Carbendazim.

b. Treat the seeds at least 24 hrs prior to soaking for sprouting. The treated seed can be stored for 30 days without any loss of viability.

Wet Seed Treatment:

a. Treatment with fungicides: Treat the seeds in Carbendazim or tricyclozola solution at 2 g/lit of water for 1 kg of seed for 3 hrs. Wet seed treatment gives protection to the seedlings up to 40 days from seedling disease such as blast and this method is better than dry seed treatment.
b. Treatment of seeds with nutrient solution: Soak the seed in any one of the nutrient solutions according to nature and problem of soil. Soak the seed in water for 10 hrs. Then drain the water and soak the seeds in any one of the nutrient solutions for another 1 hr.
c. Bio fertilizer Treatment: Three packets of Azospirillum culture (600 g/ha) are to be mixed with sufficient water where in the seeds are soaked over night before sowing in the nursery bed.

Order of seed treatment

a. Treatment with fungicides / insecticide
b. Treatment with nutrient solution
c. Treatment with biofertilizers.

1. Seed Soaking

To induce sprouting and metabolic activities of seed, soaking and incubation is necessary. The points to be remembered before soaking are,

a. Seed water ratio should be 1: 1
b. Excess water will be lead to loss of nutrients resulting in the reduction of seed vigour.
c. Soaking duration should be 18-20 hrs.
d. For every lot of seed, only fresh water should be used.
e. Seed should not be soaked in running water, which will affect seed vigour.

2. Incubation

The soaked seeds in the gunny are kept in darkness.

a. The best material for incubation is wet paddy straw.
b. Tarpaulin should be used to cover the seed for incubation when the outside temperature is high.
c. Period of incubation should be 24 hrs.

3. Nursery Sowing.

a. Observe the sprouting of seeds.
b. If the sprouting of seed is not satisfactory, increase the incubation period.
c. Maintain a thin film (1 cm) of water while sowing

d. If the nursery is muddy, allow the mud to settle and have clear water while sowing.
e. After last ploughing and levelling sowing should be done in same day in alfisols or next day in vertisols in order to avoid soil hardening. If the sowing is delayed, root penetration of seedling will be affected.

Water Management

a. Drain the water 18-24 hours after sowing. If water is stagnating in patches, form small channels and drain water
b. During rainy days, maintain a thin film of water to avoid mud coverage over germinating seeds as well as to prevent washing away of seeds.
c. Drain the water in the morning and irrigate in the evening for 3-4 days until the greenish tinch develops.
d. Increase the quantity of water to a depth of 1.5 cm after 5^{th} day.
e. Afterwards maintain 2.5 cm depth of water depending upon the height of seedlings.

Questions

1. Write about the seed treatments practiced in your crop production
2. List out the benefits of seed treatments?
3. Furnish the list of bio-fertilizers and bio-agents and its dose used in rice cultivation

Ex.No:7&8 Study and Practice of main field preparation and puddling operations
Date:

Preparation of main field:

- Flood the field one or two days before ploughing and allow soaking in. Keep the surface of the field covered with water.
- Maintain a water depth of 10 cm at the time of land preparation.
- Puddle the field with puddler i.e., three puddling with puddlers or by use of cage wheel mounted on a tractor.
- Puddle the land thoroughly and level the land by repeated planking. Keep the land submerged for 4-5 days to a depth of 2-5 cm so as to bring the soil to reduced state.
- Perfect levelling is most important to avoid stagnation of water.

Importance:

- Fine clay particles in the soil are dispersed and help preventing the loss of water by seepage and through percolation
- It destroys the weeds
- Eggs and larvae of pests in the soil are destroyed and organic matter gets rapidly decomposed.

Changes due to puddling:

Water logging causes changes in the properties of soil because of physical reactions between the soil and water. The most important changes in the soil as a result of water logging is the conversion of the root zone of the soil from aerobic environment to an anaerobic environment where oxygen is absent or limiting.

Redox potential (Eh):

Reduction potential is used for knowing the change occurring in a soil as a result of submergence. It is measured as Eh, the potential relative to normal hydrogen electrode taken as zero and expressed in millivolts. Aerated soils have characteristic redox potential in the range of + 400 to + 700 millivolts. Water logged soils exhibit potential as low as – 250 to – 300 millivolts.

Formation of impervious layer:

The formation of impervious layer or pan formation is resulted due to repeated ploughing and puddling. It will prevent the downward movement of water in subsoil by percolation and loss of nutrients and also prevent ground water upsurge from bringing salts, toxic compounds or strongly deoxygenate water to root – zone.

Questions

1. Write about the purpose of puddling
2. What are the implements used for main field preparation?

Ex.No: 9&10 Practicing of field preparatory operations - sectioning of field
Date: bunds and plastering, leveling and basal application of fertilizers

Field Preparatory Operations

Sectioning of field bunds

Sectioning of field bunds or Trimming refers to sectioning and shaping of field bunds by using mammutty.

Plastering

This refers to covering the bunds with mud paste in order to prevent weed growth and to plug crab holes. Plastering of field bunds indirectly helps to eliminate harbouring of pests and diseases carrying organisms on the weed flora. This also prevents seepage of water through bunds.

Digging the corner and maintenance of bunds:

- Dig the corners of fields, which are not covered by ploughing.
- Cut off 2.5 cm of soil from the top and side of the bunds to remove the weeds along with their seeds and to destroy the eggs of insect pest by using mammutty.
- If the bunds are very broad, trim them to the width of 15 cm and height of 20 cm so that rats do not harbour in the bunds.
- If rat burrows are noticed, pellets of 0.5g Aluminium phosphate and plug the existing holes.
- Apply mud paste to the sides and top of the bund to a thickness of 2.5 cm with mamutty. Plastering the bunds, which helps in checking weed growth and prevents harbouring of insect pests

Levelling

After giving first open ploughing, level the land by wooden planker by which weeds get pressed into the soil and covered with mud. This process will hasten the decomposition of weeds thereby the land preparation is done quickly with lesser number of puddlings. After each puddling level the land by using wooden planker. While using the planker see that it is correctly fixes to the yolk of work pairs and give pressure by standing over planker on the elevated areas to lower them and avoid giving pressure in the depressed areas for getting uniform levelling.

Advantages

- Establishment of seedlings is better due to maintenance of uniform depth.
- Uniform flow of water throughout the field.
- Optimum depth of water for each crop stage is possible.
- Helps for quicker draining of water.
- Effective of management practices such as fertilizer, pesticide and weed control is achieved.

Importance

- To meet the nutrients requirement of the crops
- Fertilizers alone will contribute to about 40 per cent of the final yield of a crop.
- To increase the grain yield to meet the food requirements of the growing population.

Basal application of fertilizers

Apply fertilizers as per the soil test recommendations. The nutrients status of the soil for different tracts in each district was estimated by the soil testing laboratories and recommendations for each crop given may be followed. If the soil test recommendations are not available, follow the blanket recommendation.

General recommendation	**Fertilizers (kg/ha)**		
	N	P_2O_5	K_2O
Short duration varieties	120	38	38
Medium and long duration varieties	150	50	50

Apply 50 per cent of the total nitrogen along with P_2O_5 and K_2O basally at the last ploughing, keeping thin film of water (2 cm). In light soils, apply 25 per cent nitrogen basally. If nursery is already manure with di-ammonium phosphate, full dose of P_2O_5 per hectare as rock phosphate, plus 10 tonnes of green leaf manure can be applied. If rock phosphate is applied, the succeeding rice crop need not be supplied with phosphorous. The organic acids produced during the decomposing process dissolve the phosphates and make them easily available to the crop.

Potash application along with green manure has no special advantage. But application of fertilizers simultaneously saves labour and is therefore economical. Do not apply nitrogenous fertilizers at this time, as loss of nitrogen will be inevitable, if the puddle dries out. However if a sheet of water is maintained over the puddle there is no loss of nitrogen.

Questions

1. Calculate the fertilizer requirement for rice in your plot area?
2. Write about micro nutrient management for rice?

Ex.No:11&12 Practicing transplanting techniques in lowland rice
Date:

Planting of rice seedlings in the puddled field is called transplanting.

Procedure for pulling out and handling of seedlings

- Allow water to the nursery to a depth of 10 cm to facilitate easy pulling out of seedlings and for washing the mud's sticking to the roots.
- While pulling care should be taken to avoid weed seedlings.
- Grasp two or three seedlings at a time.
- Hold the seedlings between the thumb and fore fingers
- Pull the seedlings gently and easily at an angle of 30° on the horizon.
- If too much of mud sticks to roots, wash mud by shaking the roots in water. The plant roots should not be beaten on any object to remove mud, as this will injure the plants.
- Bundle the seedlings to the convenient size of 5 to 8 cm in diameter and tie them with soft material like banana sheath.
- Protect the seedlings from drying.

Seedling Treatment

Salt solution

- Root dipping in ammonium molybdate 1% or ferrous sulphate 8% or manganese sulphate 8% will increase the grain yield.
- Overnight soaking of rice seedlings in 1% calcium nitrate or calcium chloride alleviates the cationic imbalances. The salt solutions treatment in rice seedlings helps the crop to overcome the adverse effect of soil conditions.

Bio-fertilizers

- Prepare a trench, size 4m x 4m and maintain 10 cm depth of water in the trench so that the root portions of the seedling can easily be dipped.
- Prepare the water slurry by mixing 1 kg of Azospirillum (5 pockets / ha) in the water
- Dip the root portion of the seedlings for 10-15 minutes in the water slurry and then transplant.

Insecticides

If white tip nematode is a problem, dip the seedlings in phosphamidon 0.02% solution for 20 minutes prior to planting.

Transplanting Methods

1. Mechanical
2. Manual

Mechanical

Paddy transplanter is used for mechanised transplanting. It requires 30-35 man-hours for transplanting one hectare.

Manual

a. Random transplanting
b. Line / Row transplanting.
c. System of rice Intensification (SRI)
d. Seedling throwing

Random transplanting.

Mostly adopted by farmers. Plant density is uncertain. It is difficult to operate a rotary weeder or other machinery for inter- cultural operations.

Line / Row transplanting

It is a scientific method and the labour requirement is higher. Field management operations can be done effectively.

The age of seedlings, the number of seedling per hill and spacing will vary according to a) Duration b) Soil type and c) Fertility status.

	Medium and low fertility Duration			**High fertility Duration**		
	Short	Medium	Long	Short	Medium	Long
No. of seedlings per hill	2-3	2	2	2	2	2
Depth of planting (cm)	3	3	3	3	3	3
Spacing (cm)	12.5x10	20 x 10	20 x 15	20 x 10	20 x 15	20 x 20
No. of hills /m^2	80	50	33	50	33	25

The age of seedlings is 20-25 days for short duration, 25-30 days for medium and 35-40 days for long duration varieties.

Steps for transplanting

- Place the planting rope along any base line and each end of the rope is tied to a bamboo pole so that the rope is about 10 cm above the soil level.
- Distribute the seedling bundles throughout the plot and set planters along the planting rope.
- Keep 2.5 cm depth of water while planting

- Plant the seedlings not shallow than 1.5 cm but not deeper than 3 cm.
- Give rogue spacing of 30 cm for every metre of planting.
- Avoid root snatching while planting.
- After transplanting allow the field to dry before establishment. Keep water to a depth of one cm for 3-4 days until the plant recover.
- Clip excessive top growth to remove egg mass of pest and to avoid lodging due to wind.
- Root dipping before planting.
- Planting of seedlings and labour movement should be towards the wind direction.

Advantages of transplanting

- Plant population becomes more assured.
- Management become easier to reduce the cost of raising seedlings.
- Weed control and other intercultural operation are much easier particularly in row planting.

Disadvantages of transplanting

- Labour cost is high
- Seedlings are exposed to possible injury during handling.
- Plants tend to grow more slowly than direct seedling because of recovery time after transplanting.
- Harvesting is delayed, as duration of the crop extended.

System of Rice Intensification:

- The major techniques followed in this system are use of single and younger seedling (14-15 days), adoption of wider spacing with square planting (22.5 x 22.5 or 25 x 25 cm), alternate wetting and drying (2.5 cm) weed incorporation by using cono (or) rotary weeder and no herbicide application.

Seedling Throwing technique

The seedlings are thrown into the levelled and puddled field.

Question

1. How much nursery area is required for transplanting one acre of main field?
2. Write about mechanical transplanting of rice
3. Explain your experience of transplanting of paddy seedlings in SRI method

Ex.No:13&14 Estimation of plant population and acquiring skill in
Date: gap filling and thinning

Plant Population or Plant Density

- Number of plants per unit area in the cropped field is the plant population

Optimum plant population

- Optimum plant population - It is the number of plants required to produce maximum output or biomass per unit area.
- Any increase beyond this stage results in either no increase or reduction in biomass.

Importance of plant population / crop geometry

- Yield of any crop depends on final plant population
- The plant population depends on germination percentage and survival rate in the field
- Under low plant population individual plant yield will be more due to wide spacing.
- Under high plant population individual plant yield will be low due to narrow spacing leading to competition between plants.
- Yield per plant decreases gradually as plant population per unit area is increased, but yield per unit area increases upto certain level of population
- That level of plant population is called as optimum population
- So to get maximum yield per unit area, optimum plant population is necessary. So the optimum plant population for each crop should be identified.

Gap filling

Refilling the gaps developed due to death or poor establishment of already planted seedlings.

Importance

To maintain optimum plant population for achieving the targeted yield.

Causes for gap-filling

- Deep transplanting (Beyond 2.5 cm)
- Planting root damaged seedlings, diseased and unhealthy seedlings
- Planting diseased and unhealthy seedlings
- Improper levelling, resulting in ups and downs.
- Higher dose of pre emergence herbicides
- Due to bird damage on the day of planting
- Use of untrained labourers for planting
- Death of seedlings in problem soils / waterlogged condition.

When to gap-fill

Fill the gaps between 7^{th} and 10^{th} day after transplanting. Even the delayed gap filling can be helpful with the tillers produced in the same field.

Precautions

a. Same variety and aged seedlings should be planted, Timely gap filling

Question

1. How many labourers are required for gap-filling one acre?
2. What is the age of seedlings for gap-filling?
3. Estimate the plant population for SRI and conventional paddy

Ex.No: 15&16 Study of weeds and weed management in rice
Date:

Importance of weed management

- Yield reduction in rice due to weeds are around 15-20 per cent for transplanted rice, 30-35 per cent for direct seeded rice under puddled conditions and over 50 per cent for upland rice.
- Weeds compete with rice for nutrients, sunlight, water and space.
- Serve as alternate hosts for disease and insect pests.
- Reduce the quality of harvested grain, plug irrigation and drainage channels and increase the labour cost.

Reasons for weed menace

- Due to improper field preparation
- Improper weeding in the nursery resulting in planting grasses and sedges along with crops.
- Rice fields are already impregnated with weed seeds in different layers.
- Improper water management resulting in too much drying without maintaining the continuous submergence of water.

Types of weeds in rice

a) Grasses b) Sedges
c) Broadleaved weeds d) Algae

Weed flora in low land situation

a). Grasses	*Echinochloa colonum*	(Barnyard grass)
	Echinochloa crus-galli	(Barnyard grass)
	Paspalum scrobiculatum	(Kodo millet)
	Panicum repens	(Inji pillu)
	Leptochloa cinensis	
b). Sedges	*Cyperus difformis*	(Korai kixhangu)
	Cyperus iria	(Nut grass)
	Cyperus rotundas	(Nut grass)
	Fimbristylis miliacea	(Joria, Bara Jowane)
c). Broadleaved weeds	*Eclipta alba*	(Karisalanganni)
	Marsilia quadrifoliata	(Arai Keerai)
	Ammannia baccifera	(Neermel neruppu)
	Astercantha longifolia	(Neer mulli)
	Ludwigia Parviflora	(Neer grampu)
d). Algae	*Filamentous green types : Pithophora, Hydrodictyon, Spirogyra*	
	Multicellular green type : Chara and Nitella	

Critical period of Crop Weed Competition

The field should be kept weed free condition up to critical period of crop-weed competition period. Transplanted rice requires weed free conditions up to 45 days after transplanting whereas direct seeded rice requires upto 60 days after sowing weed free condition.

Weed Management

a. Agronomical methods
b. Mechanical methods
c. Chemical methods

a. Agronomical methods

- Through preparation of land before planting, gives good start by ensuring better germination and vigorous growth and enables the crops to compete with weeds.
- Trimming and plastering the field bunds.
- Line planting. It is easy and more effective to operate weeder in between two rows of crop.
- Use of certified seed, following proper season and variety, optimum plant density and application of well decomposed manure.
- Maintenance of optimum depth of water. Allowing field to dry will induce weed seed germination.
- Nutrient application - nitrogenous fertilizers should be applied after weeding.

b). Mechanical methods

Rotary weeder or wheel hoe:

Importance

Weed control by chemical is quicker and labour saving. large areas can be weeded in a short time. Even in closer spacing and rainy seasons, the chemical control of weeds will hold good. In direct sowing where manual weeding is difficult chemical method can be easily practiced.

Herbicide application

Pre-emergence application:

The herbicide is applied after the crop has been planted but before the emergence of the weeds.

Herbicide:

a. Transplanted rice

Butachlor (Machete 50% EC) - 2.5 litre / ha
PE Pyrazosulfuron ethyl 10 % WP @ 150 g/ ha on 3 DAT
PE butachlor 0.75 kg/ha + bensulfuron methyl 50 g/ha on 3 DAT
Thiobencarb (Saturn 50% EC) - 2.5 litre / ha
Pritilachlor + Bensulfuron methyl G - 4 kg/ha

Direct seeded rice

1. **Wet seeding**

- Pre-emergence application of pretilachlor 0.75 kg/ha on 8 DAS or pretilachlor + safener (Sofit) at 0.45kg/ha on 3-4 DAS in direct drum seeded rice

2. **Dry seeding**

- Pendimethalin (stomp 30% EC) - 3.0 litre / ha

Application of herbicide

- Take 50 kg of sand and mix herbicides with the help of sticks.
- Apply herbicide-sand mixture uniformly over the field
- Use gloves/polythene bags for hand applications.
- Maintain a water depth of 2.5 cm at the time of herbicide application.
- Don't disturb the field minimum for three days after application.
- Don't drain water from the field after application of herbicide and allow to dry in the field itself
- Irrigate the field after disappearance of the standing water.

Post emergence application

The herbicide is applied after the emergence of the crop and or the weeds. This type of spraying is largely practised with selective weed killers.

Herbicide

- 2,4-D sodium salt (Fernoxone 80% WP) 1.25 kg/ha dissolved in 625 litres with a high volume sprayer, three weeks after transplanting or when the weeds are in 3 - 4 leaf stage.
- Early post emergence application of Bispyripac sodium 50 g a.i. ha-1 (2-3 leaf stage of weeds)

Application

- Drain the water one day earlier, apply herbicide in the morning and irrigate next day of application.
- Apply between 15 to 20^{th} days after planting.
- The weeds should be at 2-3 leaf stages.
- Best time to spray the chemical is early morning.

Precautions in herbicide application

- Apply herbicides accurately because inadequate amounts give unsatisfactory weed control and excessive rates may injure crop.
- Read the label on each herbicide container to find out the correct time, rate of application and other directions (or) precautions to be observed.
- Avoid post emergence herbicide application during rainy / cloudy days.

Integrated weed management

All the weed control methods viz., mechanical, cultural, chemical and biological methods should be integrated to control all weeds including perennial and problem weeds into a

productive system. Integrated approach is highly effective and economical with low residual problems.

Question

1. List out the grass, sedge and broad leaved weeds observed in your field?
2. Differentiate *Echinochloa colonum* and rice seedlings.
3. Advantages of cono weeding in SRI.

Ex.No: 17&18 **Study and practice of green manuring and**
Date: **bio-fertilizer application in rice**

Green manuring

Growing green manure crops in the field itself and incorporated into the soil of the same field is called green manuring.

Nutrient content of Green Manure Crops and Green Leaf Manures

Plant	Scientific name	Nutrient content (%) on air dry basis		
		N	P_2O_5	K_2O
Green manure				
Sunnhemp	Crotolaria juncea	2.30	0.50	1.30
Manila agathi	*Sesbania rostrata*	3.30	0.60	1.20
Daincha	*Sesbania aculeata*	3.20	0.60	1.20
Pillipesara	*Phaseolus trilobus*	2.80	0.50	1.15
Sesbania	*Sesbania speciosa*	2.71	0.53	2.21
Kolinji	*Tephrosia purpurea*	3.10	0.52	1.18

Incorporation of green manure

- If the green manure crop is raised in the field itself and the field is estimated at about 6 tonnes per hectare, plough the green manure crops directly into the field.
- Maintain 2.5 cm depth of water.
- Plough the field and incorporate the green matter to depth of 15 cm.
- Allow the green manure to rot inside the puddle soil for a minimum of 7 days in the case of softer plants like sunnhemp and 15 days for fibrous green manure plants like Kolinji.

Advantages of Green Manure

- Add organic matter to soil.
- Deep-rooted green manure crop brings the nutrients from deeper layer to surface.
- Organic matter added improves the soil structure, increase the water holding capacity and prevent erosion.
- During off-season, growing a green manure crop reduce the weed growth and conserve the nutrients.
- Green manure crops help to reclaim the problem soil.

Rice + Green Manuring

- Dual cropping of rice-green manure is raised using 'TNAU Rice-Green manure seeder'. Incorporate the green manure when grown to 40 cm height or at 30 days after sowing, whichever is earlier, using Cono-weeder. Green manure incorporated fields may be operated again with rotary weeder a week later in order to aerate the soil and to exploit organic acids formed if any.

Biofertilizers

- Biofertilizers otherwise called as microbial inoculants, play a vital role in increasing agricultural production either by supplementing or substituting the most essential plant nutrient.

  The commonly used biofertilizers for rice crop are

  a). Azolla b). Blue green algae c). Azospirillum and d). Phosphobacteria

Azolla

- Algalination it is a free-floating aquatic fern, which can provide a potential nitrogen source for flooded crops such as rice.
- Raise Azolla as a dual crop by inoculating 250 kg/ha 3 to 5 DAT and then incorporate during weeding for the wet season crop.
- Azolla crop can substitute 20-30 kg N/ha. Azolla mat will also effectively control weed growth.

Blue green algae

Blue green algae is an important N fixing micro-organisms in flooded soils. They possess the twin abilities of photosynthesis as well as biological nitrogen fixation. It will benefit the rice plants by producing growth promoting substances – vitamins, amino acids etc., It also increases phosphorus solubility, neutralise iron and sulphur toxicity, impart gaseous exchange in soil thereby making the root system to respire easily. It is applied at 10^{th} day of transplanting @ 10 kg/ha during dry season crop

Azospirillum and Phosphobacteria

Azospirillum fixes substantial quantities of atmospheric nitrogen. The beneficial effect of Azospirillum in crop growth was attributed to the production of IAA, gibberellins and kinetin like substances by this bacterium. It is capable of enriching the nitrogen nutrition of rice plants to the tune of 25 to 50 kg N/ha. It can be applied through seed, soil and seedling treatment.

Soil application: Mix 10 packets (2 kg/ha) each of *Azospirillum* and Phosphobacteria or 10 packets (2 kg/ha) of Azophos inoculants with 25 kg FYM and 25 kg of soil and broadcast the mixture uniformly in the main field before transplanting.

Pseudomonas fluorescens

Pseudomonas fluorescens (Pf 1) at 2.5 kg/ha mixed with 50 kg FYM and 25 kg of soil and broadcast the mixture uniformly before transplanting.

Question

1. Why green manuring is essential for rice crop?
2. Mention the recommended quantity of biofertilizers to rice

Ex.No: 19&20 **Acquiring skill in nutrient management and practicing**
Date: **top dressing techniques**

Application of organic manures

Apply 12.5 tonnes of farmyard manure or compost per hectare. Spread the manure evenly on the dry soil before letting water, which helps in even distribution of the manure. If farmyard manure or compost is not applied, apply green manure @ 6.25 ton per hectare.

Compute the quantity of green manure as follows.

a. Cut one square metre of green matter and weigh and convert the quantity for one hectare.
b. In the absence of a balance, compute on the basis of head load. (One head load weights about 20 kg.)

Inorganic Fertilizers

Apply fertilizers as per the soil test recommendations. The nutrients status of the soil for different tracts in each district was estimated by the soil testing laboratories and recommendations for each crop given may be followed. If the soil test recommendations are not available, follow the blanket recommendation.

General recommendation	**Fertilizers (kg/ha)**		
	N	P_2O_5	K_2O
Short duration varieties	120	38	38
Medium and long duration varieties	150	50	50
Hybrids	175	60	60
Low N responsive varieties (W.Ponni)	75	50	50

For sodic soils, 25% extra nitrogen and 50% extra Zn is recommended.

Top dressing

- Application of fertilizer after the crop has been sown / planted is called top dressing.

Importance

Top dressing is done to increase the fertilizer use efficiency, which will make the availability of nutrients throughout the crop growth and enhance the nutrient uptake.

Nutrients recommended for top dressing

a). Nitrogen b). Potassium

Nitrogen

It has been estimated that wetland rice recovers only 30-40 per cent of the applied nitrogen, whereas upland rice recovers 50-60 per cent. The poor utilisation of N fertilizers by rice is largely caused by losses on N from the soil-plant systems through volatilisation, leaching, denitrification and run off. Under submerged condition N is absorbed by rice primarily $NH4^+$ and to some extent as NO^{3-} and even as amino acids.

Need for split application of nitrogen

- To reduce the loses through volatilisation, leaching and denitrification.

- To increase the efficiency of applied nitrogen.
- To make adequate availability of nitrogen at important physiological stages of the crop
- To suit the varied soil type, variety and duration.
- To avoid loss due to fixation

Sources of nitrogen

The commonly used fertilizers are urea and ammonium sulphate.

Time of application

Apply nitrogen in three top dressing *viz.,* ¼ at active tillering, ¼ at panicle initiation and ¼ at heading in addition to ¼ dose as basal.

Tillering

Top dressing nitrogen at tillering will increase the number of panicles per unit area.

Panicle initiation stage

Top dressing nitrogen at panicle initiation stage increases the spikelet number, panicle size photosynthesis and lodging resistance. At panicle initiation stage the young panicles grow about 1-2 mm long, which is about 23-25 days before heading. Another effect of nitrogen top dressing on yield could be through active photosynthesis during ripening.

Top dressing at heading

Nitrogen application at heading will increase the grain weight and protein content of grain which result in higher grain yield.

Methods to increase N use efficiency

- Applying nitrogen in splits.
- Placement of N in deeper layer of soil
- Treating urea with nitrification inhibitors like Neem cake, mahua cake, Neem oil, coal tar etc.,
- Using coated urea forms like sulphur-coated urea, rock phosphate coated urea, lac coated urea, tar coated urea, gypsum coated urea etc.
- Using modified forms of urea viz., urea super granule, urea briquettes, mud ball urea, paper pocket urea.

Preparation of Neem treated urea

Blend the urea with crushed Neem seed or Neem cake 20 per cent by weight. Powder Neem cake to pass through 2 mm sieve before mixing with urea. Keep overnight before use to increase the nitrogen use efficiency.

Potassium

In submerged soils, potassium availability increases after flooding. This increase in potassium availability enhances potassium uptake by rice but ultimately accelerates exhaustion of potassium supplies. This depletion occurs more rapidly with modern high yielding rice varieties.

Advantages of split application

Split application of potassium increases productive panicles per metre square number of spikelets per panicle, percentage of filled grains, grain weight and decreases incidence of bacterial leaf blight.

Sources of potassium

The most commonly recommended source is potassium chloride (Muriate of potash)

Time of application

Potassium will be applied in four equal splits viz., basal, tillering, panicle initiation and heading stages along with nitrogen

Application of zinc sulphate

- Apply 25 kg of zinc sulphate/ha mixed with 50 kg dry sand or apply 25 kg of TNAU Wetland rice MN mixture/ha enriched in FYM at 1:10 ratio incubated for 30 days at friable moisture, just before transplanting.
- It is enough to apply 12.5 kg zinc sulphate /ha, if green manure (6.25 t/ha) or enriched FYM is applied.
- If deficiency symptom appears in the standing crop, foliar application of 0.5% zinc sulphate +1.0% urea can be given at 15 days interval until the Zn deficiency symptoms disappear.

Question

1. How will increase the N use efficiency
2. Name the insects and diseases appear when nitrogen is applied at higher dose?
3. Calculate the Urea, DAP and Potash requirement for one hectare of paddy?

Ex.No: 21&22 Study of water management practices for lowland rice
Date:

Rice is a semi aquatic plant, its water requirement is many times more than the other crops due to water requirement for field preparation i.e., puddling (20 per cent) and percolation loss (40 per cent). Excess water or water stagnation causes salinity or alkalinity, weed problem and results in poor aeration and accumulation of toxic products. Total water requirement includes water needed to raise seedlings, land preparation and to grow the crop from transplanting to harvest. In general it varies from 1000 mm to 1200 mm.

Water requirement

Short duration	900 mm
Medium duration	1200 mm
Long duration	1500 mm

Critical stages for irrigation

a) panicle initiation, b) booting, c) heading and d) flowering.

Water management in transplanted paddy

- Moisture stress due to inadequate water at rooting and tillering stage causes poor root growth leading to reduction in tillering, poor stand and low yield.
- Critical stages of water requirement in rice are a) panicle initiation, b) booting, c) heading and d) flowering. During these stages, the irrigation interval should not exceed the stipulated time so as to cause the depletion of moisture below the saturation level.
- During booting and maturity stages continuous inundation of 5cm and above leads to advancement in root decay and leaf senescence, delay in heading and reduction in the number of filled grains per panicle and poor harvest index.
- Provide adequate drainage facilities to drain excess water or strictly follow irrigation schedule of one day after disappearance of ponded water. Last irrigation may be 15 days ahead of harvest.

Water management in SRI

- Irrigation only to moist the soil in the early period of 10 days
- Alternate wetting and drying method of irrigation is practiced. Restoring irrigation to a maximum depth of 2.5 cm after development of hairline cracks in the soil until panicle initiation (PI)
- Increasing irrigation depth to 5.0 cm after PI one day after disappearance of ponded water

Water management in different stages of paddy

Water management for Nursery

The water requirement for nursery preparation is 150-200 mm. The seeds should be sown with a standing water of 2-3 cm and drain the water next day. Attend wetting or draining water for 3-4 days until the greenish tinch develops. Then maintain 2-5 cm depth of water.

Green manure application

Maintain a water depth of 2.5 cm at the time of green manure application.

Land preparation

Maintain a water depth of 10 cm at the time of land preparation

Pulling out of seedlings

Maintain water level to a depth of 8-10 cm at the time of puling the seedling to enable the seedlings with intact roots and to wash of the seedlings roots adhere with soil particles.

Transplanting

Maintain a shallow depth of 2.5 cm

Weeding management

Hand weeding

Maintain a water depth of 5 cm while hand weeding which enables early pulling out of the seedlings and wash off the muds adhering the weeds.

Pre-emergence

Maintain a water depth of 2.5 cm while application of pre-emergence herbicide and irrigate the field 3 days after application.

Post-emergence

The field should be drained well before application of post-emergence herbicides.

Rotary weeder

Maintain 2.5 cm water depth while operating the rotary weeder.

Top dressing

Drain the field before application, top dress the fertilizer and irrigate the field after 48 hours.

Vegetative phase

Maintain a water depth of 5 cm and next irrigation should be given at the time of formation of hair line cracks.

Maximum tillering phase

Drain water for one day or two days during the beginning of maximum tillering stage

Reproductive stage

After maximum tillering stage, reproductive growth period starts which covers the primordial initiation, booting, heading and flowering stages which are considered as critical stages in relation to water management. During these critical stages maintain uniform 5 cm depth of water. Moisture stress in the above stage causes severe reduction in yield.

Ripening

Ripening phase includes milky, dough, yellowing and full ripening grain stages. Water requirement is less during this period and water is not necessary after yellow ripening stage.

Pest and diseases

If brown plant hopper incidence is noticed the field should be drained to apply pesticides to control this pest.

Precaution for irrigation

a. The field plot can be 25 to 50 cents depending upon the source of irrigation.
b. Field to field irrigation should be avoided and it should be irrigated individually from a channel.
c. Small bund may be formed parallel to the main bund of the field at a distance of one and half to two feet within the field to avoid seepage of water through main bund crevices.
d. To maintain percolation loss, the depth of stagnated water should be 5 cm or less.
e. In water logged conditions, open channel drains about two feet in depth and one half feet width, may be formed in the field across.
f. Care should be taken not to allow development of cracks.
g. In canal command area, conjunctive use of surface and ground water may be restored for judicious use of canal water and guard against water logging.

Drainage

Importance

Due to excess water or water logging in the field, the crop root zone depth gets filled with water thus the supply of oxygen considerably reduced. Thus the root respirations of the crop is stopped or badly hampered which result in low grain production. Drainage is big problem in heavy clay soils.

Problems of water logging

- Poor aeration
- Uptake of nitrogen and potash is reduced.
- Tillage is affected.

Drainage of water in rice

- Draining water at maximum tillering stage helps to stimulate vigorous growth of roots and check the development of in effective tillers.
- Stop irrigation 10-15 days before harvest. Too early draining of water causes immature grain formation and broken kernels. If irrigation is not stopped at appropriate time it leads to increase in crop duration and shattering of grains.

Questions

1. Water requirement of rice crop is more than other crops. Why?
2. Write the advantages alternate wetting and drying method of irrigation?
3. List out the steps to reduce water requirement of rice

Ex.No: 23&24 **Observation of insect pests and diseases and**
Date: **their management**

Pest Management

In rice 200 pests are considered as important. Incidence of pest is more in samba season than kuruvai season due to climatic condition.

Important pests

Sucking pests

Rice stem borer
Rice mealy bug
Rice hispa
Rice leaf folders
Rice leafhoppers
Armyworm
Grasshoppers

Non insect pest

Rats
Crabs and birds

Integrated pest management

The indiscriminate use of pesticides in rice production increased the susceptibility of rice varieties to pest while increasing the yields. In order to avoid consequences of the indiscriminate use of pesticides and to make rice production profitable and sustainable, the concept of integrated pest management was introduced in rice farming system.

- Plant variety having same duration at a particular area within short intervals.
- Cultivation of resistant / tolerant varieties.
- Forming raised nursery beds using correct seed rate.
- Application of furadan 1.4 kg per 8 cents of nursery on 10 day after sowing seed.
- Formation of levelled nursery beds to drain water if necessary.
- Application of recommended dosage of organic or inorganic fertilizers as per soil test recommendation and avoiding excess application of nitrogen. Apply nitrogen along with neem cake at the ratio of 5:1.
- Collection and destruction of shoot borer eggs both in the nursery and main field.
- While planting give one foot row spacing for every eight feet.
- Trimming the bunds or reducing the height of the bunds cultivation of cowpea on field bunds will increase the population of useful beetles besides getting additional income.
- Use of light traps to predict the incidence of stem borer, leaf roller, brown plant hopper, sucking insects and ear head bugs and destruction of adult insects.
- Irrigate the field after disappearance of the ponded water. Drain the water if the BPH incidence is observed.
- Always maintain the planted field and bunds free from weeds and trim the bunds then and there.
- Avoid spraying of pesticide when the population of natural enemies to pests are observed in large numbers.
- Take plant protection measures based on ET level.

- Apply recommended pesticide with correct dose by adding required quantity of water at right time.
- Avoid spraying of artificial pyrithroids, methyl parathion, quinalphos and penthion in BPH endemic areas.
- Adopt crop rotation.
- Don't allow the stubbles to grow and plough the field immediately after harvest.
- Destroy the eggs of grasshoppers by giving deep ploughing in summer.
- If the caseworm incidence is seen in the main field, pass a rope and pull in the standing crop, which will make the casework to fall on the standing water. Then destroy the caseworms by applying kerosene (100 ml for 8 cents nursery or 2 litres per acre) or collect at the end of drainage channel and destroy.

Disease Management

Importance

About forty diseases attack paddy in the field and of these the most prevalent and important are blast, sheath rot, bacterial leaf blight and false smut. The severity of these from year to year is unpredictable since environmental factors such as soil, temperature, soil moisture, infestation of seed by fungi and depth of sowing influence of the disease resistance.

Common diseases in rice

Fungal : Rice blast, brown leaf spot and sheath rot
Bacterial : Bacterial leaf blight
Viral : Tungro

Use of neem product in pest and disease control

Spraying Neem oil at 3 or 5 per cent Neem kernel extract will control brown plant hoppers, grasshoppers and leaf folders. Adding Neem kernel powder (1 per cent) with rice seeds can found to control grain pests. Spraying of Neem kernel extract at one per cent was found to control grasshoppers. To prepare one per cent extract add one gram of well-powdered neem kernal with one litre of water.

Spraying Neem oil at 3 per cent or Neem kernel extract at 5 per cent found to control sheath rot disease and tungro disease in rice. Application of Neem coated urea to rice found to reduce the incidence of leaf spot.

Preparation of neem oil extract

To prepare 3 per cent Neem oil solution, take 6 litters of Neem oil and add 200 ml of teepol or 200 g of soap with thin oil and mix thoroughly. Then add this mixture with 200 litres of water and mix well for five minutes. Then spray the solution in the evening by using hand operated sprayers.

Questions

1. What are all the different pest and diseases observed in your field?
2. What is the plant protection chemicals sprayed in your filed?

Ex.No: 25&26 Recording growth and other related characters of rice
Date:

Study on plant growth characters will help to know the rate of growth and their effect on yield and yield characters.

Plant growth characters

- Height of plant
- No. of total tillers.
- No. of productive tillers.
- Leaf area index.

Usually a quadrate of one sq.m made up of bamboo sticks is used. Each quadrate is fixed at random for recording observations on growth characters.

How the growth characters are measured

a). Height of plant

Five randomly selected plants are used for height measurement preferably on critical stages of paddy.

b) No. of total tillers and productive tillers

Tiller are also recorded on 30^{th}, 60^{th} day after planting and productive tillers are recorded at harvest and expressed as Nos. per hill or Nos/m^2.

d). Lead area index LAI

The length and breadth of all the leaves in the middle tiller of randomly selected ten hills in two quadrates are measured at heading stage. The leaf area index can be computed as suggested by Gomez (1972) by using the following formula.

$$LA = K \times L \times B$$

Where "K" the adjustment factor which is taken as 0.75

l = Length of the leaf

b = breadth of the leaf

Leaf area per hill = Total leaf area of middle tiller x Total number of tillers.

$$LAI = \frac{\text{Sum of leaf are per hill of "r" samples (sq.m)}}{\text{Area of land Covered by "n" hills (sq.m)}}$$

Question

1. List out the different growth characters of rice ?
2. Give in details of growth data recorded by you at different stages of paddy

Ex.No: 27&28 Estimation of yield and yield parameters in rice
Date:

Importance

Maximum yield is determined by the potential of variety and the environment. A computation of yield components would be meaningful for designing a blue print of the target yield and examining the defects of a given crop if a comparison is made with a crop that has already achieved a good yield, under a similar environment. Understanding the inter-relation-ships of yield components is a trey to improvement in yield.

Yield components

a. Number of panicles per unit area
b. Number of spikelets per panicle.
c. Filled spikelets (%)
d. 1000 – grain weight (g)

a). Number of panicles per square meter

No of panicles or productive tillers are recorded at harvest stage and expressed as Nos. per hill or Nos/m^2.

b). Number of spikelets per square meter

No of grains per panicles will be counted at harvest stage and expressed as Nos. per panicle.

c. The percentage of filled spikelets

It is the ratio between filled and ill filled grains and expressed as percentage Unfavourable weather conditions (low or high temperature) during ripening may hamper continued growth of some spikelets, resulting in unfilled spikelets.

d. Thousand grain weight

Weight of 1000 grain is weighed and recorded in 10 samples from each plot. The thousand-grain weight is a stable varietal character because the grain size is rigidly controlled by the size of the hull.

Example:

Varieties	Plant height (cm)	No. of Tillers per hill	No. of Productive tillers per hill	No. of grains per panicle	1000 grain weight (g)	Length of panicle (g)	Grain yield g/hill	Straw yield g/ha

Question

1. Mention the agronomic practices to increase the productive tillers in rice.
2. How will you increase the thousand-grain weight by agronomic management?
3. Estimate the expected grain yield of your plot and compare this after harvest?

Ex.No: 29&30 **Harvesting and threshing**
Date:

Importance

a. Harvesting should be attended in time. Grain may be lost due to damage by rats, birds, insects, shattering and lodging.

Sign of the harvest

- Drain the field 7 to 10 days before the expected harvest date or when the upper grains in most of the tillers are in the hard dough stage and turning from green to yellowish. This operation hastens maturity of crop.
- Dehull a few grains from the upper portion of the matured panicles and observe their translucence and firmness. Grains when ready for harvest are clear and firm. The upper portion (80%) of the spikelets should be straw coloured.
- Inspect the same from the base of the panicles. When most of the grains (20%) from the base are in hard dough stage the panicles are ready to be harvested.
- About 80 per cent panicles should have about 80 per cent ripened spikelets at the time of harvest. At the time of harvest the grains will contain about 21% of moisture. High or low moisture content at the time of harvest of grains later on affects head rice recover badly.

How to harvest

- The rice plants are cut with serrate edged sickles by hand. When the land surface is fairly firm, short stubbles alone are left in the field. The fields are slushy in deltaic regions and long stubbles are left behind over which the cut sheaves are laid.
- If weather permits, leave the handful of cut stems in position as they were harvested and let them dry for 1 or 2 days.
- If the threshing cannot be done immediately, the harvested rice stems should be bundled and stacked in a dry place. Bundling will facilitate circulation of air around and through the stack, thus preventing excessive beating caused by decomposition of the harvested plants. If a round stack is made place the panicle ends towards the centre.
- Avoid completely lodged plants for harvesting as seed crop.
- Avoid drying the harvested plants in the field.
- Crops heavily infested with BPH, GPH, RTV and blast should not be harvested for seed purpose.

Harvest

The harvesting should be done when 90 per cent of seed attained biological maturity with the seed moisture content of 20-22%. Premature harvesting of a seed crop not only reduces the yield but also reduce the quality of the seed lot by reducing the viability, vigour and storability of the seed since the immature seeds deteriorate faster than mature seed. Delayed harvest produces cracks in the seed, which cause deterioration of viability and vigour.

Question

1. How many labourers are required to harvest one acre?
2. How will you assess the maturity of paddy?
3. What is the optimum moisture content for storage?
4. Write about paddy combine harvester.

Ex.No: 31&32 **Cleaning, drying and calculating the yield**
Date: **of produce**

Threshing

The very ideal moisture content for threshing either manually or mechanically is 15-18%. Seed lot with a moisture content of more or less than this is a proof for mechanical damage. If high moisture threshing is inevitable it is better to thresh manually than mechanically. Restrict number of beatings to only two. Threshing at moisture content saves 4-5% in seed germinability.

Cleaning

Cleaning is the process to remove rice straw chaff, foreign matters and immature/empty grains within paddy after threshing and drying. The importance of cleaning is to gain high milling recovery rate, increase the milling efficiency, decrease the post-harvest loss and to prevent broken rice where 5% broken rice decrease 10% on milling recovery

Drying

Seed should be dried to bring the moisture content to 12-14%. Avoid drying high moisture paddy either under high temperature or under heavy sun. High moisture paddy should be initially dried at low temperature and when the moisture is reducing the drying temperature can be increased. Faulty drying causes checks or cracks in the seed, which will reduce the viability and vigour.

Processing

The seed is processed to upgrade the seed quality. In processing correct size of sieves must be used to separate undersized, broken seeds and chaffs so that the quality of graded seed is improved.

Storage

- The seeds dried to 12% moisture should be stored in moisture free containers like gunny bags to enable the seed to easily interact with the ambient atmosphere to adjust the moisture content according to the relative humidity of the circulating air.
- Though the wooden and kottai used for storing the seeds, are also moisture free exchange of moisture between the seed and the air in these container are very slow which is detrimental to the seed viability. Seeds stored in gunny bags can often be dried putting the whole bag in the sun.
- The temperature and RH of the ambient air of the storehouse plays the major role in the deterioration of seed viability and vigour, apart from physical damage done to the seed by storage pest and diseases.

Question

1. What is the optimum moisture content for storage?
2. Write about paddy combine harvester

Ex.No: 33 Working out cost of cultivation and economics
Date:

NURSERY

Ploughing, pudding and preparation of nursery
Digging corners and preparation of nursery
Seed cost @ Rs. 22/ kg for 24 kg of seeds
Application of 400 kg of farmyard manure to the nursery
Seed treatment: Thiram @ 2g per kg of seeds *i.e.*, 48 gm
Nursery - application of DAP @ 16 kg
Nursery weeding twice

MAIN FIELD PREPARATION

Tractor cage wheel puddling twice
Trimming and plastering field bunds

MANURES AND MANURING

Farm yard manure
Spreading the farm yard manure
Urea, DAP and Potash
Application of 4 pockets of Azospirillum

AFTER CULTIVATION

Pulling out seedlings, application of fertilizers and transplanting
Application of Furadan 8 kg
Application of $ZnSO_4$ 10 kg
Weeding
Top dressing fertilizer - application
Application of PP chemicals
Irrigation: Twenty irrigation @ Rs. 50 / irrigation

Harvest

Harvesting the paddy, threshing and drying

Question

1. Calculate the total man hours for rice crop
2. Which cultivation operation consumes more expenditure
3. What is the prevailing market rate for paddy grain and straw?
4. What is the hire charge per hour for tractor / power tiller for puddling.
5. Workout the cost benefit ratio in your plot cultivation