

**DELTA STATE GOVERNMENT
OFFICE OF THE CHIEF JOB CREATION OFFICER,
GOVERNOR'S OFFICE.**

**YOUTH AGRICULTURAL ENTREPRENEURS
PROGRAMME
(YAGEP)**

TRAINING MANUAL

ON

RICE VALUE CHAIN

BY

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CONTENTS

1.0	INTRODUCTION.....	4
1.1	What is Rice:.....	4
1.2	Rice Production	4
2.0	TRAINING SCOPE	4
3.0	THE RICE GROWING ECOLOGIES.....	5
3.1	Rice Varieties	6
3.2	Land Preparation	6
3.3	Planting Methods	7
4.0	THE RICE GROWTH PHASES	10
4.1	The Vegetative Phase	10
5.0	THE REPRODUCTIVE PHASE.....	12
5.1	Booting Stage:.....	12
5.2	Heading Stage:.....	13
5.3	The Flowering or Anthesis Stage:.....	13
6.0	THE RIPENING PHASE	13
6.1	The Milk Stage:	13
6.2	The Soft Hard Dough Stage:	13
6.3	The Maturity Stage:.....	13
7.0	MANAGEMENT PRACTICE.....	13
7.1	Weed Control.....	13
7.2	Fertilizers/ Fertilizers' Application	14
7.21	The Organic Fertilizer	14
7.22	The Inorganic Fertilizer	14
8.0	RICE PEST AND DISEASES.....	16
8.1	Disease	16
8.2	Pest.....	17
8.21	Insect	17
8.22	Rodents:	18
8.23	Birds:	18
9.0	RICE HARVEST	19
9.1	Post Harvest Handling.....	20
10.0	RICE PROCESSING.....	21
10.1	Grading	21
10.2	Weighing and Washing.....	21
10.3	Parboiling.....	21
10.4	PACKAGING	21

11.0	MARKETTING	22
12.	ACKNOWLEDGEMENT	33

1.0 INTRODUCTION

1.1 What is Rice:

Rice is the seed of the grass specie *Oryza sativa*. It is widely consumed as a staple food by human beings in several parts of the world.

1.2 Rice Production

In Nigeria, rice has become our national staple food, consumed daily by all and sundry. It is one of the crops that attract the highest market value within and outside the country. Therefore, taking rice production as a venture, is the surest way of creating employment and wealth for our unemployed teeming populace within the shortest possible period.

Nigeria is the second highest importer of rice in the world, second only to China. China is the world's leading producer of rice with over 200 Million metric tonnes. Annual rice requirement for Nigeria is about 5 Million Metric tonnes. (*Nig*) **However we are only able to cultivate and process about 2 Million metric tonnes, leaving a balance of 3 Million metric tonnes to be imported.***eria At a glance; Food and Agriculture organization of the United Nations).*

Rice can be **grown and harvested within a short period of four months.** Some of the early maturing varieties have short duration of (100-105) days, and with good management, one can make a return of about (100-200)% of his or her investment.

2.0 TRAINING SCOPE

This training covers the production of paddy rice, that is, from planting up to harvesting, processing and marketing.

Post-harvest embraces all activities carried out from the time the rice is harvested up to when it is placed on the table as food.

In this training, we shall treat the following topics:

1. Ecologies of the Rice plant

2. Rice varieties
3. Land preparation
4. Planting methods
5. Rice growth phases
6. Management practices
7. Weed control
8. Fertilizer application
9. Pest and diseases
10. Harvesting
11. Processing
12. Grading
13. Washing
14. Parboiling / drying
15. Milling
16. Packaging
17. Marketing

3.0 THE RICE GROWING ECOLOGIES

This simply means areas where rice can grow. These are: **the Upland** and **the Lowland ecologies**.

THE UPLAND rice depends solely on rainwater for their growth and development. Yield is about (1-2) ton/ha.

THE LOWLAND rice requires much water and has to be grown in various stages of water logging conditions, with the yield potential of (4-8) ton/ha.

3.1 Rice Varieties

Up till moment since 1974, the National Cereals Research Institute in Badeggi Niger State has released over 57 different rice varieties to suit different ecologies. Nerica 1 & Nerica 2, Faro 54 & 55 are good examples of upland varieties because of their earliness (100-105) days. Their average yield/ha is (2-4) ton.

For the lowland, one can choose Faro 52 (wita 4), Faro 44(SIPI692033), Faro 27, Faro 36 and Faro 37. These are good lowland varieties with potential yields ranging between (3-6) ton/ha in a well managed farm. **For Delta State Faro 44 has been identified as the preferred variety.**

3.2 Land Preparation

This is the removal of the existing vegetation and tilling the land either by ploughing and harrowing, you first kill your weeds by applying glyosphate.



Land Preparation

3.3 Planting Methods

This simply refers to methods of propagation which include:

- (a) Direct seeding (dibbling)
- (b) Drilling
- (c) Broadcasting
- (d) Transplanting.

(a) Direct seeding (Dibbling)

This is the most appropriate method of seeds propagation in the upland situation. About 70kgs of rice seeds are required for one hectare of prepared land. A maximum six seeds are sown in a hole of not more than 2cm depth at the planting space of 20cm apart. Planting may be done randomly or in rows with use of a marked rope.



Seed Dibbling

(b) Drilling

This is the manual or mechanical sowing of viable rice seeds in rows. Mechanical drilling involves the use of machine known as rice – drills. These are often attached to and powered by the tractors. There are some locally produced ones which are hand pulled. Seed - drills are equipped with faucets, which enable them to open the soil in rows, drop the seeds and cover the later with soil as they move along.



Seed Drilling

(c) Broadcasting

This is the dispersal of viable rice seed on the prepared land. Seed dispersal can be done in both the upland and lowland ecologies. However, where the presence of water is much in the later, the seeds have to be pre-germinated before they are dispersed.

Broadcasting saves time and reduce labour cost, but weeding may be difficult to carry out in the future, as the emerged seedlings will grow haphazardly, competing with weeds for sunlight and nutrients.

(d) Transplanting

This is the physical planting at the permanent site of the young rice seedlings uprooted from the nursery.

4.0 THE RICE GROWTH PHASES

This is a must-know topic by any potential rice farmer as its knowledge will enable the farmer know which operation is to be carried out on the field as at when due. For example, the two major operations that greatly affect rice yield are fertilizer (nitrogen) application and weed control.

Nitrogen fertilizer should be applied at the stages when the crop needs it most i.e. at the active tillering and at the panicle initiation stages. The field should be kept weed free in (4-8) weeks after planting as little or nothing will be achieved, when these operations are carried out at the wrong time, such as effective weed control or applying fertilizers.

The rice plant goes through three phases to complete its life cycle. These are:

1. The Vegetative Phase
2. The Reproductive Phase
3. The Ripening Phase

Each of these phases is comprised of three stages

4.1 The Vegetative Phase

This is the beginning of the rice life cycle. It starts with the emergence of the rice seedlings and extends to panicle initiation. Panicle initiation is the beginning of the panicle development within the stem. This phase is comprised of three stages namely:

- (a) **Seedlings Stage:** This cover the periods of seedlings emergence to the time of first tillering. Tillers are branches arising from the base of the main stem. They are full plants because they possess roots, stem, leaves and at maturity possess panicle. At this stage the field should be kept free from weeds.



(b) Tillering Stage:

This is when the stem starts to increase in number. This process continues until it reaches its maximum (maximum tillering). The yield potential of each rice variety depends greatly on its tillering ability. At this stage the second dose of NPK fertilizer should be applied. This is about (2-4) weeks after seedlings emergence. Ensure that the field is free from weed before nitrogen application.

(c) The Stem Elongation Stage:

This is when the rice plant starts to gain height. This occur at about (6-8) weeks after seedling emergence. A dose of fertilizer is applied at this stage. Make sure there are no weeds on the field before applying the fertilizer.



Paddy ready for Harvest

5.0 THE REPRODUCTIVE PHASE

This phase begins with the initiation of the panicle. The rice plant flowers at about 35 days after panicle initiation and in another (35-40) day, it matures. Therefore, it takes the rice plant a maximum of 75 days to mature after panicle initiation irrespective of variety. There are three stages involved in the reproductive phase namely:

5.1 Booting Stage:

This is the upward development of the panicle within the leaf sheath, thereby making it become swollen. This occurs in about (8-10) weeks after seedlings' emergence. At this stage the third dose of nitrogen application meant for the long duration varieties should be applied.

5.2 Heading Stage:

This is the emergence of the panicle out of the leaf-sheath and its exposure to sunlight. It takes the panicle (3-7) days to emerge fully from the leaf-sheath after heading. Heading marks the beginning of bird scaring.

5.3 The Flowering or Anthesis Stage:

Immediately after heading, flowering commences. Much water is required by the rice plant at the reproductive phase because all the parts are fully developed and transpiration rate is very high. Lack of water at any of the stages in the reproductive phase, will lead to irreversible damage that will result to poor yield.

6.0 THE RIPENING PHASE

Flowering leads to grain formation and it embraces three stages:

6.1 The Milk Stage: So called because of the milky nature of the grains.

6.2 The Soft Hard Dough Stage: The grains are formed but is still soft when compressed.

6.3 The Maturity Stage: The grains are fully developed, hard and the colour change from green to golden or the colour of the straw. At this stage, the grains are ready for harvest.

7.0 MANAGEMENT PRACTICE

These are the operations that must be carried out after establishing the rice field.

- Weed control,
- Fertilizer application,
- Diseases and Pest control; are parts of the management practices that must be carried out.

7.1 Weed Control

Weeds are plants growing where they are not wanted. For example, the maize plant growing on a rice field when not used as part of the farming system, is a weed. It should be removed at the time of weeding. Grasses and sedges contribute the major weeds found in rice fields. They adversely affect the rice growth by competing with

it for soil nutrients, sunlight, space, water and applied fertilizers. They also serve as alternative host to pests and diseases. Apart from reducing crop yield, weeds slow down harvesting operations and the drying of the harvested crop, thereby increasing the cost of harvesting and drying.

Weed control is very expensive. Its cost exceeds that of any other field management practices. For an effective weed control, a thorough land preparation is very essential, as it will help to check weeds at the early stage of the rice growth. However, this alone cannot suppress weeds before the rice flowers, one or two hand weeding or the use of herbicides is required.

Various types of selective herbicides for rice are in the market. Some of these are Stam F34TM, Ronstar EC, Risane, Basagram PL2, Synpram‘N’ etc. these herbicides are selective in the sense that when they are applied unto a weedy rice field, they kill only the weeds and have little or no lethal effect on the growing rice. They are most effective on weeds, especially grasses when applied at an early post emergence stage i.e. (2-4) weeks after plant emergence.

Weeds control aims to keep the rice field free from weeds right from the time of plant establishment up to flowering period. A thorough weed control couple with fertilizer applications as and when due, will enable the rice to grow well, produce more tillers and attain its yield potentials.

7.2 Fertilizers/ Fertilizers’ Application

Fertilizers are those materials which when added (incorporated) into the soil, supplement the soil with the required nutrient elements necessary for the nutrition of the plant. There are two types of fertilizers:

- i. The organic and
- ii. the inorganic fertilizers.

7.21 The Organic Fertilizer

These are residues of plant and animal materials, such as animal’s droppings, composts, animal carcasses etc.

7.22 The Inorganic Fertilizer

Inorganic fertilizers are synthetic materials produced chemically through the reaction of certain raw materials derived from the atmosphere, water, minerals etc.

Unlike the organic fertilizers, inorganic fertilizers have high level of nutrient elements, which are readily available to plant when they are applied. Examples of inorganic fertilizers include: urea, ammonium sulphate, single and triple phosphate, muriate of potash etc. These are available in different grades or analysis which indicate the quantity of the plant nutrient elements in a given quantity of fertilizer's materials expressed in percentage. For example, the inscription on a urea fertilizer's bag is 46-0-0. This means that the urea fertilizers' bag if it weighs 100kg contains 46% nitrogen, no phosphorus and no potassium.

Urea is a typical example of a single or straight fertilizer because it contains only one nutrient element i.e nitrogen.

The 15-15-15; 20-10-10; 12-12-12 grades are good examples of compound fertilizers because they possess the three primary nutrient elements N, P and K. For example, the 15-15-15 bags of fertilizer contains 15% nitrogen, 15% phosphorus and 15% potassium.

These three nutrient elements N.P.K are the major elements required most by the rice plant. However, nitrogen is required in greater quantity because it is the most important single element that positively affects the growth and yield of the rice plant.

For maximum utilization, nitrogen fertilizer should be applied in splits at the rate ranging from 80-120kg/ha: two splits are required for the short and the medium duration varieties, applicable at the early tillering stage and at panicle initiation i.e. (2-4) weeks and at (6-8) weeks respectively after plant establishment.



8.0 RICE PEST AND DISEASES

Like the weeds, diseases and pest are equally responsible for losses in rice yields on the field. Yield losses due to diseases and pest can be prevented if the farmer had acquired the knowledge of rice pests and diseases which will enable him carry out early diagnose and effect quick treatment.

8.1 Disease

This is a state of abnormal physiological condition caused by the presence of pathogen - a sub-microscopic entity - whose presence in the host (rice plant) causes it bodily harm. If this situation remains unchecked, the host may die. For disease to occur the following conditions must be in place:

- i. There must be a pathogen.
- ii. The **host** must be **susceptible** to the **pathogen**.
- iii. The environment must be conducive.

Therefore, in order to check disease outbreak, the conditions stated above must be put into check. Rice diseases are numerous. Some are fungal, some viral,

some are associated with nutritional disorder and some are caused by the presence of nematodes.

Among the fungal disease is the rice blast which attack the plant at any stage of growth. The disease spread rapidly that a whole rice field can be wiped out within few days of infection. Control measures include the use of resistance varieties, seeds' treatment, planting at the right time (early panting), improved cultural methods and efficient management practices.

8.2 Pest

A pest is an organism whose existence causes damage and constitutes nuisance to its host, thereby conflicting with man (farmer) welfare, convenience and profit. Insects, birds and rodents are the major pests that adversely affect rice plant.

8.21 Insect

Various species of insects attack the rice plant at all stages of growth and the attack is not limited to any specific area. However, four groups of insects have been noted. They are:

(a) The Root Feeders:

This group include the moles, crickets and termites which occur prominently in the upland but can also be found in the swamp which lack adequate water supply.

Control measure include treatment of a seeds with apron-plus before planting or the application of granular insecticides such as furadan at seeding or transplanting.

(b) Internal stem feeders (stem borers):

The two group of internal stem feeders are the rice stem borer and the African rice gall-midge. The attack by stem borers give rise to dead-heart and whitehead. Gall-midge causes silver shoot or onion shoot.

Chemical control of these internal stem feeders using folia insecticides have proved to be unsuccessful because the larvae living within the plant are well protected against chemical. Systemic insecticides such as carbofuran (furadan) and isazofor (miral), at the rate of (20-25)kg/ha and (10-15)kg/ha respectively were found to be effective.

(c) Leaf feeders/miners:

This is the collective name for all insects/ larvae that feed on the area parts of the rice plant especially the leaves. They occur mostly at the vegetative phase of the rice life cycle. The grasshoppers, the case worms, army worm, leaf folders and the beetles are good examples.

(d) The plant Sucker:

Prominent among these are the grain suckers known as the rice bugs. They are found mostly at the flowering stage. Both the young (Nymph) and adult suck on the developing grains resulting to partially filled or empty grains (empty glums) at maturity. Control measures include the use of contact insecticides.

8.22 Rodents:

The three major groups of rats that attack the rice plant are the commensal rodents also known as the black rat or house rat, the field rats (bush rat) and the cane rats popularly known as the grass-cutters. While the commensal and the field rats like to devour the rice seeds which they get either by digging up the newly planted seeds or cut down a rice stand bearing seeds, the cane rats cut down the rice stems and chew the tissue within. In a well-established field, the cane rats attack the centre of the rice field leaving the periphery, thus, making the damage unnoticeable to anyone passing by. Control measures include fencing and the use of bender traps animal repellents.

8.23 Birds:

These are the most dreadful of all the pests that ravage the rice fields and are of utmost concern to the rice farmers. Various scaring devices such as scarecrows, flash tape, automatic bangers etc have been used over the years to ward off birds from the rice fields, but as the birds get used to these appliances they come back and even perch on them. Bird scaring can be very expensive and unproductive, if one is not conscious of the number of men (scarers) to be engaged. A safe method is to complement scaring devices with human scarers.

The use of chemicals such as funguforce, cotchem and bird repellents monoforce are helpful when applied as folia sprays. These chemicals are lethal to birds and their potency last for 30days. Since the rice mature within (30-40) after

heading, the use of these chemical seems to be the panacea for birds control in the rice field at the moment.

9.0 RICE HARVEST

This is the final phase of rice production. It is the removal of the matured rice grains (paddy) from the rice field. It is done either by cutting the rice straws a little above the ground level (straw harvesting) or by cutting the area part which bears the seeds (panicle harvesting).

Harvesting commences in (30-40) days after panicle emergence or when the grains colour has changed from green to the colour of the straws. The implements used for harvesting rice include a simple sharp knife or a specially made curved knife called sickle.

On a large scale, mechanical harvesting is the most appropriate with the aid of a machine called combined harvester.



Combined Harvester

9.1 Post Harvest Handling

Harvested rice, even though threshed and winnowed should not be bagged and stored immediately without drying to a safe moisture level. This is because rice is harvested at a high moisture level (26%) and will quickly deteriorate at this moisture level, when stored. Therefore, **cleaned** paddy should be gradually dried to about 14% moisture level before storage, especially if the grains are to be used as seeds for future planting.

Whereas some farmers sun dry their paddy, there are also paddy drying machines.



Paddy Dryer

10.0 RICE PROCESSING

After harvest, the next phase is processing before it is eventually ready for the table as either fried rice, jollof rice, stew rice etc.

10.1 Grading

To ensure that you get the best grade of paddy for processing, you need to first Grade them with a seed gradder the seed grader has the ability to remove stone, sand, stalk and all dirt from the field. It will then eliminate the half paddy - those birds have sucked out the milk Etc.

10.2 Weighing and Washing

To make sure of the quantity of paddy you want to process in order to know your recovery rate, you need to wash them wash your paddy as the paddy when dry has dust on them

10.3 Parboiling

After washing, you will parboil (soak the paddy) in hot water of 70 degrees for about 6 hours. Thereafter, you remove the water and steam for about one hour.

After the steaming, you will temper the paddy by allowing it to cool before putting them on the dryer. You will dry to 14% moisture content. The paddy will be ready for milling in the next 48 hours. If you mill immediately, there is a tendency to have high breakage rate. Milled rice is usually warm and if you package it like that it will certainly stick together in which case you can't preserve it for long therefore before you package it, you will once again temper it when it is cool, you then package.

10.4 PACKAGING

You can package by putting your bag on a scale and pouring the rice into it till you get your deserved weight on the other hand, you can use the automatic bagging and weighing scale. All you have to do is to calibrate it to the size of the bag you want to package your rice and it will automatically fill for you. It also has the ability to sow thereafter your rice is ready for the market.

11.0 MARKETTING

I started by saying that rice is a staple food consumed daily in Nigeria, therefore the market is there. All you have to do is to get a shop and display your rice. Once your rice quality is good it is you that will not be able to meet up with the market demand.

The Federal Government has decided that by the year 2019, there will be a complete ban in the importation of rice either in processed form or paddy.

The Government has stopped giving foreign exchange for the importation of processed rice and paddy. What it tells us is that we have a huge market waiting for us.

From the above one can be involved in the **RICE VALUE CHAIN** in any of the following areas:

1. Land preparation



2. Fertilizer Application



3. Rice Planting



4. Rice Harvesting



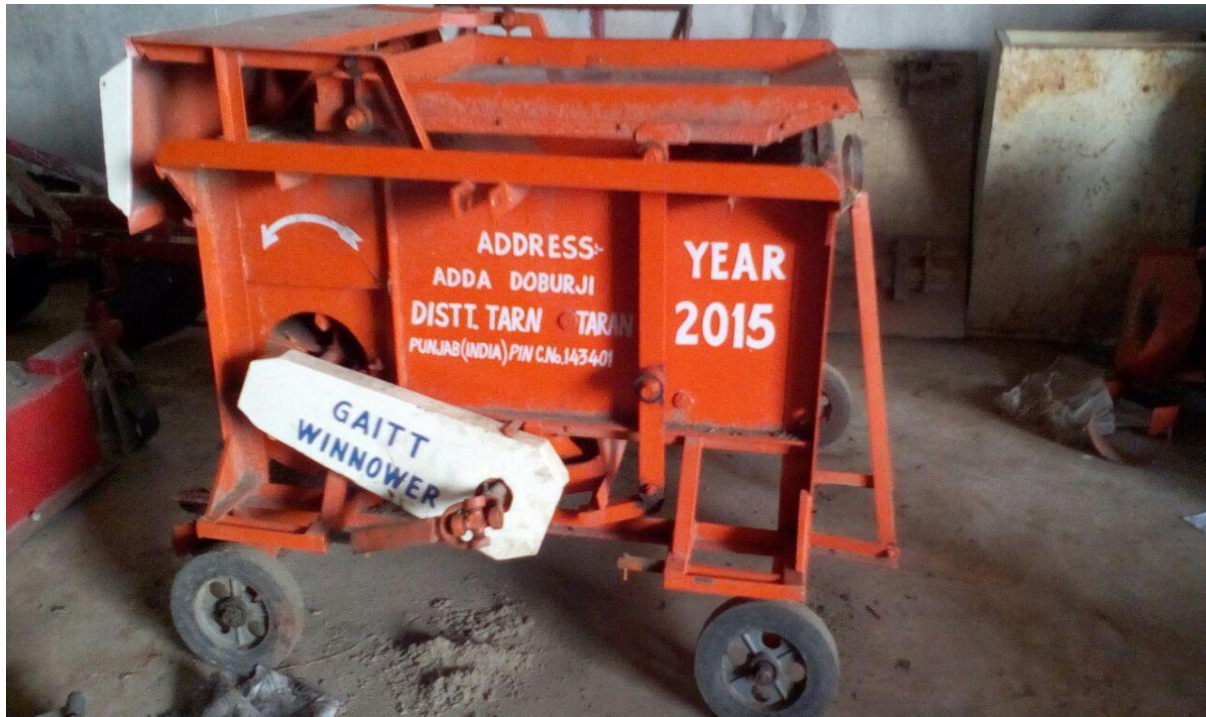
5. Paddy Dryer



6. Paddy Threshing



7. Paddy Winnowing



8. Rice Milling



9. Paddy Parboiling Tank



10. Paddy Drying Tank



11. Paddy Drying Tank



12. Rice packaging



13. Rice Distributing (Marketing)



12. ACKNOWLEDGEMENT

I wish to acknowledge Mr. Francis Okagbare (a retired staff of the National Cereals Institute Badegi) for giving me basic education on rice cultivation practices.

He inspired my interest in rice cultivation.