



MINISTRY OF
FOOD & AGRICULTURE
REPUBLIC OF GHANA



REPUBLIC OF GHANA

Rice **PRODUCTION GUIDE | 2020**



RICE PRODUCTION GUIDE

This production guide was developed to complement existing Information, Education and Communication (IEC) materials available on the Agronomy of selected commodities under the “Planting for Food and Jobs” campaign. It is designed for use by Agricultural Extension Agents and other farmers who can equally use to train their colleague farmers.

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Dr. Solomon Gyan,	DCS, MoFA	
Theophilus Osei Owusu,	Former Ag. Director, DAES	
Michael Owusu,	DCS, MoFA	
Paul Siameh,	Director, DAES, MoFA	
Paulina Addy,		WIAD, MoFA
Emmanuel A. Odame,	Dep. Director, DAES, MoFA	
Esther Agyekum,	DCS, MoFA	
Collins Oppong,	DAES, MoFA	
Daniel Ninson,	DCS, MoFA	
Kwesi Abaka-Quansah,	DAES, MoFA	
Hannah Serwaa Nuamah,	PPRSD, MoFA	
John Lovelace Kpodoviah,	DAES, MoFA	
Prosper Akpablah,	DAES, MoFA	
Portia Tandoh,	DAES, MoFA	

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1.0 INTRODUCTION

Botanical name: *Oryza sativa*

Rice is the seed of a semi-aquatic grass plant; *Oryza sativa* that is native to India, Southeast Asia and China. There are two main species of *rice oryza sativa* which all modern high-yielding rice varieties belong. The other variety is *oryza glaberrima* which originates from West Africa and is still grown by some peasant farmers.

Rice has become the second most important staple food for millions of people after maize in Ghana. Its consumption keeps increasing as a result of population growth, urbanization and change in consumer's behaviour. Apart from the grain used as food, the straw serves as source of fuel, roofing materials and also feed for livestock or ploughed back into the soil to add nutrients. The main production areas include: Western region, Volta region and the three Northern regions.



Typical rice field

2.0 SITE SLECTION/CLIMATIC REQUIREMENTS

Rice is produced in all the ten regions of Ghana, especially all the major ecological-climatic zones, including the Interior Savannah zone, High Rain Forest zone, Semi-deciduous Rain Forest zone and Coastal Savannah zone.

Choose fertile land with deep loamy and non-acidic soils with good water retention capacity (contains some clay and/or organic matter, i.e. loamy soil). Low-lying and valley bottoms are most preferred. Construct bunds around the field to retain water and suppress weeds using hoe, animal traction. Due to climate variability, climate smart agriculture activities which include; early planting taking into consideration the planting seasons for the various agro-ecological zones.

Variety	Maturity (days)	Ecology	
Agra rice	120 – 135	Lowland and Upland	8.0
Jasmine 85/Gbewaa	110 – 115	Lowland and Irrigated	5 - 6
Sikamo	120 – 125	Lowland / Hydromorphic	6.0
GR 18	132	Lowland and Upland	6.5
Digang	115	Hydromorphic and	4.8
Nerica	90 – 100	Lowland	6 -7
Nabogo rice	120 – 130	Upland	6 – 8
Katanga rice	130 – 140	Lowland and Irrigated	3 – 4
NERICA 1	90 – 95	Deep lowland	3 – 4
NERICA 2	95 – 100	Upland	4.8
Mmo teaa	110 – 115	Upland	
Otoo mmo	115 – 120	Upland	5.6
CRI-Amankwatia	115 – 120	Upland	8.0
Wakatsuki	125 – 130	Lowland	8.0
Bodia	120 – 125	Lowland	8.0
CRI-Oboafo	130 – 135	Lowland	8.5
CRI-Emopa	125 – 130	Lowland	8.0
CRI-Mpuntuo	115 – 120	Lowland	8.0
CRI-Enapa	125 – 130	Lowland	9.5

4.0 LAND PREPARATION

Land can be prepared conventionally using tractor or animal traction to plough and harrow the land for cultivation in the savannah and transition zones. A good soil tillage practice contributes to efficient fertilizer use, increased soil porosity and aeration.

The practice also has positive impact on germination, seedling emergence, crop establishment and weed control. Zero tillage can also be done by small-scale farmers using recommended weedicide.

In the forest zones, upland fields are slashed and stumped. Systemic herbicides may be used to kill regrowth before planting. Lowlands can be prepared as upland except when it is flooded and soggy. For flooded fields, slash and collect trash from field.



Land preparation in rice field

5.0 PLANTING

(i) Germination test

Conduct a germination test before planting. This will establish the actual seed rate to be used based on seed viability.

- Count 100 seeds
- Place seeds on a moist cloth, cotton or tissue paper and cover with a thin layer of soil.
- Count the number of seeds that germinated between 4 and 7 days
- :

Table 2

No of seeds that germinated	What to do
More than 80	Plant the seeds(3-4) hill
60-80seeds	Increase seed rate by about 20% i.e. (5-6)/hill
Less than 60	Do not use the seeds for planting.(obtain fresh seeds)

Seed sorting by floatation

- Farmers traditionally practice seed flotation by using water only. In this way, unfilled seeds thus straw and some seeds attacked by insects can be separated but not all the light and insect affected seeds will be separated out.
- To remove all partially filled seeds and those attacked by insects, it is necessary to increase the specific density of the water.
- First you fill a clean container with water. After that mix salt or urea with the water. Add enough salt or urea until an egg can float in the water.
- Now put seeds in the water and stir with your hands. Within a short time, light seeds and insect attacked seeds will be seen on the surface leaving the good seeds at the bottom.
- Remove the light seeds and insect damaged seeds from the top. Keep the salt water in a separate container. Wash good seeds two or three times with clean water.
- In this way, bad seeds can be separated from good seeds and be given to poultry birds. Water mixed with salt can also be used to water coconut trees. If urea was used, the water can be applied to the seed beds.

(ii)Raising seedlings (nursery management)

Rice can be nursed at the nursery or planted directly (pre-germinated and planted directly) on the field for both Upland and Lowland rice.



Rice nursery

In the Upland cultivation, nursed seedlings are transplanted when the seedlings are about 21 days after seeding with the recommended planting distances. The nursery bed should be watered regularly to keep the soil moist but not puddled. Good drainage should be provided to ensure that nursery is not flooded

(iii) Methods of planting

There are two methods for planting rice: Transplanting and Direct seeding

Transplanting is done in one of two methods: Random or Straight-row.

In the Random method, seedlings are transplanted without a definite distance or space between plants. The Straight-row method follows a uniform spacing between plants. The seedlings are transplanted in straight rows.

For Direct seeding, there are three techniques which are; Broadcasting, Drilling and Dibbling.

NB: The main advantage of drilling/dibbling is efficiency in seed use.

NOTE: Transplant seedlings in the well-puddled and leveled main field between 14-21 days after sowing.

Seeding Rate (recommended)

Method	Plant Spacing	Seed/hill	Seeding Rate/ha	Seeding rate/acre
Drill	30cm x 1.5cm	1/hill	60kg	24kg
Dibble	20cm x 20cm	4/hill	50kg	20kg
Broadcast	-	-	80kg-100kg	30kg



Rice transplanting

6.0 FERTILIZER APPLICATION

Apply organic manure as follows;

- Spread 7 to 8 tons (140 – 160 bags)/ha of cow dung or 4 tons (80 bags) decomposed poultry manure/ha and work into the soil before planting under rain-fed conditions.
- Spread 7 to 8 tons (140 – 160 bags)/ha of cow dung or 4 tons (80 bags) poultry manure/ha and puddle into the soil 2 weeks before planting under irrigated conditions.

6.1 Inorganic/chemical fertilizers

First application: Apply 180kg (3 and a half bags)/ha of 15-15-15, 2-3 weeks after transplanting and apply 125kg (2 and a half bags)/ha of NPK 15-15-15 one week after direct seeding and control weeds 2-3 weeks after seeding.

Second application: Top dress with 50kg (one bag)/ha Sulphate of Ammonia or 75kg (1 and a half bag of Urea) 5 – 6 weeks after seedling emergence and just before booting.

6.2 UDP (Urea Deep Placement)

UDP technology involves “point placement” of large fertilizer granules (1 to 3 grams each, in the shape of briquettes), 7-10 cm below the soil surface in close proximity to the root zone of the plant. Urea briquettes are applied only once during the crop growth season, compared with two to three fertilizer applications needed.

UDP technology makes nitrogen available to the crop throughout its growth cycle. Plants are able to absorb more of the applied nutrients, resulting in higher crop yields and lower production costs for farmers. It performs best in clay and silt soils and in rice production

systems in which fields are subject to surface water runoff and line sowing (drilling) is practiced.

Typically, one briquetteis placed in the puddled soil (by hand, manual applicator, mechanized row applicator, etc.) at the center of each set of four hills of rice at a depth of 7-10 cm from one to seven days after transplanting rice.



Urea briquette



placement of briquette

Crop	Agro-Ecology	Recommended Fertilizer Formulae for Blends
Rice (Lowland)	Guinea Savanna zone/ Forest Savannah Transition	N-P2O5-K2O: 15-20-20 (6 bags/ha + 2 bags/ha urea or 4 bags/ha SoA)
Rice (Upland)	Guinea Savanna zone/ Forest Savannah Transition	N-P2O5-K2O: 15-20-20 (4 bags/ha + 3 bags/ha urea)

7.0 WEED CONTROL/MANAGEMENT

Weeds can be controlled through an integrated use of cultural, manual, mechanical or chemical methods. Weed rice field at 3weeks after seeding or transplanting. The weeds are controlled by using recommended weedicides and appropriate tools in both upland and lowland rice fields. At 6th week stage, weeds in rice fields are controlled by using appropriate tools.

Roguing

It is always important to rogue your field to remove off-types from the rice field to ensure purity and achieve the following;ensures genetic purity, ensures high productivity to farmers, ensures good quality of seeds or grains ensures the requisite adjustment of mill during milling and minimizes percentage of broken grain.

8.0 PESTS & DISEASES MANAGEMENT

8.1 PESTS MANAGEMENT

(a) Insect pests:

(i) **Stem borer:** larvae bore at the base of the plants during the vegetative stage. On older plants, they bore through the upper nodes and feed toward the base.

Signs and Symptoms

- Whiteheads at reproductive stage and dead hearts or drying of the central tiller during vegetative growth
- Caterpillars bore holes at the base of the plant during vegetative stage and on old crop, they bore on the upper nodes feeding towards the base



**White heads
stem**



Larva inside

Management Prevention

- Before transplanting, cut the leaf-top to reduce carry-over of eggs from the seedbed to the field
- Avoid excess use of nitrogenous fertilizers as high rates favour population build-up
- Avoid water stagnation in the field
- Conserve natural enemies such as dragonflies, spiders, carabids beetles, parasitic wasp by reducing the amount of insecticides use
- Remove stubble, volunteer rice and wild grasses around nurseries and planting areas
- Harvest crops at ground level to remove the larvae in the stubble
- Practise crop rotation (e.g. legumes/vegetables)

Monitoring

- Install light traps at 5 traps /ha and kill trapped adults physically
- Damage may be confused with what is caused by rats, neck blast or back bug diseases. To confirm stem borer damage, pull and dissect stems to find larvae or pupae
- Take control measures when 10-15% of plants/m² show damage 40 days after planting

Control

- Monitor weekly from seedlings to harvest for the presence of the insect and damage symptoms
- Hand pick borer larvae during transplanting or in the nursery and destroy egg masses
- Plough and flood after harvest to destroy dormant stem borer caterpillars
- Remove and destroy head hearts and whiteheads
- Apply ground neem powder (a pinch per plant) onto the funnel of young plants. Rate 50g/2kg ash
- Consider practices that enhance natural enemy populations (e.g. habitat flowering plants, reducing broad spectrum chemicals, releasing natural enemies etc.)
- Spray with imidacloprid (Confidor 70WG) at a rate of 4g/15 litres water)
- Spray with Acetamiprid (Golan 20SP) at a rate of 7mls/ 15L of water

(ii) Termites (*Macrotermes* spp., *Odontotermes* spp. *Coptotermes* spp.) Signs and symptoms

- Mud on stems
- Lodging of plants
- Stunting of plants



Termites



Lodging due to tunneling
and feeding of termites

Management

Prevention

- Avoid termite-infested fields during site selection
- Destroy termitarium before planting
- Keep soil moist in the dry spell to discourage termite activities
- Inter-plant with termite repellent plants e.g basil (*Ocimum* spp.)
- Collect and burn/bury plant debris after harvest. Avoid importing termite infested materials into fields
- Avoid mulching in termite infested fields

Monitoring

- Visit farm regularly during off-season to check for termite colonies/mounds
- During cropping season, plants growing close to termite mounds should be given close attention to for protection
- Uproot young plants that show poor growth or stunting to check for termites

Control

- Dig up termite mounds to expose and kill the reproductive and destroy colonies
- Spread 1kg crushed neem leaves and/ water. 1 match box/L of water
- Spray Fipronil (Fipro 50 EC at the rate of 100mls/15L
- Spray with Deltamethrin base product 75-100mls/15L

(iii) Mole crickets –Mole crickets are large, brownish insects. They are rather cricket-like in shape but have mole-like, digging front legs. The adults have wings and many are powerful though clumsyfliers.

Signs and Symptoms

- Wilting of whole plant
- They injure plants by chewing and severing roots and occasionally stems
- Cutting of plant stems and dragging them into their burrows



Management Prevention

- Most injury to rice seedling occurs shortly after transplanting, so replacement of lost plants will help compensate for injury
- Use the proper irrigation schedules and correct fertilizer recommendations to maintain the crop in the healthiest condition possible to allow the plants to recover from injury by mole crickets
- Encourage biological control agents (sphecid wasps, carabid beetles, nematodes and fungus) by minimizing insecticide use

Monitoring

- Asses population density of nymphs by checking frequency of soil surface tunneling
- Estimate nymph and adult abundance by flushing with 0.5% aqueous solution of dish washing soap
- If 2 to 4 mole crickets come to the soil surface within three minutes of application of the soap solution, corrective action is justified to reduce mole cricket numbers

Control

- Use bund shaving and plastering of fresh wet soil to help eliminate the eggs of mole crickets
- During land preparation, search and collect the nymphs and adult and destroy
- Flood rice fields for 3-4 days. Level the field for better water control which can help to remove the eggs on the soil and reduce cricket populations
- Spray with neem. mix 400g of dried powdered leaves to 3 litres of water and apply regularly at 80L/ha
- Spray with pyrethroid insecticides. Spry only once per season

(iv) Birds: They attack the crop at the milk and grain filing stage sucking and taking grains out of the panicles. Birds become a problem from ripening phase when the rice plant is already developing and filling in grains until harvest. Whiteheads can also be caused by stem borer. The differences between the two are; in bird damage not, all grains are chaffy whiles in stem borer damage, all grains in a panicle are chaffy and the panicle can be pulled out easily.

Signs and Symptom

- Chew grains
- Whitehead or unfilled panicles



Management

- Scaring of birds to avoid attacking the plant.
- Identify and destroy the bird nest.
- Use of exclusion netting
- Use of scarecrows
- Tapes can be placed over the rice plants. This could be one of the best options for scaring birds.
- Chili extracts can be used as a chemical repellent. These are commercially available and require approximately one liter to be used on one hectare. Repellents should be continuously applied every two weeks. They also need to be re-applied after rain.

(b) Diseases:

(i) Rice Blast (*Magnaporthe grisea*) –A fungal disease caused by *Pyricularia oryzae*. The disease is seed-and air-borne and attacks the plant at all stages producing white to greyish green lesion or spots with dark green borders and widen from the centre towards either ends that results in poor grains fill in rice production.

Signs and Symptoms

- Diamond shaped lesions with grey centre and brown or reddish borders
- Lesions on seeds and in severe conditions rot
- Internal red necrosis, mould growth on lesion and stunting or rosetting



Diamond shaped lesions with grey centre and brownish borders



Shriveled culms



Drooped panicle

Management Prevention

- Use certified disease-free seeds for planting or consider using tolerant varieties (e.g. Amankwatia, Jasmine and AGRA rice)
- Treat the planting materials (seeds) with recommended and appropriate fungicides before planting.
- Avoid excessive use of nitrogen fertilizer as this can increase the severity of the disease
- Avoid drought stress to plants and extended drainage period as this makes the plants more susceptible to the disease
- Practice continuous flooding to limit blast development

Monitoring

- Monitor plants by observing leaves for appearance of major symptom
- Presence of blast lesions, just before booting often dictates decisions for chemical treatment

Control

- Remove leaves with lesions or symptoms if they are not many during monitoring
- Apply Maneb at 70g/knapsack
- Apply Kingstar WG at 75ml/15L knapsack

(ii) Brown leaf spot (*Bipolaris oryzae*): It is reddish-brown spots which appear on leaf surfaces. It spreads rapidly if good screening for diseased seedlings is not practiced.

Signs and Symptoms

- On the leaves and sheaths look for small circular lesions, dark brown to purple in colour. Older lesions are more oval with a light brown to gray center surrounded by a reddish-brown margin
- Check glumes and panicle raches for dark brown to black oval spots or discolouration on the surface
- Brown spot lesions can be mistaken for blast lesions. Lesions caused by brown spot are oval while blast lesions are diamond or spindle shape



Dark brown to purple lesion on leaves



lesion on older leaves surrounded by reddish brown margin

Management

- Transplant only seedlings that are healthy (free from brown spot symptoms)
- Destroy volunteer rice crop and infected rice debris by burning soon after harvest
- Control weeds in season and out of season
- Amend soil with calcium silicate to boost resistance to the disease
- To treat seeds, pre-soak seeds in cold water for 8 hours and treat with hot water (53-54 °C) for 10-12 minutes before planting or treat with fungicide for prevention before sowing

Monitoring

- Monitor crop weekly through the season as disease can set in at all stages of growth
- Check glumes and panicle rachis for blast lesions.

Control

- Rogue infected plants from the nursery to avoid disease spread and burn to destroy
- Rogue plants with brown spot symptoms at low disease incidence in the field after transplanting
- Apply Mancozeb at a rate of 75g/15L
- Apply Carbendazim at a rate of 25ml/15L

Rice Yellow Mottle Virus (RYMV)

Signs and Symptoms

- Yellow/ orange colouration of leaves
- Stunted growth and death of plants
- Empty spikelets
- Look for insects with shiny black bodies or others with brown heads and dark bodies and spined thorax. Hoppers with greenish-yellow bodies and others with greenish brown colouration



Yellow patches

Management

Prevention

- Avoid planting in areas where RYMV is already present
- Control weeds on rice fields and around fields (particularly grass)
- Reduce injury to plants during transplanting and weeding
- Set traps to prevent rodents and other animals from causing injuries
- Plough under infected crop residues, volunteer rice, infected ratoons and weeds after harvest
- Wash hands with soap after working on infected plants so as not to transmit to healthy plants

Monitoring

- Monitor nursery weekly for yellowing of leaves, stunted growth and death of plants
- Young seedlings (3-4 leaf growth stage) are most susceptible to infection, newly formed leaves are twisted and have difficulty in emerging
- Look for insects with shiny black bodies or others with brown heads and dark bodies and spined thorax. Hoppers with greenish-yellow bodies and others with greenish brown colouration

Control

- RYMV is a dangerous disease and farmers are advised to start control action soon after observing symptoms
- Rogue and burn infected plants in the field when first seen to reduce spread of disease to healthy plants
- Control insect vectors in the nursery with insecticides such as alpha-Cypermethrin at 5-7.5ml /15L of water and Imidacloprid at 5-7ml/15L of water to control insect vector in nursery.
- The virus cannot be managed with using insecticides but the insect vector(hopper) can be managed with an insecticide

9.0 HARVESTING

Harvesting refers to all operations carried out in the field including cutting the rice stalks (reaping), laying cut stalks on stubbles, bundling, stacking or piling, threshing and hauling. Harvest the rice field when the crops are 80 – 120 days after planting depending on the variety, and 85 to 90% of the panicles show straw colour yellowish brown and also when the grains moisture content is about 18 - 20%. Harvesting can be done in two parts; harvesting using the manual process by cutting the panicle and also using the combine harvester, sickles, slasher and reaper. Cut the stems with a sickle about 10-15cm above the ground.

To mill immediately after harvest, winnow, dry up to 12% to 14% moisture content and bag. If moisture content is below 12%, parboil before milling to avoid loss through grain breakage.



Rice harvesting using sickles



Rice milling

9.1 Threshing

Thresh immediately after harvesting and drying to avoid losses.

Avoid threshing on bare floor to prevent the introduction of sand, pebbles and other foreign material. Thresh carefully to avoid dehusking the grains

9.2 Winnowing

- Winnow to separate the chaff and empty grains from the well filled matured grains.
- Remove foreign matter in the paddy to avoid localized heating spots

9.3 Drying

Dry paddy properly to a safe content of 13-14% by spreading in a thin layer (2-3cm thick) on clean concrete floors, floors, mats or tarpaulins and turning over periodically. Sun-dry for 2 – 3 days to reduce breakage during milling. Use a mechanical drier if possible.



9.4 Parboiling

- Parboiled rice has advantages of better storage, cooking quality, being richer in food value, devoid of unpleasant odour and breaking less during milling.
- Soak paddy in hot water at 70° C or water hot enough for your fingers to withstand the heat for about two seconds.
- For about 5 to 6 hours discard all floating grains
- Parboil rice by steaming soaked paddy in a jute bag for 10 to 16 minutes.
- Suspend the bag over steaming water in a drum
- Continuously monitor the paddy
- Stop parboiling when the rice husks start to split open.





9.5 Milling

Milling is the process of removing the husk or hull from the grain and bran. Greater efficiency in the milling process results in whole grains with minimal broken grains to attract premium prices. Mill rice in two stage milling machine. Always mill one pure variety at a time.

9.6 Storage

- Store only well cleaned rice
- Inspect rice regularly during storage.
- Keep free from insect attack
- Avoid storage conditions that allow water penetration