THE NATURAL RICE COMPANY

AEROBIC RICE

2016 GROWING GUIDE

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The recommendations in this guide are based on current rice technology developed from extensive field experience and rice research and development projects. They represent the current state of knowledge and the successful farm practices identified by experienced rice growers, research scientists and extension agronomists. The recommendations have been reviewed and revised based on seasonal experiences, research, extension and farmer results.

AEROBIC RICE

Rice has been successfully grown for centuries under flood irrigation around the world, however in recent times a number of factors including conservation and pest management, has led researchers and companies to grow rice under new aerobic systems.

Aerobic Rice has been grown for the past eight years in the Northern Rivers NSW, Central and North Queensland regions and around the world with results close too traditional "paddy" irrigation systems.

Aerobic rice is grown purely on rainfall or with the use of flush irrigation in an Alternative Wet Dry system. Rice does not need to grow submerged in water to produce good yields and superior grain quality but different management and growing cultures need to be adhered to ensure a successful crop is achieved in an aerobic system. Rice is a semi aquatic plant and thrives in water logged paddocks.

TARGET YIELD

Yield potential varies from 5t/ha to 10t/ha in an aerobic system. A 5t/ha average is easily achievable when grown purely on sufficient rainfall. Yield drivers to achieve >5t/ha are proper nutrition management, soil moisture retention, low weed pressure, ideal plant population of 300plants/m2 and crop rotations using legumes. The more moisture that the rice plant has available throughout the crop cycle, the higher chances of high yields.

Yield decline can be seen from having lower than ideal rainfall (< 400mm), dry periods during the reproductive stage, low plant numbers, poor nutrition and high weed pressure.

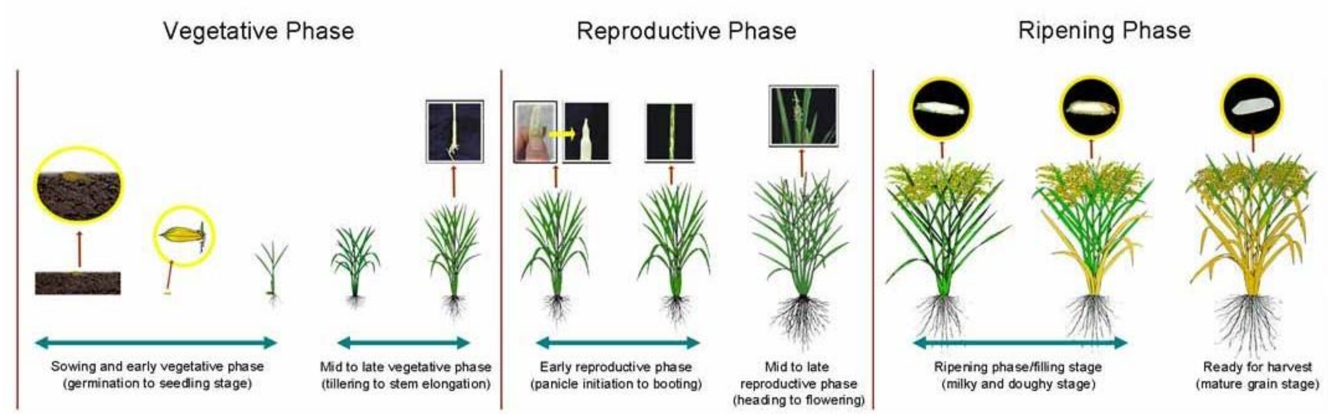
The amount of tillers (shoots) per plant plays a big role in yield as well as each tiller will produce a panicle. The ideal tiller count is 2-3 tillers/plant to achieve >600 panicles/m2. A high population of rice plants (>350plants/m2) will reduce the plants ability to tiller due to competition with other rice plants and reduce the number of panicles/m2.

CROP CYCLE

The crop cycle is split into 3 management growth stages:

1. Vegetative phase
2. Reproductive phase (PI – Panicle Initiation signals the start of the reproduction)
3. Ripening phase

The days after planting to reach the growth stages vary with variety (shown below) and climatic conditions. A dry period during the vegetative stage may slow the crop cycle down.



Days after planting

Tachiminori			
0	60	100	150
Langi			
0	60	90	140

VEGETATIVE STAGE

The vegetative stage is where all the in crop applications of fertilisers and herbicides are completed. This stage can also be broken up into:

- Planting to Early tiller 0-30 days after planting
- Mid-tiller 45 days after planting
- Green ring 50 days after planting

These stages are important with management of fertilisers and chemicals to be applied at the correct time to reduce crop injury and maximize crop growth. ALL HERBICIDE APPLICATION STOP AT GREEN RING.


Early Tiller


Mid Tiller

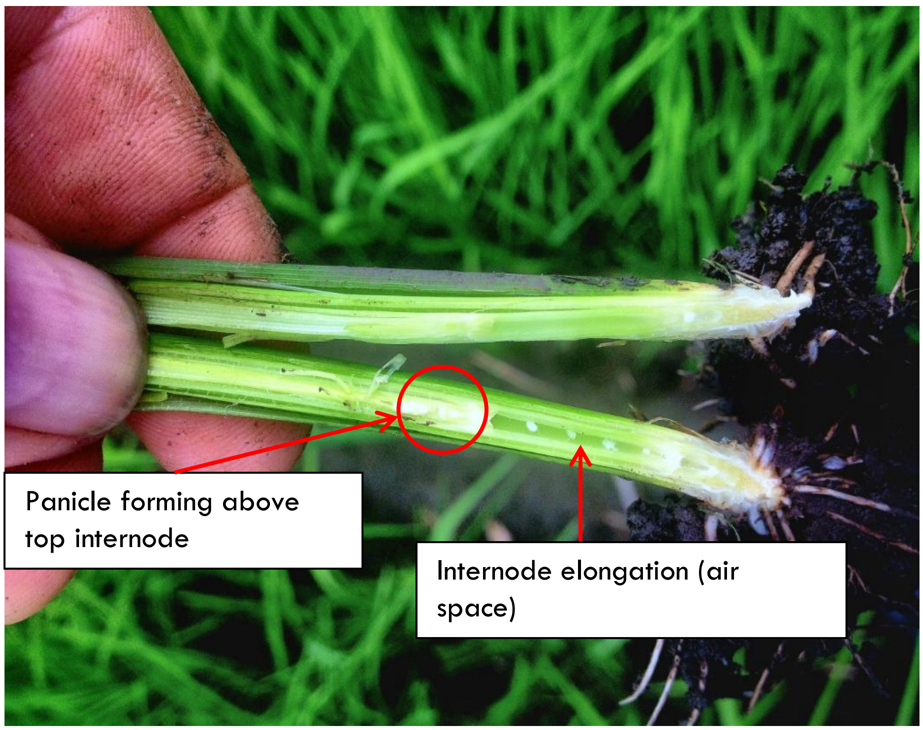
Green Ring

REPRODUCTION STAGE

The reproduction stage is broken into 3 important stages:

- Panicle Initiation (PI) 60 days after planting
- Microspore 75 days after planting
- Flowering 90 – 100 days after planting

The reproductive stage is the most important stage to have sufficient rainfall or a wet soil profile in rain-fed rice. Moisture stress during the reproduction stage can cause yield loss and sterility. The critical reproductive growth stage (microspore) should occur from when temperatures are most favorable and the risk of low (< 16°C) night temperatures is least. Microspore is normally 12 to 16 days after PI but will be quicker in hot weather and slower in cold weather



Panicle Initiation (PI)

RIPENING STAGE

The ripening stage will last for 30-50 days after flowering depending on variety and climate. The rice grain will start to fill after flowering and go through the following stages:

- Milky – when the grain is squeezed, a milky substance will be present
- Late dough – the grain becomes firmer but still easily squashed between fingers
- Physical maturity – the grain is golden, hard and clear – moisture will be 26 – 28%

Harvest is approximately 14 days after physical maturity when the moisture level is 18-22%.

PLANNING – Paddock Selection

Paddock selection is important due to the ability for soil moisture retention, weed history and crop rotations. Soil tests for nutrients are also highly recommended.

Light sandy soils are not suitable for rice due to their inability to hold moisture resulting in loss of yield. Soils that have good moisture retention are well suited for rice production.

Liming is recommended on soils with a Ph <5 with a high Aluminum concentration. Soil tests will confirm if lime is required. Incorporation of the lime in the top 10 cm is necessary for the lime to increase the Ph.

Weed history in a paddock can have an impact on the rice crop and the input costs. If a paddock has been in fallow where weeds and grasses have been able to get out of control, other low input crops or legumes should be considered prior to the rice.

Rice is best grown following a legume crop to reduce the amount of fertilsers and chemical inputs that is needed following sugarcane. Rice will grow well following sugarcane but best results have always been following a legume crop.

GROUND PREPERATION

The rice crop requires good seed bed preparation for an even uniform established crop. Ground preparation should be done early, >4 weeks before planting, to allow the bed to be consolidated by rainfall and weeds to emerge and be controlled by knockdown herbicide applications. This also aids in the efficiency of the pre-emergence herbicide being applied to a consolidated bed. Planting rice into a freshly tilled paddock increases weed pressure, reduces moisture availability to the seed and may allow pre -emergence herbicides to be washed into the rice root zone causing injury.

Minimum tillage practices are recommended if planting rice following a legume crop. Good weed control during the fallow period is important for the best results in a minimum tillage rotation. Pre-emergence chemicals get tied up in weed and plant residues from previous crops. Disc planters are recommended for minimal tillage operations.

CROP ESTABLISHMENT

Healthy, uniform crop establishment is important for high yields. Vigorous crops are more competitive against weeds and will reduce the need for excessive use of herbicides.

- A target plant population of 300plants/m2 is ideal for high yields and weed competition.
- A sowing rate of 125kg – 140kg/ha is recommended for direct drilled rice.
- Rolling directly after planting is not essential but can help with an even establishment and also improve the pre-emergence efficiency. Rolling is recommended if the paddock has been freshly tilled just prior to planting, if soil clods in the paddock are >50mm in diameter and if rice is shallow to the surface.

PLANTING DATE

The planting date is worked out with the following factors influencing the date.

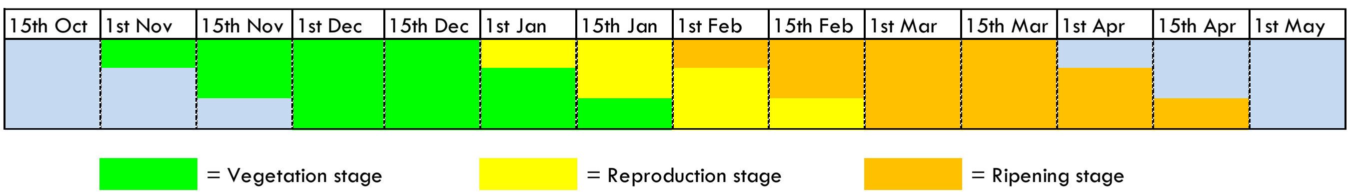
- High chance of rainfall during the reproduction phase
- Low chance of cool night temps at the microspore stage (especially the variety Langi)
- Lower chance of rainfall during harvest.

The best planting window to take the above into account for all varieties is:

10th November – 15th December

Planting too early will put the harvest time into March and planting too late (January) will increase the chance of sterility from cooler nights at the microspore stage. Earliest planting time would be last week in October with the longer variety Tachiminori.

Table below outlines the three different growth stages and the effect the planting date has on them.

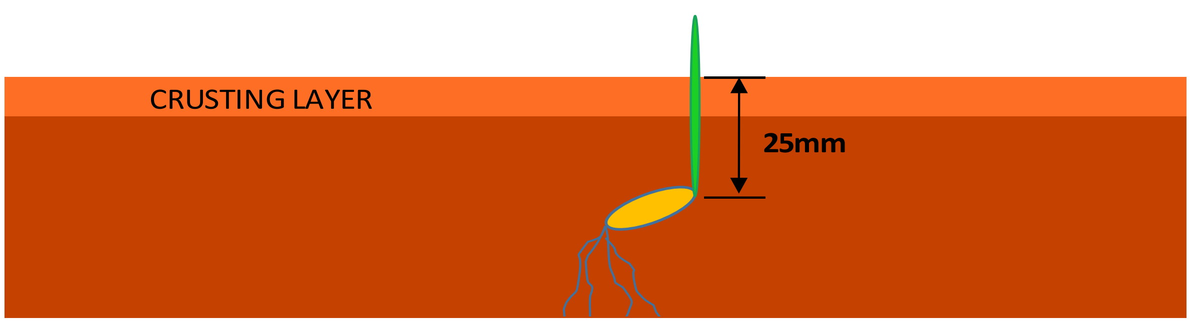


ROW SPACING

Rice should be planted with a row spacing of 6" to 10". Wider row spacing >10" increasing the time for the crop to shade out increasing weed pressure and also increases the number of plants per linear meter reducing the tillering abilities of the rice plant.

PLANTING DEPTH

The planting depth should be no deeper than 2.5–3.0 cm so that the rice coleoptile can emerge. If too shallow the rice seed may run out of moisture or be effected by the pre-emergence chemical. In crusting soils, the rice seed should be placed below the crusting layer. If planted too deep the rice plant will run out of energy and struggle to break through the surface.



CROP NUTRITION

Nutrient balance is important to achieve high yields and superior grain quality. Crop rotation planning and replacing nutrients removed by previous crops help keep the balance for a successful rice crop. Rice is similar to corn on fertiliser inputs and aerobic rice is grown after sugarcane will require more fertiliser than following a legume. Understanding the paddocks and soils on the property will help build a fertiliser plan for the rice crop. All nutrition requirements for the rice is applied pre-plant to PI. Fertiliser applications after PI are not economical and will result in delayed harvest and reduced yields.

Soil tests are strongly recommended to plan a balanced nutrition program.

Nitrogen

Rice is dependent on good soil fertility to achieve high yields but there are limitations on applying the correct amount of Nitrogen to the rice crop. Too much nitrogen will lead to excessive vegetation, lodging and sterility. Too less available nitrogen can increase chance of disease and lower yields.

Because of these limitations, it is recommended sufficient nitrogen fertiliser be applied in split applications throughout the vegetative stage to achieve the target nitrogen uptake at panicle initiation (PI) of between 60 and 150 kg N/ ha depending on variety, crop rotations and climate. A rice crop following sugarcane will require up to 150kgN/ha (325kg/ha Urea). The split application strategy maximises yield potential and nitrogen efficiency by applying the Nitrogen requirements when needed. Applying **ALL** the nitrogen pre-plant and incorporating leads to heavy losses and low availability when needed prior to PI.

Split application timing

There are 2 main strategies to apply the total % of N requirement to the crop.

A. Starter fertiliser 10%, Early Tiller 50% and Green Ring 40%

2 x in crop surface applications at early tiller and green ring stages. This is the most common strategy but can have limitations to being able to get the fertiliser on the paddock on time if the paddocks are wet.

B. Pre plant 55%, Starter fertiliser 5% and Mid tiller 40% - using entec®

Pre plant entec urea at a depth of 7 cm which will supply the Nitrogen requirements up to Mid tiller than 1 x surface application at Mid tiller to Green ring stage.

Phosphorous

Phosphorous is important for tillering and root growth. Mid-season P may have to applied if severe deficiency is observed but the best practice is to place phosphorous into the root zone at planting or pre plant due it's to inability to move through the soil. Fertiliser that contain N & P (DAP, MAP, Granulock Z) are placed with the seed.

Typical fertiliser rates direct drilled with the seed at planting is 90-110kg/ha of DAP to place 20kg P into the soil as well as N. All though soil tests may reveal sufficient P in the soil, high buffer index will lock up P availability.

Potassium

Potassium plays a major role in crop strength, 1000 grain weight, spikelet numbers and disease prevention. Unlike N & P it has no influence on tillering. Following crops such Sugar cane that export a lot of K from the soil, higher amounts K should be applied. Up to 180kg/ha of K can be removed from the soil by Rice. Split applications, surface applied are recommended due to the loss from leaching by placing all K needs pre-plant.

Zinc

Aerobic rice is very responsive to Zinc. Deficiencies can especially occur in soils with pH >7 and it will cause tie up of other fertilisers. A foliar spray of Zinc chelate at 3L/ha with a herbicide spray helps with the mid tiller and PI Nitrogen applications. Jar tests should be performed for herbicide compatibility.

Zinc levels below 0.7mg/kg on the soil test will result in a zinc deficiency.

Sulphur

Deficiencies have been recorded in crops on lighter soils where Sulphur containing fertilisers have not been used in recent years, and where soil Sulphur levels are below 5 mg/ kg (KCl test). Sulphur deficiencies have similar plant symptoms to nitrogen deficiencies in terms of pale green plant colour. However, Sulphur deficiencies shows up in the young leaves and nitrogen deficiencies shows up in the old leaves. Sulphur deficiencies respond quickly too top dressed Sulphur in available forms (e.g. single superphosphate or a low rate of gypsum).

Boron

Boron is important to rice production as a deficiency can lock up availability of other nutrients and is usually found to be low in high leaching soils. Tissue tests at the early stages of rice is recommended and boron applied as a foliar with a herbicide is preferred to soil application.

Acid Soils

Soil with a ph <5 is recommended to be limed to increase the ph to 5.5. Especially if the aluminum saturation is high which will cause significant damage to the rice. 2 – 5t/ha of lime is recommended.

Salinity

Rice will suffer from salinity if EC levels are >2 dSm. The preferred level for rice is 1 – 1.5 dSm and damage occurs at flowering and seedling to the rice which can reduce yields. It is not recommended to grow rice in paddocks with an EC of >2 dSm.

CROP PROTECTION

Weed Control

Aerobic Rice is dependent on good weed control programs as there is no puddled water as in the paddy system to suppress weeds. Given the high value of rice crops, relatively low densities of weeds can induce economic losses and grain quality. Weeds emerging before or during early crop establishment are highly competitive with rice crops. Once the rice crop shades out at approx. 40 days after planting, new germinations of weeds are less likely.

Successful weed control requires you to:

1. Know your rice field. A good knowledge of the weed situation in each field is important. Observations of previous other rotation crops will provide useful information on weed activity.

2. Inspect the crop. Look for weeds at sowing and inspect your crop every 4 to 5 days during the first 3–4 weeks.

3. Apply herbicides at the appropriate time. Herbicides should be applied at the correct stage of weed and rice growth, before the weeds become too large.

4. Apply the correct rate of herbicide. Apply the registered label rate to ensure adequate control and reduce the risk of herbicide resistance

Pre-emergence application is important to achieve a clean crop and reduce the number of chemicals needed in crop. The less chemicals need to be applied, the less stress the rice crop will be in.

High grass infestation due to pre-emergence chemical being missed.

HERBICIDE PROGRAM FOR AEROBIC RICE

ALWAYS READ THE LABEL PRIOR TO APPLICATION

	Pre sowing	Planting - Pre emergence	Germination	1 leaf	2 leaf	4 leaf	Early tiller	Mid tiller	Green ring	Panicle Initiation
Grasses **Option 1** Preferred program	Roundup 1 -3L, pre sowing 24hr plant back	Magister @ 0.4L + Stomp 440 @ 3.4L + Gramoxone @ 0.8L Post sowing prior to rice emergence		Barnstorm @0.75 - 1.5L + 1L/ha Uptake oil. Use lower rate for small grasses 2-3 leaf stage and high rate for larger grasses. **DO NOT APPLY WITHIN 7 DAYS OF MCPA OR BASAGRAN M60.**						
	Gramoxone 0.8 - 1.6L pre sowing or prior to rice emergence									
Option 2 If planting into dry soil or heavy rain is predicted, use option 2		Magister @ 0.6L + Gramoxone @ 0.8L post sowing prior to rice emergence		Stomp 440 @ 2.25L + Stam @ 3.75L Apply after full rice emergence and prior to 5 leaf stage						
				Stomp 440 @ 2.25L + Barnstorm @ 0.75 - 1L plus 1L/ha Uptake oil. Apply after full rice emergence and grass is at 2-3 leaf stage. Best applied prior to 4 leaf stage						
	***Do not apply Stam to rice within 14 days of insecticides*									
				Stam @ 7 - 12.5L, apply prior to 4 leaf stage to small grasses						
Broad leaf **weeds and sedges**	*As above for grasses +* 2,4-D @ 0.5 - 1L Pre sowing, 7 day plant back	*As above for grasses*		Dicamba 500 @ 0.575L, apply after even germination of rice up to Early tiller						
						Basagran @ 2 - 2.5L, Apply to small weeds.				
								Basagran **M60** @ 2- 2.5L + MCPA 250 @ 1L Do not apply prior to Mid tiller		
	Hammer @ 30g No plant back							MCPA 750 @ 0.975L. Do not apply prior to Mid Tiller.		

PEST CONTROL

Aerobic rice does not have as many pests as other summer crops like soybeans but some pests can cause trouble and farmers must be aware of them. Knowing your paddock history and pests is the first start to a pest free crop. Soil insects like wireworm, cane beetle and nematodes can cause significant damage to emerging rice. Grasshoppers and armyworms in high numbers can cause damage during late stages of the rice crop.

Lorsban applied with the seed at planting can drastically reduce damage from wireworm and cane beetle if the pests are known to be present in the soil. Wireworm rarely come to the surface of the soil to feed so getting a pesticide to come in contact with the pest is near impossible once rice is established. Careful planning is necessary for successful crop establishment if the pests are known to be in the paddock.


Wire worm

Ducks and birds often affect crops with weak establishment areas or have low lying areas in the paddock where water puddles. Use strategic shooting, scare guns, lights and plastic bags on stakes to scare birds from rice crops. Aim to prevent any birds from settling, as they are likely to attract additional numbers. Refer to the NSW DPI website for more information regarding the Native Game Bird Management Program.

GRAIN QUALITY

Rice grain quality is an important factor that will influence market value and future industry building. Whole grain yields are the most important factor along with appearance of the grain.

For every tonne of rice paddy harvested, the miller is trying to recover 55% - 70% of finished product that is marketable. Broken rice, discoloured rice and damaged rice can affect the whole grain yield and the farmer can be penalised if the rice delivered to depot is outside the quality specifications set out on the contract.

Growing rice at the optimum nitrogen levels will maximise whole grain yield because the crop will mature later in cooler conditions than a crop with low nitrogen. High nitrogen levels can delay crop maturity

HARVESTING

To reduce the risk of brokens, rice should be harvested at 18-22% moisture using a rotary header. If using a conventional header, a peg tooth drum is needed to help with the threshing of the grain. Rasp bar drums in conventional headers typically need to be sped up and closed to thresh the grain from the plant and this in turn tends to break the rice seed.

Care is taken to inspect the harvest sample and adjustments done to ensure the rice grain quality is within the grain specifications. If the hulls are being removed from the rice seed during harvest, the threshing is too aggressive.

High admixture of trash and weeds >3% also incur a deduction to the grower. Proper air set up and sieve adjustments can reduce the admixture.

Rice harvested at high moisture needs to be delivered to depot ASAP to reduce the rice being stack burnt. Stack burn occurs when the rice increases in temperature and turns red in colour. Penalties to the farmer occur if rice is stack burnt. To reduce the risk of stackburn, deliver the rice harvested within 12hrs of being harvested.

Varietal harvesting order. If at similar moisture contents, the medium grain varieties should be harvested before the long grain varieties, as the rate of decline in whole grain is faster in the medium grains. However, Langi should not be delayed because of the risk of shedding.

RICE STUBBLE

Rice can leave behind a considerable amount of stubble. The management of the stubble will depend on the crop rotation following rice and time needed before the following crop is planted. A 7t/ha rice crop will typically leave 5t/ha of stubble.

Baling or burning the rice stubble is used when a fast turnaround is needed to plant the next crop. This removes the nutrients (mostly potassium and silica) from the paddock that the stubble contains.

Mulching and allowing the stubble to break down naturally is the best option to retain the nutrients in the paddock if the next crop is >3 months from being planted. Once the stubble starts to break down it can be easily incorporated into the soil. Another option is to plant a legume into the stubble that acts like a weed blanket and incorporate after the legume crop.

NOTES

References

NSW Dpi - Rice crop protection guide 2015