3. CERTIFICATION

In India, accredited certifying and inspection agencies are there in almost all regions, which issue appropriate certificates to the products grown in strict conformity with the approved standards of organic farming. Important agencies are: Association for Promotion of Organic Farming (APOF) at Bangalore, National Organic Certification Association (NOCA) at Pune, Indian Organic Certification Agency (INDOCERT) in Kerala and Indian Society for Certification of Organic Products (ISCOP) at Coimbatore. Growers can approach these agencies for getting their organic rice certified. If they follow terms and conditions outlined by these agencies, they can obtain the logo, 'India Organic'. The products certified with this logo as organic produce are likely to attract premium price in the market. In addition, specific global agencies like IFOAM, CODEX, DEMETER, etc., also examine the products, particularly those having export potential.

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- improved package of practices for sustainable production

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ORGANIC RICE

Improved package of practices for sustainable production

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Organic agriculture implies a holistic system of crop production utilizing local resources at affordable prices that maintains a relatively pollution-free environment providing food of higher nutritional quality. This basic philosophy has led to the promotion of organic rice farming ensuring quantitative as well as qualitative enhancement and sustenance in rice productivity.

Indian agriculture in large parts of the country is 'organic by default', particularly in the hilly regions. At present, some 14,000 tons of organic food is produced, to which organic rice contributes about 25%. In addition, countries like USA, UK, Germany, France, Switzerland, etc., are ready to pay premium prices for organic rice implying substantial export potential of organically grown rice.

During last couple of years, the Central Rice Research Institute, Cuttack has developed improved varieties and package of practices for sustainable production that could help farmers to cater to the local as well as export demand for organic rice.

1. PRODUCTION TECHNOLOGY

Suitable variety, appropriate crop and nutrient management, effective plant protection, and proper storage are the main component factors that constitute the matrix of production technology of organic rice.

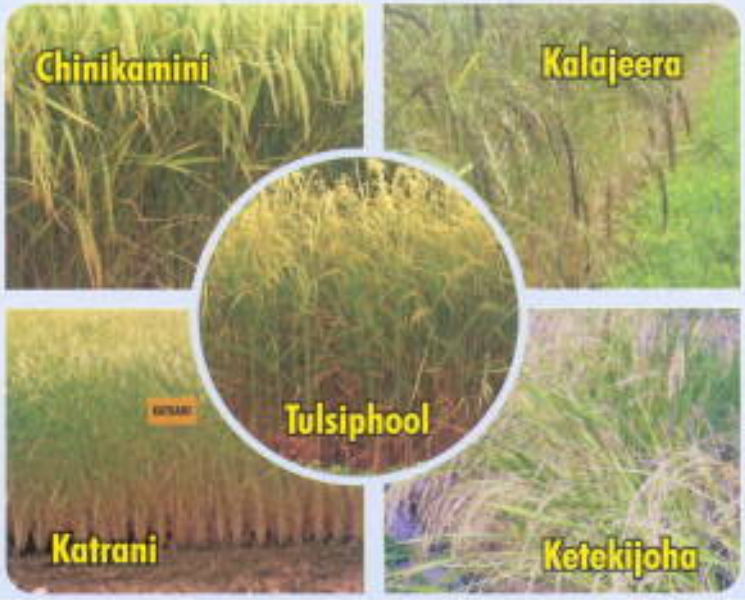
A. Suitable variety

In general, low input responsive rice genotypes, mostly improved land races perform well with organic management. Average yield potential of these land races under optimum crop and nutrient management ranges from 2.0 to 3.5 t/ha.

A number of land races have emerged promising for organic cultivation due to their characteristic features like presence of aroma, high head rice recovery and good eating quality. Of which **Chinikamini** and **Ketekijoha** produce better grain yield under minimum and intensive management respectively (Table 1).

Table 1. Yield potential of organically grown rice cultivars

Sr. No.	Name of the cultivars	Grain y ield (t/ha)
1.	Chinikamini	3.30 - 3.45
2.	Ketekijoha	2.0 -3.71
3.	Leelabati	2.23 - 3.43
4.	Katrani	1.90 - 3.11
5.	Kalajeera	1.85 - 3.10
6.	Tulsiphool	1.50 - 3.05
7.	Dhusara	2.10 - 2.96



Top shoot of wild sugarcane to control case worm

- Crop rotation with jute/potato/wheat to control root nematodes
- Crop rotation with maize/sugarcane/jowar as alternate hosts to control Gundhi bug
- Intercropping rice with jute (4:1) to control yellow stem borer
- Intercropping rice with red gram (4:1) to control brown spot
- Crop rotation with green gram/black gram to control root-lesion nematode

f) Grain storage

Grain should be stored under organic environment to avoid infestation with storage pests. Admixing dried leaves of senwar (*Vitex negundo*), wild sage (*Lippia geminate*), bael (*Aegle marmelos*), crude extracts of garlic, oils of cotton seed and Eucalpyptus, flower head of Ageratum, dried fruit of **raja mircha** (*Capsicum sp*) or seed powder of black pepper at 1% w/w with grains protects seed from a number of stored grain pests up to nine months.

2. PRODUCTION ECONOMICS

During initial years of cultivation, the productivity of organic rice declines with 40-50% less yield reported by 2nd-3rd year of cultivation compared to the conventional management practices. However, the yield increases gradually with the potential yield achieved in the 5th-6th year. Accordingly, the net income of rice farmers considering premium price (20% more than normal price) starts increasing from 4th year onward.

Pheromone trap to control YSB

d) Use of microbial pesticides

- Several formulations of *Bacillus thuringiensis* (Bt) are effective against a wide range of insect pests and diseases.
- Spray the Bt formulation, e.g., Biolep, Bioasp, Bactospeine, Dipel-8L, Delfin, Biobit, Halt and Spicturin at 1 kg / ha wettable powder to control lepidopteron caterpillars,
- Foliar application of *Pseudomonas fluorescens, Aspergillus niger* and *Bacillus subtilis* at 5 ml liquid formulation/lit or soil application of 100 g liquid formulation + 10 kg FYM/acre can control sheath blight.

e) Cropping system

Crop diversification in a rice based cropping system can effectively interrupt the perpetuation of insect pests and diseases. Following cropping systems are found promising in controlling pest dynamics.

Crop rotation with green gram

B. Crop and nutrient Management

Summer ploughing

Summer /off season ploughing (1or 2 times) is suggested at monthly intervals during April-May that helps control weeds and soil borne insect pests and diseases.

Organic manuring

At initial ploughing, it is recommended to apply farmyard manure (0.5-1.0% N-dry weight basis) @ 8-10 t /ha along with powdered rock phosphate @ 6.0 q/ha. Vermi-compost (1.5-2.5% N) can also be applied alone or in conjunction. Requirement of K would be made available from applied FYM (0.6-0.8% K_2O)/ vermicompost (0.8% K_2O)/ rice straw/stubble (1.4-1.5% K_2O).

Green manuring

Green manuring is recommended with broadcast-sown Sesbania (2.35-2.55% N) or Sunhemp (3.0-3.5 % N) at a seed rate of 15-20 kg/ha followed by its incorporation at 6 week stage. Green leaves of Gliricidia (2.75-3.5% N) or Azolla (2.5-3.0% N) @ 10 t/ha can also be applied to supplement N requirement of the crop.

Green manuring with Sesbania

Nursery management

Seedlings are to be raised in the nursery under similar organic environment. Rice straw/hull/husk ash should be applied in the nursery for raising healthy seedlings as it supplies sulphur (0.17-0.37%) and silicon (8%), the two essential micro nutrients. Rock phosphate is suggested to be applied @ 1kg/10 m^2 in the nursery.

Transplanting

Transplanting is recommended to be completed within 1st fortnight of July to ensure adequate and vigorous crop stand. However, under delayed situation, paired row planting would be more advantageous accounting for less yield reduction (10-12%) than normal planting. Yield reduction is less in variety **Chinikamini** (10-15%) followed by **Katrani** (15-20%) if planting is delayed as compared to other varieties.

Weed management

Weed management has to be done manually or using finger/cono weeder. Clean farming needs to be ensured keeping the surroundings and bunds free from weeds. Irrigation needs to be provided through concrete channels or **hume** pipe, in place of earthen field channel / polythene / metal pipe.

C. Plant protection

Integrated management consisting of cultural, mechanical, botanical and biological measures along with location specific cropping system should be followed for controlling insect pests and diseases both in the field and during storage.

a) Cultural method

i) Stand establishment

It is noticed that micro-climate prevailed during the growing period largely determines the extent of insect pest and disease infestation. Accordingly, crop establishment needs to be taken care to avoid the vulnerable period thereby enabling better plant protection. Sowing early in the 1st fortnight of May or planting in the 1st fortnight of July helps reduce insect infestation resulting in 5-10% less of chaffy grains.

ii) Field drainage

Draining accumulated water twice at early tillering and at panicle initiation stage helps suppress the build-up of BPH and gall midge population that results in greater panicle emergence (180/m^2) as compared to no-drainage practice (150 /m^2).

b) Use of botanical pesticide

A good numbers of botanicals have been found promising in controlling a wide range of insect pests and diseases successfully (Table 2).

Table 2. Botanical pesticides for controlling insect pests and diseases in organic rice

Insect & diseases	Source	Formulation	Dose
Yellow stem borer and Gall midge	Neem *(Azadirachta indica)*, Karanja *(Pongamia pinnata)* and Kochila *(Strychnos nuxvomica)*	Seed powder	20-30 kg/ha
BPH and WBPH	Neem and Karanja	Seed oil	0.5-1.0% with 2% Detergent
Leaf folder and Cut worm	Neem	Barkdecoction / leaf Extract	20-25 g/lit
Stem borer	Parasi *(Clerodendron collinus)*	Fresh leaf	20-30 kg/ha
Case worm	Wild sugarcane *(Saccharum spontaneum)*	Top shoot	
BPH, WBPH and Case worm.	Water pepper *(Polygonum hydropiper)*	Leaf extract	10-20 g/lit
Bacterial blight	Neem + Cow dung/urine	Leaf extract + cow dung slurry/urine	50 g leaf/lit
Blast	Basil *(Aegle marmelos)* and Tulasi *(Ocimum sanctum)*	Green leaf extract	250 g/1.0lit steamed aqueous

c) Use of Bio-agents

i) Natural predator

Monitor and encourage natural predators like Coleopterans and Odonates, e.g., Mirid bugs, Damsel flies, Dragon flies, Grass hoppers, Staphylinidis, Carabids and Coccinellids to control a large number of insect pests.

ii) Parasitoids

Release parasitoids like *Trichogramma japonicum* (Tricho card) at 40,000 /acre /week depending on incidence controls yellow stem borer effectively and *Trichoderma viride* at 1.5 g liquid formulation + 25 kg FYM/acre to control sheath blight.

iii) Pheromone trap

Mass trapping of yellow stem borer by placing sex pheromone trap @ 20 traps/ha at a distance of 25 m keeping the 'lure' at canopy level would also effectively control yellow stem borer.