



**Tips on Direct
Seeded Rice using
seed-cum-fertilizer drill
in Odisha**



Tips on Direct seeded rice using seed-cum-fertilizer drill in Odisha



Funded by



BILL & MELINDA
GATES foundation



Partners



The Cereal Systems Initiative for South Asia (CSISA) is a regional initiative to sustainably increase the productivity of cereal-based cropping systems, thus improving food security and farmers' livelihoods in Bangladesh, India and Nepal. CSISA works with public and private partners to support the widespread adoption of resource-conserving and climate-resilient farming technologies and practices. The initiative is led by the International Maize and Wheat Improvement Center (CIMMYT), implemented jointly with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI), and is funded by USAID and the Bill & Melinda Gates Foundation.

www.csisa.org

email: cimmyt-csisa@cgiar.org

Compiled by:

Preeti Bharti, Ashok Yadav, Amit Mishra, Narayan Chandra Banik, Vivek Kumar, Sudhir Yadav, Virender Kumar, Sheetal Sharma and Sudhanshu Singh

2016

© This publication is a product of the Cereal Systems Initiative for South Asia (CSISA) and copyrighted by the International Maize and Wheat Improvement Center (CIMMYT) and International Rice Research Institute (IRRI) 2016, and is licensed for use under a Creative Commons Attribution Non Commercial Share Alike 3.0 License (Unported).

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of CIMMYT and IRRI concerning the legal status of any country, person, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. Where trade names are used, this does not constitute endorsement of, or discrimination against, any product by CIMMYT and IRRI.

CONTENTS

1.	Traditional method of seeding	1
2.	Disadvantages of broadcasting	1
3.	Direct seeding of rice	2
4.	Advantages of dry Direct Seeded Rice (DSR)	2
5.	Soil suitability, land preparation and suitable varieties	3
6.	Seed treatment	4
7.	Fertilizer management	5
8.	Weed management	6-8
9.	Insect pest management	9
10.	Disease management	10
11.	Machinery for sowing	11-12
12.	Seed metering mechanism and calibration of seed drill	13-15
13.	Machine maintenance	15
14.	Machine storage & trouble shooting	16-17
15.	Common issues in DSR	17-18



Traditional method of seeding

Rice is generally sown in Odisha through broadcasting. Beushening is done after 35-40 days of sowing where field is ploughed using bullock-drawn plough or power tiller to thin down the plant population and achieve weed management.



Disadvantages of broadcasting

- Non uniform distribution of seeds
- Seed damage by birds
- Uneven plant population
- High seed rate is required
- Inappropriate and non-uniform fertilizer application
- Proper seed depth is not maintained
- Weeds are more rampant
- Difficult to conduct intercultural operations
- Insect and pest attack is more
- Difficult to apply plant protection measures



Consequently, resulting into lesser yields and net returns.

Direct seeding of rice

Direct Seeded Rice is a method of sowing rice seeds directly into the main field, without raising nursery and transplanting. There are two methods of direct seeded rice:

Dry direct seeding

- Broadcasting
- Seed drilling



Wet direct seeding

- Broadcasting
- Drum seeding



Advantages of dry Direct Seeded Rice (DSR) using seed-cum-fertilizer drill

- Requires lower seed rate
- Optimum seeding depth
- Maintains spacing between the rows
- Uniform seed rate throughout the field
- Good soil and seed contact- improved germination
- Provides option for drilling DAP as basal application
- Conducive for interculture and plant protection measures

- Better yield and more profitable than broadcasted
- Labor saving (as compared to transplanting)
- Environmental friendly

Brings opportunity to run business as 'service provider'

Dry direct seeded rice

Soil suitability

DSR can be grown on soil ranging from medium textured (loam) to heavy textured (heavy clay). However, it is recommended not to go for DSR if the soil is light textured and poorly drained.

Land Preparation

Operation	Equipment/ Machinery
Primary tillage (depth of 5-10 cm to achieve a fine tilth for good seed-soil contact)	4-wheel/2-wheel tractor with moldboard plough/disc plough/rotavator
Levelling	Laser land leveller/scraper/planking
Secondary tillage	Disc and peg tooth harrow/cultivator/rotavator

DSR can be successfully established by direct drilling after applying pre-sowing irrigation (or rains) (in heavy textured soils) and irrigation may also be given immediately after sowing (in medium textured soil) or followed by rains.

Suitable varieties

Season	Area	Inbred varieties
Kharif	Coastal	Swarna - Sub 1 (Dhala Swarna), Swarna (Nali Swarna), Ranidhan, Pooja, Pratiksha, Sarala, CR 1009, CR 1018
Kharif	Plateau	Sahbhagi dhan, Lalat, Bina 11, DRR 42

Seed treatment

Seed treatment is done to prevent the seed borne diseases and to protect the seeds from insect-pest attack.

Steps to be followed for seed treatment

- Soak the seeds in water treated with fungicides for 10-12 hours.
- Fungicides used: Tebuconazole-Raxil Easy[®] at 1 ml/kg seed or Carbendazim-Bavistin[®] at 2 g/kg seed.
- Apply Imidacloprid-Gaucho 350 FS at 3 ml/kg alone or in combination with Tebuconazole-Raxil Easy[®] at 0.3 ml/kg seed for soil borne fungi and insects like termite.
- The seeds can also be treated with Vitavax power[®] at 2 g/kg seed.
- Remove the seeds from solution after soaking.
- Dry in the shade for 1-2 hours.

Don't use water-soaked treated seed for sowing in dry conditions and with seed drill having fluted roller type seed metering system. Under dry sowing conditions; treat the seeds with above chemical by mixing in 15 ml water/kg seed.

Good seeds result in high germination percentage and optimal crop stand



Key points to remember at the time of sowing

Seed quality	Seed rate	Sowing depth	Row spacing	Sowing time	
Use certified seed for sowing	12-16 kg/acre	Seeding depth should be 2-3 cm	20-25* cm	<i>Kharif:</i> 15 May -25 June	<i>Rabi:</i> 10-25 January

*Wider row spacing allows use of cono-weeder/paddy power weeder

Fertilizer management

- Fertilizer dose to be applied depends on soil fertility and crop variety.
- General recommendation is to apply 80 to 100-40-40 to 60 kg N- P_2O_5 - K_2O per hectare.
- Zn ($ZnSO_4$) can be applied at a rate of 25 kg/ha. Urea and potash should be applied in three & two splits, respectively (see table below).
- Compound fertilizers (DAP) should be placed in the soil at the time of sowing i.e. basal using the seed drill.
- "Rice Crop Manager" a decision support tool can be used for calculating fertilizer requirement for variety and field specific nutrient management. The tool is available at <http://webapps.irri.org/in/od/rcm>.

Name of fertilizer	Rate of fertilizer application (Kg/acre)			
	At sowing	At 15-25 DAS	Active tillering	Panicle initiation
DAP	35	-	-	-
Urea	-	20* (for medium-long duration varieties only)	30-35	30-35
MOP	15-20	-	-	15-20
$ZnSO_4$	10	-	-	-

* Should be applied with first irrigation or with light rains, depending on weather conditions

Active tillering (AT) and panicle initiation (PI) stages vary depending on the varieties eg. for short term variety (Duration: 115-120 days, AT at 25-30 DAS and PI at 43-47 DAS), medium term variety (Duration: 130-135 days, AT at 31-35 DAS and PI at 55-57 DAS), long term variety (Duration: 145-155 days, AT at 41-45 DAS and PI at 73-77 DAS).

Weed Management

1. Cultural Practices

- a) **Stale seedbed:** In this technique, after seedbed preparation, the field is irrigated and left unsown for few weeks to allow weeds to germinate and then the emerged weeds are killed either by non-selective herbicides (glyphosate @ 1 kg ai/ha or 1% by volume or paraquat @ 0.5 kg ai/ha or 0.5 % by volume) or by shallow tillage prior to rice sowing. This is effective in reducing weed emergence after rice sowing and also reduces seed bank. This is also effective for the control of weedy or volunteer rice.
- b) **Rotation of crop establishment method:** DSR can be rotated with transplanted rice (manual or mechanical) after 2-3 years to keep weeds under check especially to check the build-up of problematic weeds such as *Leptochloa chinensis*, *Eragrostis sp*, weedy/volunteer rice etc.

2. Chemical control

Pre-emergence followed by post-emergence herbicide application has been found effective for weed control in DSR. The rate, time, and method of application are given in the table below:

(a) Pre-emergence (use any of them)

Sl. No.	Herbicide	Product dose/ acre	Target weeds
1	Pendimethalin (Stomp*)	1300 ml	<i>Leptochloa</i> , <i>Eragrostis</i> , <i>Dactyloctenium</i> , some grassy and broad leaf weeds
2	Pretilachlor with safner (Sofit*)	600 g	-do-
3	Oxadiargyl (Top star*)	50 g	-do-

Time of application: For vattar sowing, apply on the same day; for dry sowing, 1-3 days after sowing followed by irrigation/ rains.

(b) Post-emergence (select based on the weed flora)

Sl. No.	Herbicide	Product dose/ acre	Target weeds
1	Bispyribac – sodium (Nominee Gold/ Taarak/Adora)*	80-100 ml	Grassy weeds mainly <i>Echinochloa</i> and few broad leaf weeds
2	Bispyribac sodium+ Pyrazosulfuron (Tank mix) (Nominee Gold/Taarak/ Adora+ Sathi)*	100 ml+80 g	Grassy weeds mainly <i>Echinochloa</i> , sedges mainly <i>Cyperus rotundus</i> and few broad leaf weeds
3	Feroxaprop - with safner + Ethoxysulfuron (Rice star + Sun rice)*	350-500 ml+ 50g	Broad leaf weeds, grasses mainly <i>Leptochloa</i> , <i>Eragrostis</i> , <i>Dactyloctenium</i> and sedges
4	2, 4-D Ethyl Ester (2, 4-D Ethyl Ester)*	500 ml	Broad leaf weeds and sedges
5	Ethoxysulfuron (Sunrice)*	50 g	-do-
6	Chlorimuron + metsulfuron (Readymix) (Almix)*	8 g	-do-

*Does not imply endorsement of the product

Time of application: 15-25 days after sowing when weeds are at 3-4 leaf stage.



Echinochloa



Dactyloctenium



Broad leaf weed



Cyperus

Method of application for pre and post-emergence:

- Use multiple-nozzle boom fitted with flat-fan nozzle. If using single nozzle boom, use flood jet/cut type nozzle. Do not use cone type nozzle for herbicide spraying.

Procedure for preparing stock solution :

- Pour 12 glass/mug/container (equal to number of tanks to be used per acre) of water into a bucket and add prescribed quantity of herbicide in the last glass along with water and mix it thoroughly in the bucket.
- In a 15 liter tank half- filled with water, add one glass of this mixture, fill the tank with water and mix thoroughly. Repeat similar process each time before application and also stir the herbicide solution intermittently. Spray 12-13 tanks of this mix to cover one acre.

C) Mechanical/hand weeding: A follow up mechanical or hand weeding (need based) is important to remove escaped weeds as a strategy to manage/delay evolution of herbicide resistance in weeds.

Safety measures

- Read the label prior to understand the toxicity and safety measures required.
- Plastic gloves, goggles, respirator/face shields and full clothing should be worn during mixing and application of herbicides.
- Wash your hands properly with soap after application.
- Bury the empty container after use.
- Post application, all clothes need to be washed separately.



Insect Pest Management

Stage of insect / pest attack	Insect/Pest	Control measures
Vegetative stage	Stem borer	* Clipping of leaf tips of the seedlings at the time of transplanting will help in destruction of egg masses * Clean cultivation and destruction of stubbles * Apply Phorate 10 G @ 4 kg/acre (Trade name: Foratoxor/Phormax/Thimate/Ratnamate) - Or * Fipronil 0.3 G @ 10 kg/acre (Trade name: Regent/Mahabir/Fauji/SriramFipro Plus)
	Leaf folder	* Spray Triazophos 40 EC @ 160 ml/acre (Trade name: Trazan/Ghatak/Trizoplus/Trip) - Or - Chlorpyrifos 20 EC @ 600 ml/acre
Reproductive stage	Brown plant hopper, White backed plant hopper	* Spray Imidacloprid 200 SL @ 50 ml/acre (Trade name: Corafider/Hilmida/Trishul) - Or * Thiamethoxam 25 WG @ 40 g/acre (Trade name: Exam/Thioguard/Evident)
	Stem borer	* Spray Chlorpyrifos 20 EC @ 800 ml/acre - Or * Quinalphos 25 EC @ 600 ml/acre (Trade name: Cross/Quick/Exalux)
	Leaf folder, Ear-cutting caterpillar	* Spray Triazophos 40 EC @ 200 ml/acre - Or * Chlorpyrifos 20 EC @ 800 ml/acre



Stem borer



Leaf folder



Leaf folder moth



Brown plant hopper

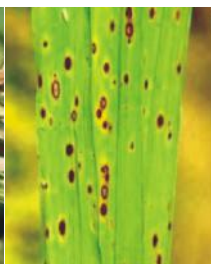
Disease Management

Stage of pest attack	Pest	Control measures
Vegetative stage	Leaf Blast/ Neck blast	* In endemic area, adopt seed treatment with Tricyclazole 75 WP (Trade name : Beam/Baan/Newage) - Or * Spray Tricyclazole 75 WP @ 0.6 g/lit - Or * Carbendazim 50 WP @ 2 g/kg seed (Trade name: Bavistin/Curator)
	Sheath blight	* Spray Validamycin 3 l @ 2.5 ml/lit (Trade name: Sheathmar/Delcin) - Or * Hexaconazole 5 EC @ 2 ml/lit(Trade name: Contaf/Mash/Samadhan-Plus) * Reduce or delay the top-dressing of nitrogen fertilizer and apply in 2-3 splits
	Brown spot	* In endemic area, adopt seed treatment with Carbendazim 50 WP + Mancozeb 75 WP @ 2g/kg seed or spray @ 2 g/lit of water (Trade name: Saaf/Safaya/Sixer)
Post flowering	False smut	* Spray Propiconazole 25 EC @ 1 ml/lit at around flowering (Trade name: Tilt/Result/Rezole)

* Trade name does not imply endorsement of the product



False smut



Brown spot



Blast



Sheath blight

Machinery for sowing

Seed-cum-fertilizer drill (or multi-crop planter)

Seed drills, fitted with seed metering device and fertilizer dropping attachment; distribute the seed and fertilizer uniformly.



1. Frame, 2. Furrow openers, 3. Tynes, 4. Fertilizer box, 5. Seed box, 6. Chain and gear drives, 7. Drive wheel, 8. Depth control wheel, 9. Fertilizer delivery pipe, 10. Seed pipe, 11. Fertilizer rate adjusting nut, 12. Seed rate adjusting strip

Major components

Frame

The frame is usually made of iron angle with suitable braces and brackets. It works as a body in the seed-cum-fertilizer drill. Tynes are attached with the frame by clamps/bolts.



Seed box

It may be made of mild steel sheet or galvanized iron with a suitable cover. A small agitator is sometimes provided to prevent clogging of seeds.



Fertilizer box

Made of same material as seed box (fertilizer box in front and seed box in the rear). For 9-tine seed-cum-fertilizer drill, the length would be around 180 cm.



Drive wheel

Drive wheel is attached in the middle of the front bar of the frame. It transmits power to the seed and fertilizer metering gears. Chains are attached to the driving shaft. Lugs on the circumference of the wheel minimize slippage.



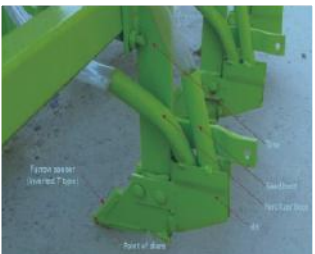
Depth control wheel

There are two side wheels fitted on the main axle. The depth control wheels are essential for placement of seeds and fertilizer at right depth. The depth of seed and fertilizer placement can be increased and decreased with the help of depth adjusting screws by tightening and loosening these, respectively.



Furrow openers

The design of furrow openers of seed-cum-fertilizer drills varies to suit the soil conditions of particular region. Most of the seed-cum-fertilizer drills are provided with pointed tool (inverted T-tynes) to form a narrow slit in the soil for seed deposition and these are most suited.



Seed covering device

It is a device to cover/plug an open furrow after the seed and fertilizer have been placed in it. Covering of seeds is usually done by patta, flappers, chains, drags, packers, rollers or spring-loaded press wheels, designed in various sizes and shapes.



Seed metering mechanism

Inclined plate

Inclined plate with cell type metering mechanism picks and drops individual seed or a hill of seeds depending on design of cell on the plate.



Fluted roller

Fluted rollers are attached to the shaft. When the shaft rotates, the fluted roller also rotates and seed is delivered to the seed delivery pipe through the flow control tongue.



Groove roller

The vertical rollers have grooves which guide the seed and drop it in to the seed pipes.



Inclined plate seed metering mechanism is most suited for DSR and it can be used for sowing of other crops (wheat, pulses, maize, oil seeds). Multi-crop planter are now available with provision of both inclined plate as well as fluted roller in two separate detachable seed boxes besides fertilizer box.

Calibration of seed drill

(A) Workshop calibration

It is done by rotating drive wheel manually to 10 full rotations and collecting seed/fertilizer from each delivery tube separately in attached polythene bags below each tyne.

Steps to be followed

- Measure circumference of the drive wheel
$$= 2 \times 3.14 \times \text{radius of wheel i.e. } 2 \pi r$$
- Measure width of the drill (No. of tynes x distance between tynes).
- Rotate the drive wheel manually to 10 full rotations.
- The quantity of seed and fertilizer collected in each pipe is then measured in grams separately.

Calculation

Calculate the seed and fertilizer rate by the given formula as under

$$\text{Seed rate or fertilizer rate (kg/ha)} = \frac{\text{Wt. of seed/fertilizer in 10 rotations (g)}}{\text{Circumference of drive wheel (m) \times Width of drill (m)}}$$

If the seed or fertilizer rate is not equal to recommended rate then accordingly set the indicator/setting lever at higher or lower rate and again follow the procedure of calibration.

(B) Field calibration

Run the seed drill to a distance of 20 m in the field. Collect the seed and fertilizer from the delivery tubes in attached polythene bags from each pipe.

Steps to be followed

- Run the seed-cum-fertilizer drill to a distance of 20 meters in the field.
- Collect the seed and fertilizer from the delivery pipes in polythene bags from each pipe.
- The quantity of seed and fertilizer collected in bags through each delivery pipe in 20 meters run is then measured in grams.



Set the indicator/lever at desired seed and fertilizer rate



Collect the seed/fertilizer in polythene bags for weighing

Calculation

Calculate the seed and fertilizer rate by the given formula as under

- One acre = 4000 m²
- Distance = 20 m

$$\text{Seed rate or fertilizer rate = } \frac{4000 \times \text{Weight of seed or fertilizer (g)}}{\text{Width of drill (m)} \times \text{Distance (20 m)} \times 1000} \text{ (kg/acre)}$$

If the seed or fertilizer rate is not equal to recommended rate then accordingly set the indicator/ levers at higher or lower rate and again follow the procedure of field calibration.

Make it sure that the weight of seed/fertilizer collected in different pipes is nearly equal to each other.

Machine Maintenance

- The seed-cum-fertilizer drill should be properly serviced and maintained.
- It should be checked before use to ensure that all the nuts and bolts are tightened and that all the parts are in good condition.
- The fertilizer and seed boxes should also be properly cleaned and need to be in a good condition to allow free flow of seed and fertilizer.
- Chains should be adjusted and to be properly oiled.
- After use at the end of each day, the machine should be checked, the seed and fertilizer boxes are to be cleaned, and the moving parts to be oiled.
- After the planting season, the machine should be properly stored.



Machine storage

- For storing the seed drill after completion of sowing season, clean each part of the machine particularly seed and fertilizer box carefully.
- Apply grease/oil to the transmission chain and moving parts.
- Store the machine in a dry and well-ventilated store.
- Keep the appropriate tools with the machine during storage for ensuring availability as and when needed next time.

Trouble shooting

Problem	Cause	Remedy
Seed not placed at desired depth	Adjustment of depth control wheel is not proper	Properly adjust the depth of furrow openers with the help of depth control wheel
Unequal depth of seeding among different rows	Improper three point linkage balancing Improper setting of furrow openers	Put the machine on a fairly level ground and then level all the furrow openers with the help of top link Tightening the top link will deepen the front furrows and uplift the rear furrows and vice versa Balance the drill end to end with the help of right lower link of the tractor
Seed/ fertilizer is not dropping from furrow opener	The seed/fertilizer box is empty or the material has gathered to one side of the boxes	Refill the seed fertilizer box or distribute the material uniformly across boxes during operation

Problem	Cause	Remedy
	The furrow opener or seed/fertilizer delivery tube is blocked by soil/mud or fertilizer/ seed delivery pipes bent	Clean mud out of the opener and/or seed/fertilizer delivery tubes or change the pipes if old/bent
	Seed/fertilizer fluted roller is blocked	Clean the fluted rollers
	The drive wheel does not touch the ground/ or otherwise lugs are worn out	Lower down the hitch to ensure that the drive wheel touches the ground/ replace drive wheel with proper size lugs Ensure that chain is at right position
	Broken chain/sprocket	Change the broken part

Common issues in DSR (Feedback from stakeholders)*

Topics	Issues	Suggestions
Land preparation and laser land leveler	Most of the farmers do not level their field properly and hence seed establishment was not proper at some locations	Need to promote the importance and benefits of leveled land for successful establishment of DSR using seed drill
Seed treatment	Very few farmers use treated seeds	Need to generate more awareness on proper seed treatment
Row to row spacing	Narrow row to row spacing hinders intercultural operations	Spacing can be adjusted to 25-30 cm
Date of sowing	Poor germination due to early seeding (last fortnight of May)	Preferable sowing date should be from 15 May to 25 June
Rice variety	Due to stagnant water in the field at maturity stage of Swarna-Sub 1 and Ranidhan, farmers are facing difficulty in harvesting the crop	In the low lying areas either long duration varieties (CR 1009, CR 1009-Sub 1) should be sown or late sowing of Swarna-Sub 1 should be done

Topics	Issues	Suggestions
Seed drill and its operation	Some operators are not well trained, hence sowing process is not that perfect. Also machines are not available on time	Need more trainings for seed drill operators. Good quality seed drills are required
Weed Management	Improper and untimely application of herbicides	Need more trainings and awareness on weed management
Fertilizer Management	Farmers apply mainly urea. There is misunderstanding that DAP, if applied as basal, will damage the seed or will be lost through volatilization. So DAP is applied very late, around 20-25 days after sowing	Need to promote timely and balanced application, besides emphasizing on importance and benefits of fertilizer management
Insect-pest management	Mealy bug and brown plant hopper are the main insects found in the field	Timely application of insecticide will be beneficial

* Feedback sessions were conducted by CSISA- Hub team after harvest of DSR at four locations, three in Bhadrak (Khirasahi, Adia village & DDA office Bhadrak) & one in Puri (Satyabadi block) during December - January 2016. Around 150 participants attended the sessions & the group comprised of DDAs, DAOs, AAOs, ATMs, BTMs, VAWs, progressive farmers & service providers.

For more information please contact

Department of Agriculture, Odisha

Ph: 06752 - 223007 (Puri), 06784-250906 (Bhadrak)
06792 - 252743 (Mayurbhanj), 06782 - 262127 (Balasore)

CSISA Hub Office ATIC Building, OUAT, Bhubaneswar -751003

Mob: +917684879712 (Puri), +918895281206 (Bhadrak)
+918763458077 (Jasipur), +919438035517 (Betnati)

This image shows a single page from a notebook or a template for taking notes. At the top center, the word "Note" is written in a bold, black, sans-serif font. Below the title, the page is filled with horizontal ruling lines. There are 18 evenly spaced lines in total, providing ample space for writing. The paper has rounded corners at the bottom, while the top corners are sharp. The background of the paper is white, and the lines are a light gray color.

[illegible]



Cereal Systems Initiative for South Asia

Funded by



BILL & MELINDA
GATES foundation



Partners

