DEVELOPMENT AND EVALUATION OF A DRY SEEDING ATTACHMENT TO A RIDING TYPE RICE TRANSPLANTER

By

AISWARYA SANTHOSH (2015-02-003)

AMIT KUMAR (2015-02-005)

AMRUTHA K. (2015-02-006)

SREEHARI M. (2015-02-037)

Department of Farm Machinery and Power Engineering

Kelappaji College of Agricultural Engineering and Technology

Tavanur, Kerala 679573

2019

DEVELOPMENT AND EVALUATION OF A DRY SEEDING ATTACHMENT TO A RIDING TYPE RICE TRANSPLANTER

By

AISWARYA SANTHOSH (2015-02-003)

AMIT KUMAR (2015-02-005)

AMRUTHA K. (2015-02-006)

SREEHARI M. (2015-02-037)

PROJECT REPORT

Submitted in partial fulfillment of the requirement for the degree

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING
of

Kerala Agricultural University

Department of Farm Machinery and Power Engineering

Kelappaji College of Agricultural Engineering and Technology

Tavanur, Kerala 679573

2019

DECLARATION

We hereby declare that this project report entitled **'DEVELOPMENT AND EVALUATION OF A DRY SEEDING ATTACHMENT TO A RIDING TYPE RICE TRANSPLANTER'** is a bonafide record of research work done by us during the course of the academic programme in Kerala Agricultural University and this project has not previously formed the basis for the award of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Tavanur, **AISWARYA SANTHOSH (2015-02-003)**

05/02/2019

AMIT KUMAR (2015-02-005)

AMRUTHA K. (2015-02-006)

SREEHARI M. (2015-02-0037)

CERTIFICATE

Certified that this project report entitled **'DEVELOPMENT AND EVALUATION OF A DRY SEEDING ATTACHMENT TO A RIDING TYPE RICE TRANSPLANTER'** is a record of project work done jointly by Ms. Aiswarya Santhosh, Mr. Amit Kumar, Ms. Amrutha K. and Mr. Sreehari M. under my guidance and supervision and that it has not previously formed the basis for any degree, diploma, fellowship or associate ship or other similar title of any other University or Society.

Tavanur,

05/02/2019

Dr. Shaji James P.

Professor and Head,
Department of Farm Machinery and Power Engineering,
Kelappaji College of Agricultural Engineering and Technology

ACKNOWLEDGEMENT

First of all, we would like to thank **God Almighty** for His grace for giving courage, resources and blessing to complete this endeavor. He is the source of everything without whose grace nothing is possible.

We would like to express our devout gratitude towards **Dr. Shaji James P.** Professor, FMPE KCAET, Tavanur for his proper guidance, instilling motivation and valuable advices which have driven the pace of completion of the work within stipulated time.

We are greatly indebted to **Dr. Sathian K.K., Dean in charge** for his support and encouragement for granting us the necessary permissions and helping us complete the project.

We would like to express our deep sense of gratitude to **Dr. Jayan P.R.**, Professor and **Er. Shivaji K P**, Assistant Professor of the Dept. of FMPE, KCAET, **Dr. Manoj Mathew**, Professor (FPM) Rice Research Station, Moncombu for their immense support and valuable advices during the course of the work.

We thank all the staff under the AICRP on FIM especially **Sri. Kiran K., Sri. Rishil, Sri. SudheerV., Sri. Shajith Lal P.P., Smt. Prabhi,** for their ever-willing help and coordination.

We would like to express our thanks to **Er. Younus A.**, Test Engineer, FMTC KCAET and all the members of the technical staff under the Department of FMPE.

Words are not enough to express the deep sense of gratitude and love for **family members** for all the moral support and encouragement which instilled the motivation and confidence for the completion of project.

Finally, we thank all of those, who directly or indirectly helped us.

Aiswarya Santhosh **Amit Kumar** **Amrutha K.** **Sreehari M.**

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SYMBOLS AND ABBREVIATIONS

Symbols	Abbreviations
et al.	and others
etc.	et cetera
Fig.	Figure
IS	Indian Standard
KAU	Kerala Agricultural University
KCAET	Kelappaji College of Agricultural Engineering and Technology
Sl. No.	Serial Number
viz	Namely

INTRODUCTION

CHAPTER 1

INTRODUCTION

Rice is the most important food crop in India that occupies 44 million ha of agricultural land which is largest rice area in the world. The annual production of rice in India is about 89.09 million tonnes with a productivity of 2125 kg/ha. Rice is the major food crop in Kerala as well. It was cultivated in 0.35million ha with a production of 0.77 million tonnes in 1999-2000. During 2009-2010 rice was grown in a gross area of 0.23 million ha producing 0.6 million tonnes with a productivity of 2.557 tonnes/ha. In 2015-2016 productivity of rice in India became 2790 kg/ha from the gross cultivated area of 0.196 million ha.

Rice is grown in three season in India, autumn and winter (Kharif season) from June to October and summer (Rabi season) from December to May. The Kharif season accounts for 88% and Rabi season accounts for 12% of total production in India. In India the rice crop is highly dependent on the southwest monsoon, which occurs over the subcontinent from June through September. Green revolution in India (1967-1978) brought substantial increase in production of cereals, particularly wheat and rice. Among the cereals, rice and wheat continue to dominate among various crops. Rice is grown in very vast regions in the country due to its adaptability to wider range of agro-climatic conditions.

The three main rice growing seasons in Kerala are Virippu, Mundakan and Puncha. Virippu (autumn) is the first crop season which starts in April-May and extends up to September-October. Mundakan season (winter) is the second crop season which starts in December-January and extends upto March. Of the three seasons Mundakan season is the predominant rice growing season in Kerala.

There are three principal methods of rice establishment; dry seeding, wet seeding and transplanting. Transplanting is the dominant method of crop establishment in Southeast Asian countries (Pandey and Velasco, 2002).Direct seeded rice also plays a great role in satisfying the rice grain requirement of the people of the world. Under direct seeding, the rice seeds are directly sown to the well prepared main field. Direct seeded rice is either dry seeded or wet seeded. Broadcasting or drilling of seeds to a well pulverized field with sufficient moisture for germination of the seeds is done. For wet seeded rice cultivation, pregerminated seeds are used.

The seeds are soaked in water and kept in dark for sprouting before sowing in well puddled and leveled fields either by broadcasting or using pre-germinated paddy seeders (drum seeders).

1.1 Dry Seeded Rice

Dry rice cultivation is followed in uplands or in the fields where there is less possibility for water stagnation. Upland rice can be grown on both leveled and sloping fields with or without field bunds. The rice crop solely depends upon rainfall for its water requirement. In tropical humid climate like Kerala, the seeds are sown in a dry field and thereafter maintained as wet once the rains are received. This system of cultivation is followed in many parts of the country, however, mainly confined to tracts that don't have adequate irrigation facilities.

1.2 Wet Seeded Rice

In wet seeded system of cultivation, the rice crop is grown under wet (season) condition right from sowing to harvest. In this system, the field is puddled with 5-7 cm standing water to create a least pervious layer of soil. Rice fields with sandy to sandy loamy soils are ploughed in summer and again ploughed once or twice after letting in water to get the requisite puddled condition. Heavy soils of clay nature are not generally opened in summer. Germinated seeds are then sown in the puddled field. The field is well drained to enable seedling establishment. Once the seedlings reach sufficient height water is impounded to a proper height to prevent the growth of weeds.

1.3 Transplanted system

In transplanting system, the rice seedlings are raised in a nursery and then transplanted to the main field at appropriate age (2 to 30 days). Manual transplanting is currently being replaced by machines.

Table 1.1 Area, Production, Productivity of Rice in Kerala and India

Year	Area (lakh ha)		Production (lakh tonnes)		Productivity (Kg/ha)	
	Kerala	India	Kerala	India	Kerala	India
2005-06	2.76	442.58	6.30	917.90	2285	2074
2006-07	2.64	438.10	6.42	933.60	2435	2131
2007-08	2.29	439.00	5.28	967.00	2308	2203
2008-09	2.34	456.00	5.90	994.00	2520	2177
2009-10	2.34	419.20	5.98	890.90	2557	2125
2010-11	2.13	425.60	5.22	959.80	2452	2255
2011-12	2.08	439.70	5.69	1027.50	2733	2337
2012-13	1.97	424.90	5.08	1043.99	2577	2462
2013-14	1.99	439.00	5.64	1065.00	2827	2424
2014-15	1.98	438.60	5.62	1048.00	2837	2390

Source: www.ecostat.kerala.gov.in

1.4 Justification of the Study

The single wheel riding type 8 row rice transplanters are commonly used in south India for transplanting paddy in the Rabi season. Where ever the geophysical condition is ideal for wet seeding, farmers adopt this system due to the low cost involved. The transplanting machine can be used only when sufficient moisture for puddling is received after the onset of monsoon. Hence farmers often adopt dry seeding during the first crop season (Kharif) and most farmers are currently adopting manual broadcasting. Most farmers in Kerala do not own tractors or seed drills and they usually hire tractors for ploughing operations. Tractor operated seed drills for rice are also not available on hire. But many transplanting machines are kept idle during this season and hence utilization of the prime mover of these transplanters for dry seeding operations can be a boon to the farmer.

1.5 Objectives of the Study

i. To study the machine parameters of the drum-type paddy seeder so as to use the system for dry seeding of rice.

ii. To develop a rice dry seeding attachment to the power unit of the 8 row riding type single wheel rice transplanter.

iii. To evaluate the performance of the developed prototype.

REVIEW OF LITERATURE

CHAPTER 2

REVIEW OF LITERATURE

Rice is the most important food crop in the world and is the staple food for more than half of the world population. The annual food grain production of India need to be enhanced to 333 million tonnes by 2050. For achieving this, the average rice productivity has to be increased to 3.3 tonnes per ha (CRRI, 2013).

2.1 Systems of rice cultivation

Rice can be cultivated under different climatic and soil conditions and it can be grown as transplanted or direct sown crop during the three seasons in Kerala (KAU, 2016). The principal rice ecosystems followed in India according to TNAU (2019) are classified as wet and dry systems.

2.1.1. Wet system

In this system, the crop is grown under wet (irrigated) conditions. The field is brought to a soft puddle by repeated ploughings with 5-7 cm standing water. After obtaining a soft puddle and perfect levelling, rice seedlings are transplanted or sprouted seeds dibbled or broadcasted on the puddle field. This system of cultivation is followed wherever assured irrigation water is available. This irrigated rice contributes to 55 per cent of the total rice production.

2.1.2 Dry system

In this system the fields are ploughed and harrowed in summer for achieving the required tilth. The seed is sown directly with the onset of the monsoon showers, either by broadcasting, dibbling behind the country plough or by drilling in lines. Line-sowing is preferable, as it ensures an adequate stand establishment and facilitates easy weeding and inter-culture.

2.2 Seeding and planting machinery for rice

James et al (1998) described three different systems of rice cultivation with respect to mechanized rice cultivation. They are (i) dry seeded, (ii) wet seeded and (iii) transplanted systems.

Different types of direct paddy seeders have been developed and evaluated in India and abroad under different field conditions. The performance of paddy seeder is affected by many factors like machine weight, soil and field condition, speed of operation, power source. The crop yield is affected by number of plants per hill, row spacing, and variety of crop. Research studies relating to machine have been reviewed and presented in this chapter under the following headings.

2.2.1Equipment for wet seeding of rice

Singh and Garg *et al.,* (1979) mentioned that wet seeding method is adopted in an area where agricultural laborers are not easily available for transplanting or, sometimes laborers

Fig.2.1 Traditional method of broadcasting

are very expensive. In this method field is prepared and puddled same as in the case of transplanting. In the puddled field sprouted seeds with a length of 1 to 2 mm are broadcast by

hand. The main drawback of this method is that the seeds distributed are highly irregular and hence often results in high wastage of seeds.

2.2.2 Pre-germinated paddy seeders

Three rice seeders namely; manually drawn 8-row drum seeder, bullock drawn 8-row drum seeder and self-propelled 8-row drum seeder in the chronological order represent the development of various pre-germinated paddy seeders.

2.2.3 The manually drawn 8-row drum seeder

Baruah *et al.,* (2001) mentioned that the manually drawn 8-row drum seeder is one of the revolutionary equipment that changed the face of sowing paddy seeds in wetland fields. Direct paddy drum seeder has eliminated the need of transplantation and hours of manual work which literally broke the back of the farmers involved in sowing the paddy seeds to the field. At one stretch with single operator effort, it covers 8 rows of 20 cm row to row spacing at a time. The seed drums are made up of plastic material, which makes it easy to carry from one place to another.

2.2.3.1 Parts of the manual drum seeder

The seed drum is hyperboloid shaped with 200 mm diameter. There are 8 number of direct seeding holes of 9 mm hole diameter. Baffles are provided inside the seed drum between the seed holes to ensure the uniform seed rate in operation as well as to ensure hill dropping of the seeds. Each seed drum has two rows of planting, and four drums are assembled to form eight rows of planting at single stretch. Wheels are provided at both ends. These wheels are made up of plastic material to provide floating characteristics. Wheel diameter is 62.5 cm. One square shaft, a handle base and handle is provided. Four seed drums are assembled together with the square shaft. The handle is meant to pull along.

Fig.2.2.Manually operated drum seeder

2.2.4 Power operated drum seeder

Sivakumar *et al.,* (2005) mentioned about the 8-row pre-germinated paddy seeder operated by 2.4 kW diesel engine. The drum seeder commercially available in the market (TNAU model) was used to mount in the developed machine. The float was fabricated by using 1.5 mm and 0.9 mm MS sheet. The engine mounting frame was made from 50 x 50 x 5 mm MS angle welded together to make hollow box and a base plate for the engine. The gear assembly of Yanji rice transplanter was used with its cage wheel to run the machine. The float was so designed that it gives alternate raised surface and furrow during its operation in puddled field.

The drums of the seeder were so arranged that the seeds drop only over the raised surfaces (ridges) formed by the float and stagnant water if any flow into the furrows. The base plates made up of 0.9 mm MS sheet for making ridges are welded beneath the float. The machine is provided with a pneumatic wheel in front and two smaller wheels in rear side for transporting the machine on the road. During seeding operation in the field, pneumatic wheel is removed and the cage wheel is attached in the front, which gets drive

Fig.2.3 TNAU 8 row power drum seeder

from the engine through a V-belt drive and suitable gear arrangement and pulls the machine in forward direction. There is a provision of seats for the operator in the machine and a steering handle to steer the machine. The fabrication, operation and adjustment of the machine are made simple so that a farmer can operate and maintain the machine.

The drum seeder (TNAU model) has seed drums of hyperboloid shaped with 200 mm diameter. There are 8 number of direct seeding holes of 9 mm hole diameter. Each seed drum has two rows of perforations and four drums are assembled to form eight rows of planting at single stretch. Wheels are provided at both ends. These wheels with 62.5 cm diameter are made up of PVC. PVC pipes of 20mm diameter with 15 cm length were used for the seed extension tubes. To eradicate the problem of scattering the seeds while operating the drum seeders in field these seed extension tubes are provided. These tubes were mounted on the periphery of the drums over each of the perforations by using thermo-cool and synthetic adhesive.

Fig.2.4 TNAU drum seeder mounted to the rear end of machine

The drum seeder is powered by a Z170F air cooled diesel engine of 2.4 kw@2600 rpm. The V- belt drive transfers power to the traction wheel while operating in wetland field and pneumatic wheel while travelling on road. The gear drive for movement of the traction wheel is provided with available gear reduction ratio as in Yanji transplanter.

A six row pre-germinated rice seeder was developed at CRRI Cuttack (Anon. 1995).The performance of the seeder was reported to be satisfactory on the farmers' fields. The crop yield levels of 3.5 tonnes/ha was reported and design was released for local production. The work on development of seeding machines, seeders and sowing devices has been going on in India since 1965 at ICAR institutes, state agricultural universities and other organizations.

Srivastava *et al*., (1984) stated that this resulted in the development of large number of designs of seed drills and planters. At CRRI, the first seed drill for rice was developed and reported by Pradhan *et al.*, (1968). The development of drum seeder for rice at Orissa took place around the same time. Biswas (1981) reviewed the work done on seeders and pre-germinated seeder and reported the development of number of machines in India and at IRRI, Philippines. The CRRI(during 1988 to 1991) released the designs for commercial production in Orissa of manually-pulled 2-row, 3-row seeder and 5-9 row animal drawn seeder and a 9-row tractor mounted seeder for dry sowing of seeds under upland soil conditions.

Singh *et al*., (2007) stated that an eight row-drum seeder was developed at CIAE Bhopal, India. The amount of pre-germinated seed required to fill the drum seeder was about 2.5 kg and of approximately 4.6 cm length. The drum seeder is 80 cm wide as per the ergonomic parameters suitable to the worker. Sinkage of the filled drum seeder in puddled fields reported is 4.6 cm. The seed rate reported for the seeder is 51.6 kg/ha. Deep placement of seeds often resulted in poor germination, which lead to the development of refined tractor operated dry seeder at KVK Palakkad during 2012. The cost of the implement could be reduced substantially as the 9-tyne cultivator was replaced with a simpler furrow opener from assembly on which the seed box with cup feed type metering mechanism was mounted. The refined model was tested and was found to have better performance with no clogging of boot. The depth of the seed placement could be successfully controlled to the required range of 3-6 cm.

2.3 Performance Evaluation of the Paddy Seeder

Krishnaiah *et al*., (1999) mentioned that under the Directorate of Rice Research, Hyderabad (ICAR) and Crop and Resource Management Network (CREMNET Project of IRRI), the evaluation of an 8-row drum seeder was taken up at all India level during 1996-97. The drum seeder developed at Hyderabad was provided with wheels on both sides. It was able to sow seeds at the rate of 50-75 kg/ha. The sprouted seeds were prepared by soaking the seeds for 24 hours in water followed by incubation of 24 hours before sowing with seeder.

The direct paddy seeder was evaluated in sowing ADT 36 paddy along with mechanical broadcaster and manual broadcasting (Jesudass *et al*., 1996). The seed rate recorded using direct paddy seeder was 89.69 kg/ha compared to 135.75 kg/ha, 100 kg/ha respectively for mechanical broadcasting and manual broadcasting. The coverage of the direct paddy seeder was 1.32 ha/day, while that of mechanical broadcaster was1.6 ha/day. The draft of the unit with the operator sitting on the seeder was 66.3 kg. When the operator stood behind and guided the seeder, the draft was 40.5 kg. The slippage of the ground wheel was 15.3%. The average plant stand in a meter length was 49.75, 37.43, and 33.4 for seeder, mechanical broadcaster and manual sowing, respectively.

2.4 Influence of Agronomic Parameters and Machine Parameters on Yield and Performance of Paddy Seeder

Dixit *et* al., (2010) found that the experiments conducted at Bodhan (Cheki Camp) showed that higher tillers and panicles were observed for the crop establishment by the broadcast method. However, the grain yield of rice variety (Erramalelu) was higher under the drum seeder method of cultivation. More panicle size and more sterility percent might have resulted in lower yields in the broadcast method. There was a considerable reduction in the cost of cultivation in the drum seeding method. It is clear from this that drum seeder is found to be as efficient as transplanting.

Singh and Hansel (2012) reported that demonstration and extension of drum seeder as a drudgery reducing tool or technology in local farming communities is advantageous. According to them, use of drum seeder helped in timely sowing of crop resulting in more yield. Also the drum seeder reduced labour requirement and cost of sowing. Line sowing by drum seeder reduces weeding cost due to use of mechanical weeders. The crop matured one week early in drum seeded plots. The net profit obtained by use of drum seeder was more than transplanting. Better economy and future can be predicted through the replacement of conventional method of transplanting paddy into the seeding of paddy by using drum seeder. Natural resource conservation is there because irrigation is completely deleted in the utilization of natural resources for growing seedlings required in the conventional method.

2.5 Cost Economics of the Drum-Seeder

Chavan and Palkar (2010) found that the rice farmers practicing transplanting are facing problems like shortage of labour during peak time and hike in labour charges. Hence direct seeding is becoming increasingly popular now days in India due to its labour saving capacity.

Chaudhary *et al*., (2005) found that the wet seeding of rice is generally followed in irrigated areas. For wet drum seeding the paddy seeds are soaked in water for 24 hours and incubated for 24-48hours. These sprouted seeds are sown in puddled field 1-2 days after puddling using perforated drum seeder. Eight-row paddy seeder is manually operated low cost equipment. Drum seeder can be used in Konkan region for seeding in both Kharif and Rabi season for proper irrigation practices. Drum seeder tested was manually operated.

The laboratory calibration was carried out with different combinations of drum fills viz., 90, 75, 50 percent, and travel speed viz., 1 km/h, 1.2 km/h and 1.5 km/h. From the laboratory calibration test the combination of 75% drum fill and 1.5 km/h speed were selected for field evaluation of drum seeder. The theoretical field capacity was calculated as 0.2 ha/h, while effective field capacity of the drum seeder was observed to be 0.11 ha/h. The field efficiency of the seeder was found to be 55 per cent. The cost of operation of drum seeder is Rs.32.73/- per hour and Rs.297/- per hectare.

The Moncombu Rice Research Station under Kerala Agricultural University has developed a self propelled pre-germinated paddy seeder by attaching the ordinary drum seeder assembly to a Yanji-Sakthi rice transplanter. This machine was evaluated by the AICRP on farm Implements and Machinery at KCAET, Tavanur (Anon., 2017). It was found that the attachment is suitable for popularization where farmers prefer wet seeding.

2.6 Ergonomics Aspects

Three types of paddy seeders namely two row, three row and four row paddy seeders to reduce the drudgery of women and three types of material namely plastic, galvanized iron (GI) and fiber reinforced plastic (FRP) for reducing the weight of the unit were selected for ergonomical evaluation by Sirisha and Manian (2008). Ten female subjects were selected for the investigation based on the age. The age of the selected subjects varied from 28 ± 2.49 to35 ± 2.49 years as the maximum percentage of work could be expected from 25-35 years. The selected ten subjects were calibrated in the laboratory by indirect assessment of oxygen uptake. The maximum aerobic capacity of the selected ten subjects varied from 1.214 to 1.386 L min-1. A swinging type handle was developed for pulling the seeder to avoid the awkward posture of 19 farm women.

The mean values of heart rate of the ten subjects for four row, three row and two row paddy seeders with plastic, GI and FRP materials varied between 124.43 and 152.50 beats min-1 and the corresponding oxygen consumption values varied between 0.535 and 0.698 Lmin-1. The overall discomfort rate for the four row, three row and two row paddy seeders with plastic, GI and FRP varied from 6.37 to 8.10. The force required for the four row, three row and two row

paddy seeders with plastic, GI and FRP varied in between 91.50 and 195.98 N. The field capacity for the four row, three row, two row paddy seeders with plastic, GI, FRP materials varied from 0.025 to 0.0625 ha/h. Based on the ergonomical evaluation and field capacity, the four row paddy seeders of three materials are chosen for performance evaluation and the four row paddy seeder with plastic material was adjudged as the best seeder for rural women folk.

MATERIALS AND METHODS

CHAPTER 3

MATERIALS AND METHODS

This chapter deals with the development and constructional details of the dry seeding attachment to a riding type rice transplanter. The methodology adopted for field evaluations at different stages of the development process are also described.

3.1 Agro-climatic features of the study area relevant for rice cultivation

The agro-climatic features relevant for rainfed rice cultivation are as below:

3.1.1Experimental site

The field test of the paddy seeder with dry seeding attachment was conducted in a field in Alathur, Palakkad district. It's predominantly rural and has agricultural economy. It's located at coordinates 10°38'53"N 76°32'18"E.

3.1.2 Climatic condition in study area

Alathur has a tropical wet and dry climate. Temperature remains moderate throughout the year with exception in March and April being the hottest months. A very high amount of precipitation is received in Palakkad district, mainly during the South-West monsoon. Dry seeding of rice is generally done during the month of May two to three weeks before the onset of monsoon. The plants are expected to reach sufficient height once water stagnates in the field during the monsoon.

3.2 Preliminary studies for development of dry seeder attachment to rice transplanter

The procedure followed for modification of the Yanji-Sakthi rice transplanter by detaching the transplanting unit and attaching the dry seeder assembly is described below.

3.2.1 Basic configuration of a Yanji-Sakthi rice transplanter

Chinese design Yanji-Sakthi 8 row rice transplanter marketed by V S T Tillers Pvt. Ltd selected for attaching the dry seeder attachment is show in Fig. 3.1. It had eight rows with 23.8 cm row to row spacing and two position to change hill to hill spacing of 14 and 17 cm. The machine was provided with a three speed gear box for transplanting, planting and reverse speed. It had a crank type planting mechanism. The machine is provided with a pneumatic wheel in front and two smaller rigid rubber treaded steel wheels on the rear for transporting the machine.

Fig.3.1 Basic model of a Yanji-Sakthi rice transplanter

During transplanting operation in the field, all these three wheels are removed and a steel wheel is attached at the front, which gets drive from the engine through a V-belt drive and suitable gear arrangement that pulls the machine in forward direction. There is a provision of seats for the operator in the machine and a steering handle to steer the

machine. The operation and adjustment of the machine are simple so that a farmer can operate the machine.

The machine has a provision to control the depth of planting. All the operating and control levers of different units are provided on front side of the seedling platform.The technical specifications of the transplanter are given in Table. 3.1.

Table 3.1 Technical specifications of Yanji-Sakthi rice transplanter

Sl.No	Particulars	Specifications
1	Trade name model	Yanji-Sakthi rice transplanter
2	Dimension(L x W x H)	2500 × 2131 × 1300
3	Engine Power, hp	4
4	Fuel system	Diesel
5	Cooling system	Air cooled
6	Weight, kg	305
7	Drive	Single wheel driven
8	Type of float	Fibre
9	Transplanting mechanism	Crank type planting mechanism
10	Number of rows	8
11	Row Spacing, cm	23.8
12	Hill to hill spacing, cm	14 and 17 cm
13	Depth of transplanting, cm	2.5 to 12.5
15	Traction wheel a. Diameter b. Number of lugs	 600 27
16	Planting speed, m/s	0.44 to 0.55

3.2.2 Features of the Yanji-Sakthi transplanter modified by RRS Moncombu for wet seeding of rice

It is an 8-row pre-germinated paddy seeder operated by single cylinder 4-stroke air cooled 2.4kw diesel engine of the Yanji transplanter. The drum seeder commercially available in the market was mounted on the machine. The drum seeder was attached at the rear end of the machine on a stand that extends from the frame of the transplanter. The engine power take off shaft is connected to a gear box which supplies power to the main axle on which the drums are mounted. The drums rotate from the power received from the engine.

The drum seeder has four fibre seed drums of hyperboloid shaped with 200 mm diameter. There are 8 number of direct seeding holes of 9 mm diameter. Each seed drum has two rows of perforations and four drums are assembled to form eight rows of planting at single stretch. The attachment is used for popularization in areas where wet seeding is preferred.

3.2.3 Preliminary assessment of existing wet seeding attachment to rice transplanter

The self-propelled pre-germinated rice seeder developed by Rice Research Station, Moncombu was observed for noting its specifications.

Table 3.2 Specification of the existing self-propelled wet seeding machine

Make and model	Yanji-Sakthi rice transplanter modified as KAU self-propelled pre-germinated rice seeder.
Prime mover	Single cylinder 4-stroke air cooled diesel engine
Seeding unit	Four numbers fibre drum mounted on a square shaft
Width of operation	25x8=200cm
Drive wheel	Single steel wheel with lugs
Field speed	2km/hr

The salient performance parameters observed by AICRP on FIM (2018) were as below:

Table 3.3 Performance parameters of wet seeding attachment to Yanji-Sakthi rice transplanter

Parameters	Observed values
Fuel consumption	0.710 l/hr
Theoretical field capacity	0.400 ha/h
Actual field capacity	0.242 ha/h
Field efficiency	60.5 %
Seed rate	46 kg/ha
Labour requirement	2

Source: Annual report 2018, All India coordinated project on Farm Implements and machinery, KCAET, Tavanur

Fig.3.2 Yanji-Sakthi rice transplanter with wet seeding attachment

3.3 Development of dry seeding attachment to rice transplanter

The power operated Yanji-Sakthi rice transplanter required the following components to be integrated to perform dry seeding:

i. Frame
ii. Seed drums mounted on an axle
iii. Gear box
iv. Seed delivering mechanism
v. Furrow opener
vi. Seed covering mechanism

3.3.1 Configuration of dry seeding attachment

The seed drums available in the market as well as the gear box used for the self propelled pre-germinated seeder developed by the agricultural Engineering unit at Rice Research Station, Moncombu was adopted. A conceptual design was developed for fabrication of the dry seeding attachment.

Seed tubes were required to further convey the seeds. The time of fall of a seed through a tube is affected by the size and type of tube and bouncing of seeds against the walls of the tube. Hence the seed tube should be either vertical or it's inclination from vertical should be smaller than 25°.

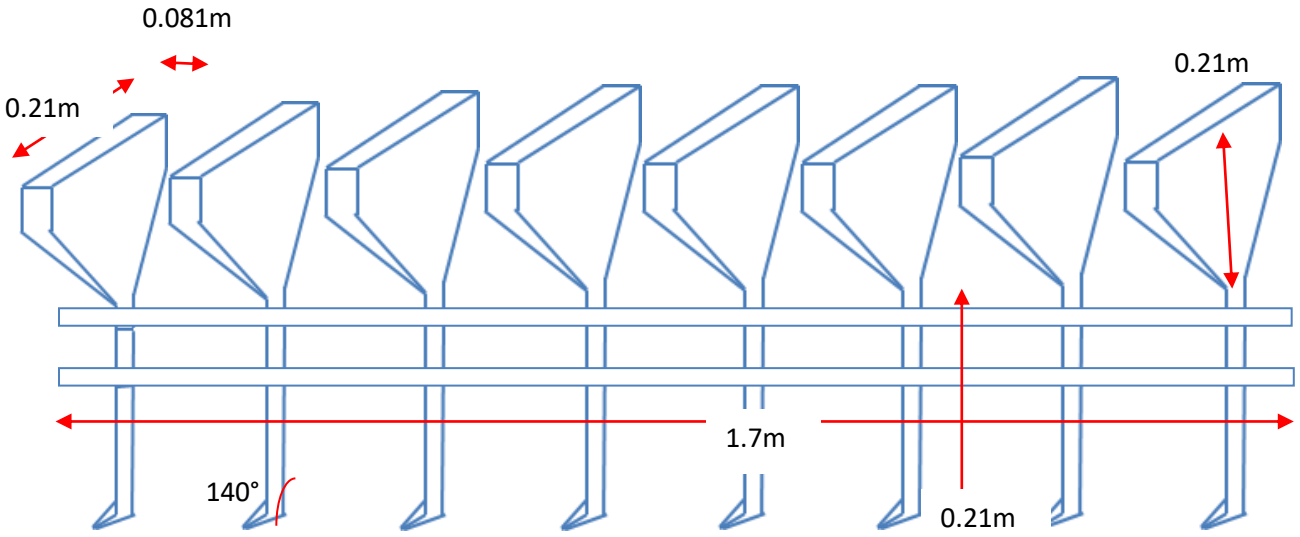


Fig.3.3 configuration of dry seeding attachment

3.3.2 Fabrication of components and assembly of dry seeding attachment

Based on the conceptual design the dry seeding attachment was fabricated.

3.4 Preliminary testing of the prototype

The fabricated prototype was tested in the laboratory and field for its suitability for dry seeding operation.

3.4.1 Test operation of the prototype

For the machine to operate in the field, instead of the pneumatic wheel, the steel wheel with lugs is fixed in the front which gets drive from the engine. The power from the engine is also transmitted to the shaft on which the seed drums are mounted through the gear box. The seeds are dropped from the holes in the drum which in turn are collected by the funnel shaped seed collector and conveyed through the seed conveyingsystem into the furrows. As the furrow opener moves forward, the leveler chain that drags behind the set of furrow openers covers the furrow with soil.

3.4.2 Laboratory tests

The prototype machine was assessed in the laboratory for its seed rate by calibration tests.

3.4.2.1 Calibration of the seed metering system in static position

Drums were filled upto 3/4thvolume with dry paddy seeds and all the holes of the drums were kept open. Engine was started with the machine kept in static position. Seeds falling for 10 revolution of the drum were obtained. Almost 100gm of seeds fell through each opening indicating a very high seed rate.

3.4.2.2 Calibration during running

Alternate holes in the seed drum were closed with plugs to avoid excess seed rate. Drums were filled 3/4th with seeds and poly bags tied to the furrow openers so as to collect the falling seeds. Seeder was allowed to operate for a distance of 10m and the observations were recorded.

3.4.3 Field evaluation of the prototype

The prototype dry seeding attachment was tested in field conditions. A test field in Alathur was selected for testing the machine during Virippu season of 2018 (19/5/18).

3.4.3.1 Field conditions and agronomic requirement

The specific problem with the field was that, it was left fallow for a long time, due to which many species of weeds had come up. Major one among these weeds was weedy (wild) rice. The weedy rice could not be completely destroyed in the land preparation as the seeds will lie dormant under the soil and emerge when tilled again. Even though herbicides were applied after land preparation, the seeds were unaffected. Because they belong to the same genus as that of rice post emergent herbicides cannot be used to destroy them as they would destroy good rice plants as well. As the wild rice variety competes with the sown paddy variety as it has better nutrient absorbing capacity and resistance. The farmer requirement was sowing of seeds with minimum of soil manipulation preferably not to a depth more than 3-4 cm.

The developed prototype was expected to meet this requirement as it had a very low working depth of 3-5 cm. It was likely that it could work in the field without disturbing the seeds of wild rice embedded in the soil.

3.4.4 Experimental procedure

The seeder drums were filled with seeds up to 3/4th of its volume. Seed variety used was 'Jyothi'. The machine was thoroughly checked for fuel, bearings etc and then it was operated in the field. Two plots were selected for the operation. Field observations and different machine parameters were recorded during the performance evaluation.

3.4.4.1 Theoretical field capacity

It is the rate of field coverage that would be obtained if the machine were performing its function 100 per cent of the time at rated forward speed and always covered 100 per cent of its rated width. It was determined by the following relation.

Theoretical field capacity (TFC), ha/h $=\frac{WS}{10}$

Where, S = speed of machine, km/h

W = rated width of the machine, m

3.4.4.2 Effective field capacity

It is the actual rate of coverage of the field by the machine. It was calculated by the following formula.

Effective field capacity (EFC), ha/h = $A/_{T+t}$

Where, A = area covered in ha

T = productive time, hr

T = Non-productive time, hr

3.4.3.3 Field efficiency

This gives an indication of the time lost in the field and failure to utilize the full working width of the machine.

It was calculated by the following formula.

Field efficiency, % = $\frac{AFC}{TFC} \times 100$

Field efficiency varies according to the shape and size of the field, the type and size of machine, the skill of the operator and other similar factor.

3.5 Refinement of the prototype

The developed prototype was further refined based on the field tests.

3.5.1 Configuration of the refined dry seeding attachment

The float of the Yanji-Sakthi rice transplanter was found to be unnecessary for dry seeding operation and was contributing to the overall weight of the machine. Hence replacing the float with a frame was considered advantageous for reducing the draft and improving ease of operation. A basic configuration for the frame was adopted which had square pipes as the members. The configuration is given in Fig. 3.4

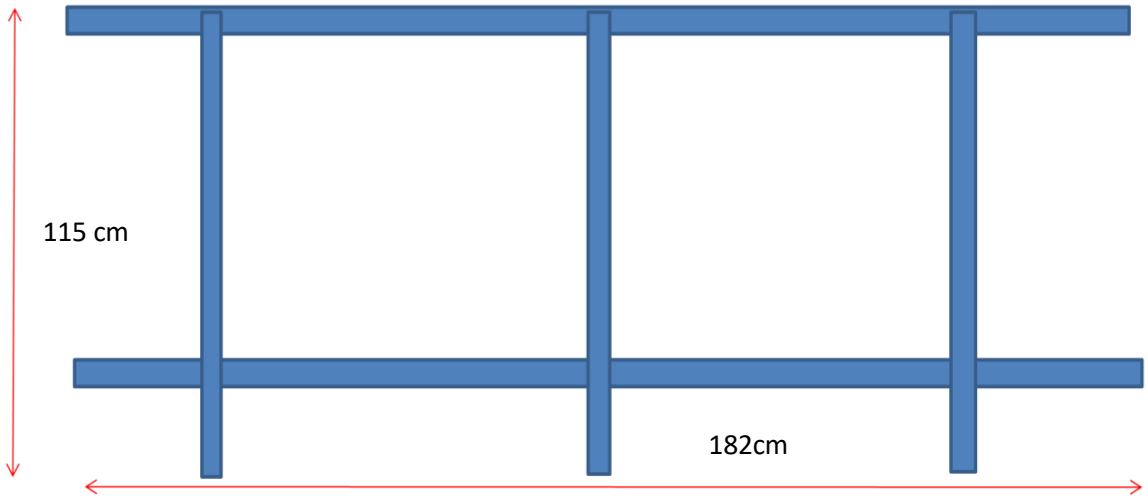


Fig 3.4 Configuration of the frame of the refined prototype

3.5.2 Field operation with refined prototype

The refined prototype developed by replacing the float of the rice transplanter was soperated in the field to assess its performance.

RESULTS AND DISCUSSION

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Seed viability test

Paddy seeds of variety '*Jyoti*' was selected for conducting the experiment. Hundred seeds were counted and soaked in water for 24 hrs and then were taken out and kept for germination. After 5 days it was observed that 97 seeds had germinated. Thus the seeds were found to have good germination capacity of 97%.

4.2 Fabrication of the dry seeding attachment

The dry seeding attachment was fabricated and attached to the Yanji-Sakthi rice transplanter by replacing the transplanting unit.

4.2.1 Support Frame

Two square MS pipes of 2.5×2.5cm cross-section and 1.7m length was attached on the free board beneath the drums. These pipes attached by nut and bolt supported the seed delivery mechanism. At the two ends of the frame clamps were attached to attach the cover chain.

4.2.2 Seed collector and conveying mechanism

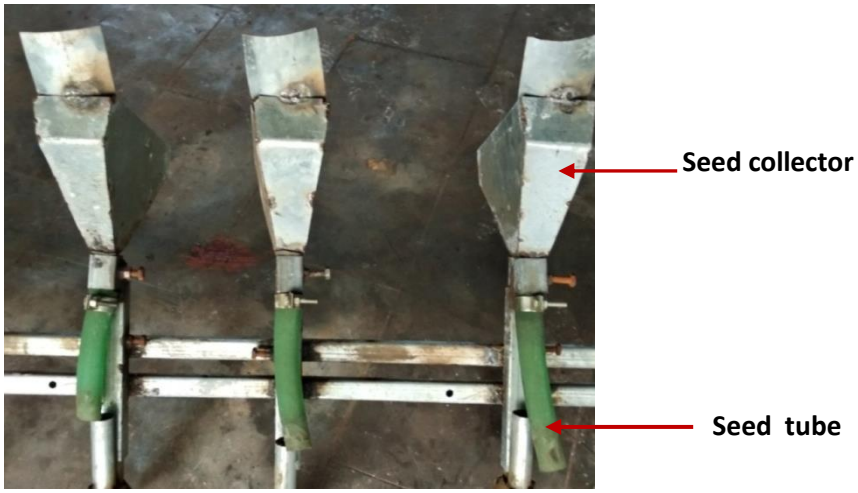


Fig. 4.1 Fabricated seed collector and conveying system

The configuration selected consisted of a funnel shaped seed receiver placed beneath the opening of the seed drums which were connected to a flexible PVC pipe. The funnel shaped seed collector was made up of 2 mm thick MS sheet. The seed collector was trapezoidal in cross-section with a top length of 21cm, top width 8.1cm and depth 21cm. It was held in such a way that the seed collector receiver covered the whole section beneath the seed drum. Thus the seeds were directly collected by the seed collector as they are dropped through the holes when the drums are rotated. Two seed collectors were fitted for each drum and thus for a set of four seed drums, there are eight number of seed collectors fixed.

A flexible plastic tube of 3cm diameter was attached through a collar to the bottom of the seed collector. The other ends of the flexible plastic tubes were fixed to PVC pipes of 10cm length that could slide in through the boot made of MS pipe which was fixed to the standard. The seeds collected by the seed collectorconveyed through the flexible plastic tubepassed through the boot to be dropped into the furrows.

4.2.3 Adjustable Standards

The adjustable standardsfor furrow openers were made up of MS square pipes of 21cm length. Eight such standards were attached to the frame with a spacing of 20cm. The furrow openers with a cutting angle 50° were adjustable to operate at a depth of 3-5 cm. The furrow openers were fabricated with MS flats of 6.7cm length. An MS pipe of 2.5cm diameter and 9cm length was welded to the standards so that the flexible seed tubes could be attached to it, to facilitate proper dropping of seeds. The furrow openers had curved

Fig. 4.2 Adjustable Standards

wings extending backwards covering the bottom end of the seed boot, so that the soil do not fall back into the furrow before the seeds reach the furrow bottom. The wings also prevent clogging of the boots.

4.2.4 Cover chain

A chain of 2-2.5m length was fixed to the clamps provided at the two ends of frame. The chain could drags behind to cover the furrows after the seeds are placed in it.

Fig. 4.3Cover chain

4.2.5 Assembly of Components

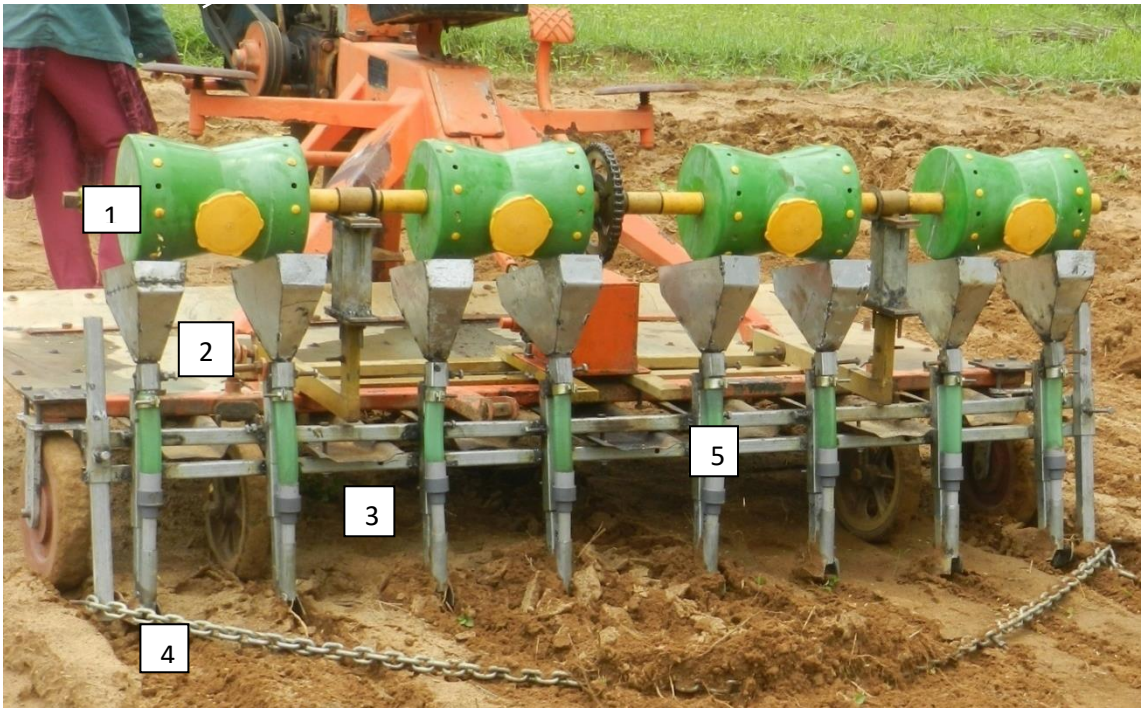
These adjustable standards with seed tubes were provided with telescopic depth control mechanism such that the depth of seed placement can be controlled. This was done by placing the square hollow standards inside another square pipe of greater cross-section with nut and bolt arrangement. Each of these adjustable standards with bootwas attached to frame. The overall

Fig. 4.4 Assembled dry seeding system

view of the assembled unit is shown in Fig. 4.4

4.2.6 Assembly of dry seeding attachmentto the rice transplanter

The dry seeding attachment was fitted to the rice transplanter as shown in Fig.4.5



①Seed drum **②Seed collector** **③Seed metering mechanism**

④Cover chain **⑤Frame**

Fig. 4.5 Dry seeding attachment fitted to the rice transplanter

4.3 Preliminary field trial

A preliminary field trial was conducted with all the holes of the seed drums open. The objective was to assess the dropping of seeds as well as seedling emergence. As all the holes of the drums were open the quantity of seeds dropped was much higher than the required rate. In the present study ordinary seeds were used for the trial as the machine was expected to be used for dry seeding. As the holes of the drum were designed to drop germinated seeds the quantity of ordinary seeds dropped were more as there was no resistance due to the emerged radicles. It was observed that the population was very high as shown in Fig 4.6.

Fig. 4.6 Plant population in the field during the first trial

4.4 Calibration of the dry seeder in the field

The calibration of the seeder when done with alternate holes plugged gave the following results:

Distance moved (m)	= 10
Number of revolution of seed drum for 10m	=6
Hill to hill distance	=17 cm
For a plot of 10×1.6m^2weight of seeds dropped	= 91g.
For a plot of 1ha weight of seeds dropped	=56.8 kg.
Seed rate	=56.8 kg/ha.

Thus, it was observed that the seed rate is compatible with the recommendation for dry seeding as per the Package of Practices Recommendations of KAU.

The distribution of seeds through the seed tubes are shown in Table 4.1. It was observed that there was considerable variation in the weight of seeds dropped as depicted in Fig. 4.7. The coefficient of variation of weights of seeds was 22.16% indicating that the uniformity was not

very good. The variation in the number of seeds dropped were also high and the coefficient of variation was 24.83%.

Table 4.1 Weight and number of seeds dropped through each furrow opening

Sl. No	Weight of seeds from each tube, g	No. of seeds
1	14	350
2	15	375
3	08	200
4	08	200
5	11	275
6	09	225
7	14	350
8	12	300
Total	91	2275

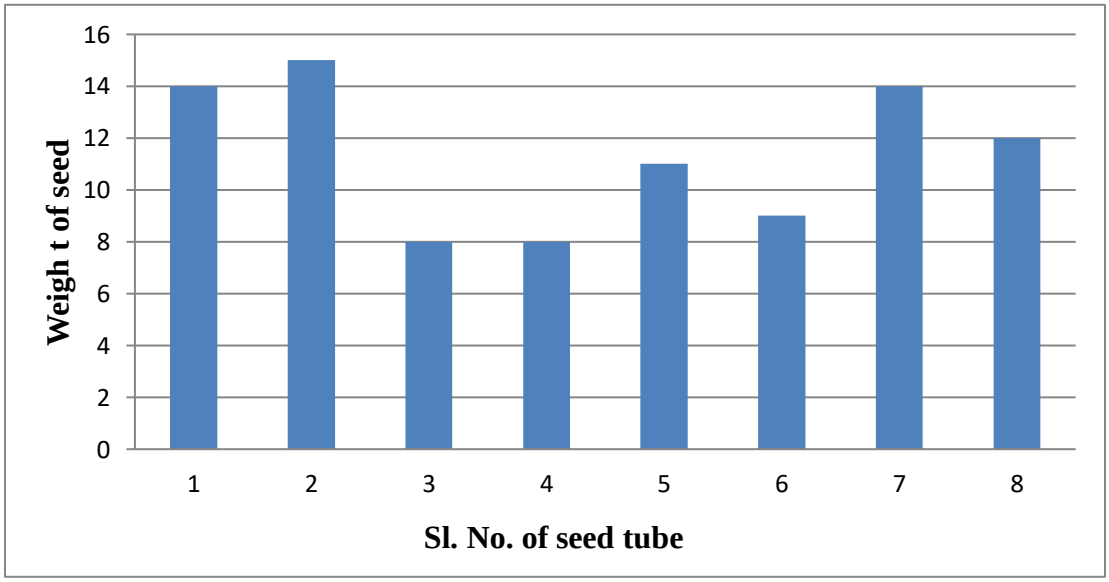


Fig. 4.7 Variation in the weight of seeds dropped through each seed tube

When the number of seeds dropped through each furrow opener while the machine was operated for 10 m distance was counted, it was observed that 284 seeds fell through each furrow opener on an average. Hence from eight furrow openers approximately 2272 seeds were dropped for 10m operation. Thus, the number of seeds per m² was observed as 142.

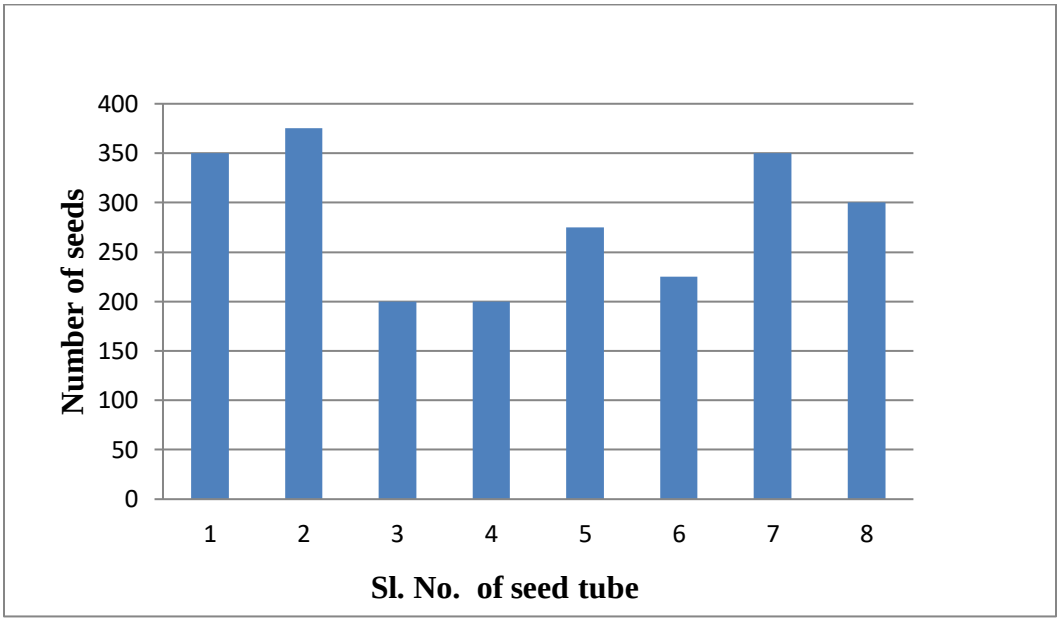


Fig. 4.8 Variation in the number of seeds dropped through each furrow opening

4.4.1 Assessment of seedling emergence in the field

The number of seeds germinated per unit area was obtained by counting the seedlings in a randomly placed square frame of one meterside on different parts of the plot. The number of paddy seedlingsemerged in each square meter area is given in Table 4.2.

Average number of seeds germinated per square meter wasseen to be 106. The germination efficiency was 74.64%. In dry seeding the target number of plants to be established ranges from 100 to 150 per square meter as the number of plants per square meter is within the rage hence population was adequate.

Table 4.2 Seedling population

Number of trials	Number of seeds germinated per square meter
1	120
2	110
3	89
4	96
5	115
Total	530

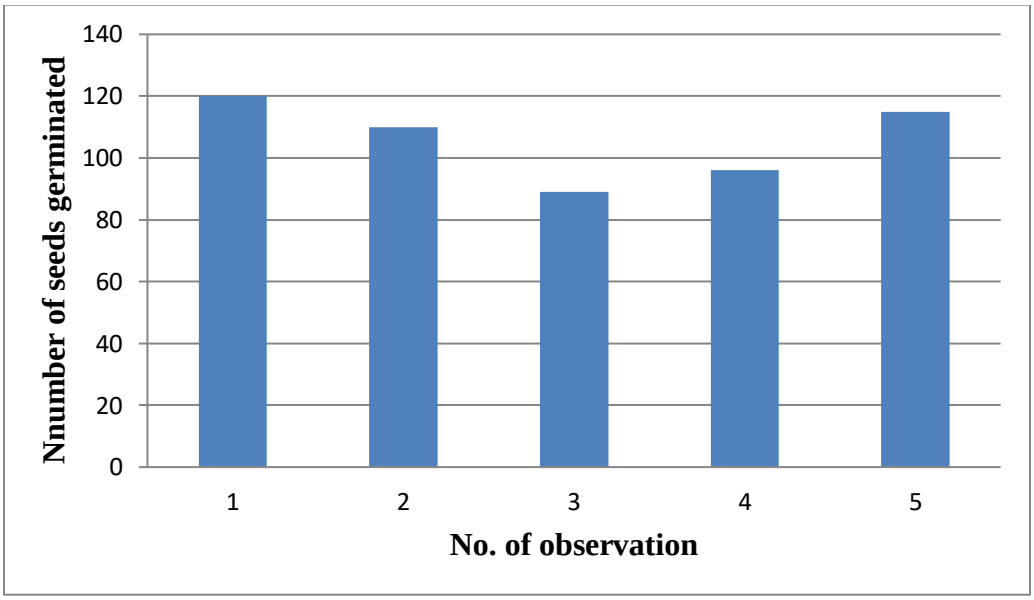


Fig. 4.9 Variation in seedling population

Fig. 4.10 Prototype dry seeder in operation

The salient observations from the field assessment are shown in Table 4.3. Even though the theoretical field capacity was near to 0.4 ha/h the field efficieny was only about 67 %.

Table 4.3 Salient results of field evaluation of prototype

Sl. No	Parameters	Trial 1	Trial 2
1	Speed of operation (m/s)	0.645	0.645
2	Theoretical field capacity (ha/h)	0.371	0.371
3	Actual field capacity (ha/h)	0.180	0.250
4	Field efficiency (%)	48.00	67.43
5	Fuel consumption (l/h)	0.710	0.710

4.4.2 Overall performance

The dry seeding attachment to the Yanji-Sakthi transplanter could enable the dry seeding process without any major modification of the basic unit significant.Thus the utility of the machine is doubled.

i. The prototype is especially helpful in fields where the low depth of operation is preferred i.e. 4-5cm and the field efficiency of the prototype was found to be approximately 68% which is appreciable even though it may vary with soil type and conditions like moisture content.

ii. The seed collectors attached were found to be slanting against the seed drumsand hence appropriate clearance need to be provided between the drums and the seed collectors.

iii. In highly wet and muddy field conditions the drive wheel of the refined prototype gets clogged in the mud and can get stuck. The drive wheel is to be modified to provide better traction.

Fig. 4.11 Drive wheel stuck in the field in excessive moisture condition

4.4.3 Fabrication of the refined dry seeding attachment

Based on the field trials it was decided to mount the dry seeding attachment on a separate frame so as to enable easy replacement of the transplanting unit as well as to reduce the weight. A hollow square pipe of cross section 2.5x2.5 cm was selected for the construction of frame.

The fabrication was done in accordance with the configuration given in section Fig.3.4 Three sections of the square pipe of the length 115cm was cut and placed vertically. Two sections of 182cm length pipe was also cut and placed perpendicular to it at both the ends. The five combined sections of the square pipe were used to form the frame that could replace the float. The square pipes were suitably spot welded to obtain a rigid formation. The developed frame is shown in Fig.4.12. The assembled machine with the dry seeding attachment fixed on the frame is shown in the figure 4.13.

Fig. 4.12 Seeder attachment fitted with modified frame

Fig. 4.13 Refined prototype

4.5 Field evaluation of the refined prototype

The results of the field evaluation is shown in Table 4.4.

Table 4.4 Salient results of field evaluation of refined prototype

Sl. No	Parameters	Observation
1	Speed of operation (m/s)	0.540
2	Theoretical field capacity (ha/h)	0.311
3	Actual field capacity (ha/h)	0.244
4	Field efficiency(%)	78.450
5	Fuel consumption (l/h)	0.710

Fig. 4.14 Refined prototype working in the field

Preliminary trials with the refined prototype was done at KCAET Instructional farm and it was observed that the machine with refined frame worked better compared to the precious one. The field efficiency was also found to be improved. Extensive field tests could not be done as the season was not suitable.

4.6 Suggestions for future work

The riding type Yanji transplanter with dry seeding attachment was found to be a useful machine. Based on the experience gained in the present research work the following suggestions are made:

i. The dry seeder may be evaluated in different soil conditions.
ii. The drive wheel of the Yanji- Sakthi rice transplanter may be modified to obtain sufficient traction.
iii. Provisions may be made for enhancing the efficiency of the refined prototype. Provision may be made for conveying the machine to the field easily such as a trolley along with the machine.

SUMMARY

AND

CONCLUSION

CHAPTER 5

SUMMARY AND CONCLUSION

Direct seeding is an important method of rice cultivation, which includes wet seeding and dry seeding systems. Wet seeding machinery includes manual pregerminated paddy seeder popularly called drum seeder. Recently self propelled paddy drum seeders have been developed by many centres. Dry seeding machinery include various dibblers, seeder attachment to cultivator, seed cum fertilizer drills etc.

The VST Yanji-Sakthi 8 row paddy transplanter is a popular machine among the farmers. RRS Moncombu had modified the Yanji-Sakthi rice transplanter to perform the function of wet seeding by attaching a paddy drum seeder that is commercially available in the market. The modified KAU self-propelled paddy drum seeder can be used for sowing pre-germinated paddy seeds in puddled and leveled field condition. But dry seeding is a common practice in the *Khariff (Virippu)* season in major rice growing areas like Palakkad. Since wet seeding is performed only after the onset of monsoon and the scope of use is limited, the utility of the machine could be enhanced by a dry seeding attachment. As the transplanter unit of Yanji-Sakthi rice transplanter could be easily replaced by the dry seeding or wet seeding attachments the machine could be utilized for both the direct seeding methods. This was expected to enhance the utility of the machine and thereby aid the farmers with small land holdings.

As the seeds are dropped from a height into puddle soil in the wet seeder, seeds tend to scatter when used for dry seeding. To address this problem a suitable seed metering mechanism has been developed. The seed collectors fitted with flexible seed tubes and boot attached on adjustable standards with furrow openers could enable dropping of seeds to shallow furrows. A cover chain was attached to either ends of the frame for closing the furrow after the seeds are dropped.

The machine was fabricated and operated in the field. The following results were obtained in field trials:

i. The developed prototype is helpful in fields where a low depth of operation is preferred i.e. 4-5cm.

ii. The field efficiency of the prototype was found to be approximately 68% which may vary with soil condition.

iii. In highly wet and muddy field conditions the drive wheel of the machine got stuck in the mud.

iv. To avoid the sinking of the drive wheel of the developed prototype in extreme moisture conditions, the weight of the attachment had to be reduced. The float of the prototype was replaced with a frame of lesser weight.

v. The field efficiency of the refined prototype was found to be approximately 78.55% which was good enough.

Enabling the dry seeding mechanism along with the wet seeding mechanism makes the self propelled paddy drum seeder more useful without major changes in the basic design. The attachment can be used in areas where dry seeding is preferred, especially in the first crop season (*virippu*).

It was also suggested that the machine may be evaluated extensively and further refined to improve the efficiency. Provisions may also be incorporated to provide a conveying system for easy transportation of the dry seeding attachment to the fields.

REFERENCES

REFERENCES

Dixit, R., Khurana, J., and Singh, G. 2010. ICAR News, ICAR, Krishi Bhavan, New Delhi, India, Vol.5, No.1,p.12.

Anonymous. 2017. AICRP on Farm Implement and Machinery. Kerala Agricultural University, Thrissur, India.p.27.

Anonymous. 2017. Annual report, All India coordinated project on Farm Implements and machinery, KCAET, Tavanur. Kerala Agricultural University, Thrissur, India. p.26.

Baruah, D.C., Goswamy, N.G., and Saikia, R.2001. Manual Transplanting vs. Mechanical Transplanting of Paddy. A Techno-economic Analysis in Assam. *Journal of Agricultural Engineering*. 38(3):66-72.

Biswas, H.S. 1981. A review of rice transplanters and pre-germinated paddy seeders. Technial Bulletin No. CIAE 81/2/CIAE Bhopal, India.

Chaudhary,V.P., Varshney,B.P., and Kalra,M.S. 2005. Self-Propelled Rice Transplanter-A Better Alternative than Manual Transplanting. *Agricultural Engineering Today*. 29(5-6): 32-37.

Jesudass, D.M., Kumar, V.J.F., and Balasubramanian, M. (1996). Performance of bullockdrawn upland direct paddy seeder. Agr. Mech. In Asia, Africa and Latin America. 27 (1): 21-24.

Krishnaiah, K. 1999. Row seeder for sowing rice in puddle soil. ICAR News, ICAR, KrishiBhavan, New Delhi, India, Vol.5, No.1, p.12.

Pradhan, S.N. 1968. Single row paddy planter. Indian Farming, ICAR, New Delhi 17(11):44-47.

Singh, C.P. and Garg,I.K.1979. Design, Development and Field Evaluation of a Tractor Mounted Paddy Transplanter. Journal of Agricultural Engineering. 16(2):59-66.

Singh, SP., Gite, L.P., Agarwal, N., and Majumdar, J. 2007 Women friendly improved farm toolsand equipments. CIAE Bhopal. India.

Singh, S. and Hensel, O. 2012. On farm research on transplanting paddy: a “best-bet”prototype for drudgery reduction, International Journal of Agriculture: Research andReview. Vol., 2 (4), 483-490,2012

Srivastava, A.P. and Panwar, J.S. 1984. Technology for seeding and planting of paddy.Agricultural Science Progress, Vol.3, 1984, p.13-41.

Sumati, P.,Chavan, J.K.,Shwetambari, M., andPalkar, K. 2010. Performance evaluation of paddy drumseeder. Research paper. Int. J. of Agric. Engg., Vol.3, 279-287.

Sirisha, D.,Kathirvel, K., and Manian, R. 2008. Development and evaluation of direct paddyseeder for assessing the suitability to rural women. AMA, 39: 41-45

Sivakumar, S.,Manian,R., and Kathirvel,K.2002. Investigation on the performance evaluation of drum seeder as influenced by machine, ergonomic and crop parameters. Ph.D Thesis, Department of Farm Machinery, Tamil Nadu Agricultural University, Coimbatore, India.

APPENDICES

APPENDIX 1

1. Determination of theoretical field capacity

Width of operation =1.6m

Speed of operation =0.645m/s

TFC $= \frac{W x S}{10}$

= (0.6x1.6)/10

= 0.371 ha/h

2. Determination of actual field capacity

Area covered =1026.39 m^2

=0.102639 ha

Time of operation =34 min 17 sec

=0.566 h

AFC $= \frac{A}{T}$

= 0.102639/0.566

= 0.18 ha/h

3. Determination of field efficiency

Field efficiency = AFC/TFC

= (0.18/0.371)x100

= 48 %

APPENDIX2

1. Determination of theoretical field capacity

Width of operation =1.6 m

Speed of operation =0.540 m/s

TFC $= \frac{WS}{10}$

= (0.540x1.6)/10

= 0.311 ha/h

2. Determination of actual field capacity

Area covered =320 m^2

=0.032 ha

Time of operation =7min 51sec

=0.130 hr

AFC $= \frac{A}{T}$

= 0.0.032/0.13

=0.244 ha/h

3. Determination of field efficiency

Field efficiency = AFC/TFC

= (0.244/0.311)x100

= 78.55 %

ABSTRACT

DEVELOPMENT AND EVALUATION OF A DRY SEEDING ATTACHMENT TO A RIDING TYPE RICE TRANSPLANTER

AISWARYA SANTHOSH (2015-02-003)

AMIT KUMAR (2015-02-005)

AMRUTHA K. (2015-02-006)

SREEHARI M. (2015-02-037)

ABSTRACT

Submitted in partial fulfillment of the requirement for the degree

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING
of

Kerala Agricultural University

Department of Farm Machinery and Power Engineering

Kelappaji College of Agricultural Engineering and Technology, Tavanur

Kerala 679573

2019

ABSTRACT

Rice is the crop that can be regarded as the foundation of the Indian food security, vital in meeting the goal of ensuring food for all. There are three principal methods of rice cultivation; dry seeding, wet seeding and transplanting. Direct seeded rice plays a great role in satisfying the food grain requirement of Kerala. Direct seeded rice is either dry seeded or wet seeded. Dry seeding is a common practice in the *Khariff (Virippu)* season in major rice growing areas like Palakkad.

Paddy drum seeder is one of the common machines for wet seeding of rice for sowing pre-germinated paddy seeds in puddled paddy field. A modified self-propelled pre-germinated seeder was developed at Rice Research Station, Moncombu of KAU by replacing the transplanting unit of Yanji-Sakthi rice transplanter with a drum seeder unit. Since the machine could only be used for wet seeding, its utility could be increased by incorporating dry seeding attachment to it. Hence an effort was taken up to modify the available machine with the objectives of developing a rice dry seeding attachment to the power operated eight row riding type single wheel rice transplanter and to evaluate the performance of the developed prototype.

The methodology used for the development and evaluation of a dry seeding attachment to the modified KAU self-propelled paddy drum seeder included preliminary studies for the development of the attachment to the Yanji-Sakthi rice transplanter followed by development of the attachment. The development procedure included fabrication of components, assembly and preliminary testing of the prototype in laboratory as well as field. The prototype was also further refined based on the field tests.

The dry seeding attachment to the riding type rice transplanter was found to be comparable with the existing KAU self-propelled pre-germinated paddy seeder in its performance. With limited constructional modification, the dry seeding attachment to a Yanji-Sakthi riding type rice transplanter could render the rice transplanter as a multi-purpose machine for different seeding and planting operations such as dry seeding and wet seeding which in turn helped to increase the annual working hours of the machine.