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CSISA

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Cereal Systems Initiative for South Asia

BED PLANTERS FOR SERVICE MECHANICS

Experiential learning modules for sustainable intensification and agricultural service provision (Book VIII)

Timothy J. Krupnik[1], Kamrun Naher[2], Kh. Shafiq Islam[1], Md. Abdul Matin[3], Syed Mahmudul Huq[1], Shamim Ara Begum[1], Muhammad Arshadul Hoque[3], Sheikh Md. Nazim Uddin[4], Scott Justice[5,6], Khondker Murshed-E-Jahan[7], and Md. Israil Hossain[8]

1 International Maize and Wheat Improvement Center (CIMMYT), House 10/B, Road 53, Gulshan 2, Dhaka 1213, Bangladesh
2 Food and Agriculture Organization (FAO) of the United Nations, House 37, Road 8, Dhanmondi R/A, Dhaka 1205, Bangladesh
3 Farm Machinery and Postharvest Engineering (FMPE) Division, Bangladesh Agricultural ResearchInstitute (BARI), Joydebpur, Gazipur 1701, Bangladesh
4 Department of Agricultural Extension, Khamarbari, Farmgate, Dhaka 1215, Bangladesh
5 International Maize and Wheat Improvement Center (CIMMYT). Botany Division, 1st Floor, NARC, Khumaltar, Lalitpur, Nepal
6 Independent farm mechanization consultant. Yangon, Myanmar.
7 Winrock International. House 13/B, Road 54, Gulshan 2, Dhaka, Bangladesh
8 Bangladesh Wheat and Maize Research Institute. Nashipur, Dinajpur, Bangladesh.

The International Maize and Wheat Improvement Center (CIMMYT) is the global leader in publicly-funded maize and wheat research and related farming systems. Headquartered near Mexico City, CIMMYT works with hundreds of partners throughout the developing world to sustainably increase the productivity of maize and wheat cropping systems, thus improving global food security and reducing poverty. CIMMYT is a member of the CGIAR Consortium and leads the CGIAR Research Programs on MAIZE and WHEAT. The Center receives support from national governments, foundations, development banks and other public and private agencies.

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Tel (landline/fax): +880 2 989 6676, +880 2 989 4278
Postal address: PO Box 6057, Gulshan, Dhaka 1212, Bangladesh
For more information by email: t.krupnik@cgiar.org

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CSISA was established in 2009 with the goal of benefiting more than eight million farmers by the end of 2020. The project is led by the Internation al Maize and Wheat Improvement Center (CIMMYT) and implemented jointly with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI). Operating in rural 'innovation hubs' in Bangladesh, India and Nepal, CSISA works to increase the adoption of various resource-conserving and climate-resilient technologies, and improve farmers' access to market information and enterprise development. CSISA supports women farmers by improving their access and exposure to modern and improved technological innovations, knowledge and entrepreneurial skills. CSISA works in synergy with regional and national efforts, collaborating with myriad public, civil society and private sector partners.

CSISA's goals are to:

- Promote widespread adoption of resource-conserving practices, technologies and services which increase yields with lower water, labor and input costs.
- Support mainstreaming innovations in national-, state- and district-level government programs to improve long-term impacts achieved through investments in the agricultural sector.
- Generate and disseminate new knowledge on cropping system management practices which can withstand the impacts of climate change in South Asia.
- Improve the policy environment to facilitate the adoption of sustainable intensification technologies.
- Build strategic partnerships that can sustain and enhance the scale of benefits accrued through improving cereal system productivity.

CSISA-MI emerged out of CSISA's ongoing efforts in the USAID/Bangladesh Mission-funded CSISA expansion project (2010-2015), and during CSISA Phase II. It continues to be strategically aligned with the broader CSISA Phase III program in Bangladesh, and is led by CIMMYT in partnership with International Development Enterprises (iDE). CSISA-MI is a five-year project (July 2013 – September 2018) that focuses on unlocking agricultural productivity through increased adoption of agricultural mechanization technologies and services.

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* PowerPoint files of the flip charts in 'ready to present' format can be downloaded from here (for English language: https://bit.ly/2T7xcGj) or here (for Bangla language: https://csisa.org/wp-content/uploads/sites/2/2019/12/191204_BP-SP_190512-PP_BP-SP-smh.pdf).

Introduction

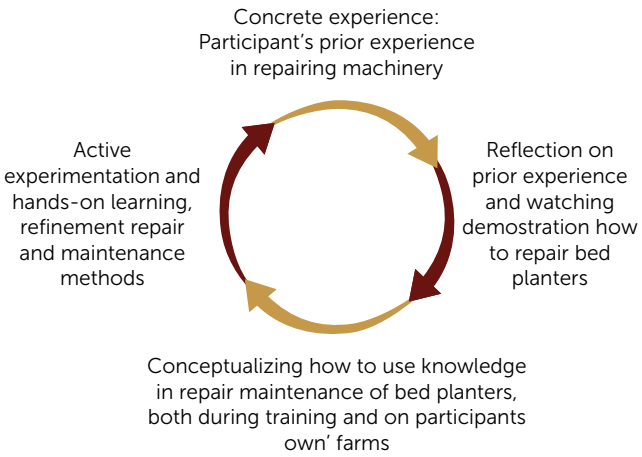
This set of training modules focuses on ensuring that mechanics are able to make repairs to bed planter efficiently and correctly. It builds on other books in this series, and is designed so that anybody who uses these materials can easily conduct training – even those with a limited background in and understanding of agricultural engineering or machinery. By the conclusion of the training module (which can be completed in a single day of intensive training or in a multi-day, multi-session format), participant mechanics will be well equipped to repair bed planter as part of their ongoing agricultural machinery servicing business. However, users of this book should carefully read all the instructions on how to implement the training effectively in order to ensure the best learning experience possible for the participants. A key aspect of this is ensuring that the training is experiential and interactive, as discussed in the next section.

Experiential education and training format

This training uses an experiential and hands-on modular format. It is based on a foundation of experiential and hands-on work, combined with discussion and reflection among participants. This means that although the facilitator is instructed on how to carry out the training and how to present materials, the format in which this is done should be horizontal and participatory, with room for adaptation and modification. We also underscore that farmers and agricultural machinery service providers – who are the target of this training – are experts in their own fields. They work daily on farms and have considerably more experience than most university educated technicians, researchers or extension agents. Attentively listening to their opinions and working with them to respond to their needs and experiences will facilitate improved learning and enhance the quality of any given training session. In this sense, it is the responsibility of the training facilitator to elicit the participants' input, opinions and ideas, and to use these interactively to shape discussion and learning. Each facilitator therefore should think of him or herself as a guide whose goal is to elicit insight and ideas from the trainees, in order to enhance their learning process. The technical materials included in this document should therefore be seen as a guide to supplement the in-depth knowledge that the trainee farmers and agricultural machinery service providers already have.

The training format presented in these modules is loosely based on the experiential learning cycle described by Kolb (1984)[1], who posited that adults learn differently from children, with learning based on cycles involving concrete experience, learners reflecting on this experience, conceptualizing their experiences, and then doing experimentation. After this, the learning cycle is repeated. He further hypothesized that there are generally four types of adult learners and learning styles which should be accommodated. In the production of this manual, we have tried to account for these types of learners, including those who learn by taking part in demonstration activities and critically thinking about them (whom Kolb called divergers), those who learn by thinking, reading and watching (assimilators), those who learn by hands-on thinking and doing (convergers), and those who learn by doing (accommodators).

Well-designed training should accommodate each participant's individual learning style by providing a mixture of lectures and discussions, reading or visual material, hands-on experiential and experimental opportunities, and opportunities to watch demonstrations and to learn. The challenge thus given to training facilitators when using these modules is to accommodate different types of learners in an active learning process. Kolb's theories have been widely researched and validated in a number of contexts, and provide a solid foundation for educational programs aimed at experienced farmers and agricultural service providers, as well as farmer field, school-oriented and action learning. In this training, we loosely attempt to



Kolb's (1986) experiential learning cycle as loosely applied to these training modules.

[1] Kolb, D.A. 1984. Experiential Learning: Experience as the Source of Learning and Development. Prentice-Hall, Englewood Cliffs, NJ.

formulate Kolb's learning styles as shown below. Therefore, at every step of the process, facilitators should work to generate discussion and hands-on learning through practical activities, to demonstrate the bed planter and show participants how to use them, and to encourage critical but constructive reflection among the training participants. There is a certain art to this process, so beforehand, facilitators should practice with their peers different techniques for eliciting discussion among participants..

Here are some examples of how to ask questions of the training participants in a way that will encourage them to think and critically reflect on the training materials:

1. ***Arrange seating in a circle, not like in a classroom.*** Circular seating arrangements encourage participants and facilitators to interact as equals, and improve the potential for discussion.

2. ***Rather than ask closed questions, ask open ones.*** For example, rather than ask "What are the financial advantages to farmers using a bed planter?", ask "How can a bed planter help farmers to sow more crops from the same plot of land within one year?" Participants may require some additional encouragement to discuss this question, but gently push them towards realizing the answer.

3. ***Prompt questions that have open and multiple answers.*** For example, rather than asking training participants "What happens if water gets into the bearing?", ask "If water gets into the bearing, what are the implications for water leakage from the bed planter, and how might this cause reduced profits for farmers and service providers?"

4. ***Pick a particular participant to give an answer.*** Rotate among students, picking different ones and asking them individually or as a group to answer a question. It may take time for them to answer, but allow them to work through the process of reflection and come up with a response. Engage with them and discuss their response, and ask others for their thoughts on the response. However, if a particular participant is naturally quiet or reserved, avoid asking him/her too many questions. The goal is to encourage an active learning atmosphere, but not to make participants feel uncomfortable.

5. ***Most importantly, ask logical questions based on the training materials.*** This seems like a simple point, but it is important to stay on topic and make sure that participants are equipped to respond to questions. The ultimate goal is not to make training participants identify what they do not know; rather, our goal is to engage training participants with the training materials so they can succeed at mastering mechanical reaping by applying a combination of what they already know and what they will learn.

6. ***Provide space for under-represented students to speak.*** In many training sessions, men speak over women or dominate the conversation. Members of a particular economic or religious group or caste may also speak over those who are not part of their group. Facilitators are encouraged to recognize this, and work to give space to underrepresented groups to enable them to learn and speak out equally. This may require giving individuals an opportunity to contribute by asking other participants to wait to reply.

The field is the best classroom for farmers and service providers

Training sessions are to be held primarily outside and in the field, where participants are encouraged to learn with their own hands how to operate the bed planter safely and effectively. It is only by setting up the bed planters safely and operating them that trainees can learn how to benefit from them. To facilitate this, the flipchart material provided in this book can be printed on large paper and taken out into farmers' fields, where electricity for PowerPoint presentations or other learning formats may not be available (downloaded https://bit.ly/2T7xcGj).

Emphasis should be given to these participatory activities throughout the training. Last but not least, training and education does not end at the conclusion of the day. Participants should be encouraged to experiment with, learn from, modify and adapt the techniques they learn for using bed planter on their own farm, emulating the cycle of continual learning articulated by Kolb, as discussed above. For this reason, training facilitators should share their contact information with participants so they can backstop and assist with technical matters when needed over time. Similarly, trainers may wish to supply contact information of experienced extension agents with knowledge of bed planter.

Organization of this book

This book is organized as follows: after a general introduction to the training format and style, and materials needed for one day's training, five independent learning sessions are presented. Each session covers a different topic, as follows:

1. Introduction, training objectives and pre-training evaluation
2. Introduction to the axial flow pump and mixed flow pump
3. Main parts of the axial and mixed flow pumps and their functions

4. Common causes of bed planter failure and breakdown – possible solutions
5. Common causes of bed planter failure and breakdown – practical troubleshooting
6. Review of key points, post-training evaluation and close of training

The individuals who are facilitating the training are then instructed on how to implement each training session. This includes a review of the learning objectives, key messages, required materials, and step-by-step instructions on how to conduct the session from start to finish. At each step of the process, training facilitators are expected to encourage experiential learning as articulated above. Most sessions include a component during which the facilitator will give a brief presentation on the topic. Presentations are intended to be discussion oriented, and the facilitator should allow time for participants to ask questions, and in turn elicit questions and feedback, especially if few participants are speaking.

Flipchart materials are provided to guide the technical content of each of these presentations. Facilitators should simply follow the flipcharts and use the materials presented to initiate discussion and ensure that all technical points are covered. Care should be taken to allow all participants to speak, and to make space for under-represented participants, specifically women, to speak and ask questions.

The pages of this book can be printed out on large poster-sized paper and used as flipcharts. The same flipcharts are also intended to be printed on normal-sized paper, stapled together and provided as hand-outs and reference material for participants. In many countries, training facilitators may also choose to use the flipcharts as projected PowerPoint slides, which is encouraged here as long as a reliable electricity source can be supplied, and participants are able to easily view the slides. Some trainers even prefer to use the flipchart materials as a base for PowerPoint slides, modifying them and adding relevant material as they see fit. We fully encourage this approach.

Lastly, training begins with a pre-training evaluation of participants' knowledge, and ends with a post-training evaluation of their knowledge at the end of the day. The change in participants' scores provides an indication of their progress in learning. Ready-made pre- and post-training test questionnaires and their answers are provided in Annex 1. Simply print them on regular sized paper for use. Some training facilitators also like to conduct post-training evaluations a second time, a week or more after the training, to gauge how much information participants have retained over time. We also encourage this, as it can be instructive for training facilitators to learn how to improve and emphasize particular parts of the training that some participants may forget as time passes.

Training aims and objectives: The bed planter

The aims of this training are to (1) increase participants' knowledge of the common causes of bed planter failure and breakdown experienced by farmers and service providers, and (2) improve their skills in repairing the machine effectively and efficiently.

By the end of the training, participants should be able to:

- identify the major mechanical parts of the bed planter and understand their functions;
- identify the causes of major failures and breakdown associated with bed planters and find solutions to fix them;
- select appropriate spare parts and tools/ workshop facilities required to make repairs to the bed planter;
- demonstrate awareness of where to purchase spare parts; and
- demonstrate that they can repair a bed planter effectively and efficiently.

Whom is this training designed for?

This training is designed for mechanics (1) preferably with experience repairing bed planters, but also two-wheeled tractors, or (2) who are already running a business and have an interest in repairing agricultural machinery. Gender balance should be maintained when selecting the participants – the ideal is to have an equal mix of women and men.

Key considerations for training

Key considerations for planning, preparing and organizing are given below. The facilitator(s) should prepare well in advance, reading each section carefully to make sure the training is implemented effectively and efficiently. The information presented here can be generalized for each training day in this series of books. More specific information pertaining to individual training days is also presented at the beginning of each module; be sure that you also review this material.

Participants

The number of participants per batch should be around 6-8. They should be mechanics who have experience (or who are interested in) providing mechanical repair services for the users of bed planters. Contact participants well ahead of the training date (at least one week) to allow them time to prepare.

Venue

Select the training venue carefully. It should be next to a mechanic's workshop, preferably with an open shady place, for example, under a tree. No seating arrangement is required, either for participants or for the facilitator(s), as the majority of this training is hands-on and practical – so participants should be active! There should also be accessible restroom/toilet facilities nearby.

Training aids

At least one month before the training is due to start, please review the detailed list of training aids on the next page and make sure you get together all the materials needed well before the training starts.

Facilitator(s)

An experienced local mechanic with the competence to train others should be selected to facilitate the training. However, if help is not available locally, the facilitator should arrange support from other research or extension institutes, or from machinery manufacturers. Allow enough time to arrange this in advance. If resource people such as these are not available, the facilitator(s) should carefully study all the points in this book and make sure they can repair a bed planter easily, without having to refer to printed instructions. The key point is that the person who facilitates the training should be well-versed in both how to lead an effective interactive and experiential learning-based training, as well as being a knowledgeable mechanic themselves.

Facilitator's preparation

Well ahead of the training start date, the facilitator(s) should go through each module and its respective topics, and practice the implementation techniques as per the allocated time. Each session contains different topics, implementation techniques and time allocation. Facilitators therefore need to read each module minutely and practice their delivery following the PowerPoint presentation/flipcharts to ensure a lively presentation that keeps to schedule.

Date of training

The date of the training should be decided following discussion and agreement with trainees to ensure their participation. It should preferably be during their weekly day off to avoid any financial loss to their business.

Registration

Participants should reach the training venue on time. On arrival, each participant should register their name; registration should be completed before training begins, after which no new participant can be allowed to join.

Participatory, experiential and hands-on learning

The training approach should be participatory, with an emphasis on hands-on and experiential learning, and actual operation of the bed planter. This is why it is important to limit participant numbers relative to how many bed planters are available, as each participant should get the opportunity to have hands-on experience operating the machine. The facilitator should have been trained in these methods, and utilize techniques that aim to motivate participants to get involved in the training, for example, question and answer sessions, experience sharing, group exercises, group discussions, and group presentations. This guide explains how to do that.

Effective and enjoyable training

The training should be facilitated in such a way that participants understand the key messages and information clearly, and find it useful and valuable, rather than a waste of their time. To achieve this, the facilitator should work to ensure that the training is enjoyable (using fun games, quizzes, sing-along sessions, or other techniques to get trainees motivated and involved). One-way lecture formats are not acceptable and are discouraged –hands-on training is always more effective. The facilitator should arrange a short break (about two minutes) after each ten minutes of presentation, discussion and exercise, during which they should ask questions to check whether participants are understanding the training well, and if necessary, adapt their teaching style.

Mobile phone use

Use of mobile phones causes distraction and reduces the effectiveness of the learning experience. All participants, including the facilitator(s), should keep their mobile phones switched off during the training session. If they receive an urgent call, they should excuse themselves from the group to answer it.

Evaluation of participant progress

A pre-training evaluation questionnaire at the start of the training and post-training evaluation at the end are important and necessary to judge whether and to what degree the learning has been effective. These questionnaires are provided in Annex 1.

Course preparation, duration, materials and setting

This course is designed for one day's training of approximately 7.45 hours of instruction, comprising about 2.20 hours of discussion and review plus 5.25 hours of demonstration and practical exercises. This excludes lunch and breaks. This is an intensive course; sessions are held in the field and not in a classroom. The facilitator(s) can decide the best time to take tea and lunch breaks (these times are not included in the estimates below and so should be accounted for when planning the training). It is important to keep times flexible, depending on the needs of the participants – some sessions may be faster than allowed for, others may be slower.

The content is divided into an introductory session plus five instructional sessions, as follows:

Session	Topic	Approximate duration (minutes)
1	Introduction, training objectives and pre-training evaluation	60
2	Main parts of the bed planter and their functions	30
4	Common causes of failure and breakdown – possible solutions	85
5	Common causes of failure and breakdown – practical troubleshooting	240
6	Review of key messages, post-training evaluation and close of training	50

Planning and preparing for the training

Please review the "Key considerations for training" section at the front of this book. Note that you may wish to establish demonstration learning field plots before the start of the training (detailed below in different sessions), so advanced preparation of several weeks is required. In addition to the items listed there, prepare for the training by considering the following:

Training venue

Provide space with adequate cover for a maximum of eight participants plus the facilitator(s). The venue should be easily accessible and safe for any vulnerable or non-able-bodied participants. Bathroom facilities with appropriate privacy (particularly for women participants) should be provided.

Required training aids

- ✓ two sets of toolboxes, each containing: 1 dual wrench set, 1 adjustable wrench set, 1 pair of pliers, at least 1 Phillips head screwdriver, 1 flathead screwdriver, 1 measuring tape, 1 Allen key (hex key) wrench set, hammer and other common hand tools, 1 x 3-jaw puller (10"), oil, 1 grease gun, files, cloth, common sizes of nuts and bolts, and chalk (see Annex 3 for more details).
- ✓ diesel (2 L), gasoline (2 L), grease (0.25 kg), lube oil (1 L)
- ✓ rugs (*jhuts*) to sit on and work from, and to catch spilled oil
- ✓ printed flipcharts for sessions 1-3 and 5
- ✓ blank flipchart paper for group feedback (approximately 10 sheets)
- ✓ whiteboard and flipchart/whiteboard stand
- ✓ two or three whiteboard (dry erase) pens; two or three flipchart markers
- ✓ a notebook, pencil and spare paper for each participant
- ✓ two used bed planters
- ✓ faulty or broken bed planter parts (if available)
- ✓ spare bed planter parts (use the faulty/broken parts)
- ✓ pre-arrangement with a workshop to provide necessary mechanical support

Session 1

Introduction, training objectives and pre-training evaluation

Learning objectives

At the end of this session, participants should be able to:

- state the names of the trainer(s) and other participants
- understand and state the course contents and objectives of the training
- understand the training guidelines about learning and cooperation, including the participatory approach and their expected contribution
- assess their pre-existing knowledge level in terms of the content of the training

Key messages to convey to participants during this session

1. The training day is composed of an introductory session plus four instructional sessions and will take about 7.55 hours excluding lunch, tea and other breaks. Get ready to learn plenty of new things – and please be patient: there is a lot of material to complete.
2. This training is participatory and fun – trainers and trainees will learn from each other.
3. The training is mostly hands-on: participants should learn by working with the bed planters, rather than just listening. Active participation works best.
4. There is a pre-training and post-training evaluation process, which is an essential part of the day.
5. Participants should be attentive during the training and participate actively – either individually or as part of their group – in each task/assignment/exercise given to them.
6. The facilitator and participants should keep their mobile phone switched off or on silence. If they receive an urgent call, they should excuse themselves from the group and go elsewhere to answer it.

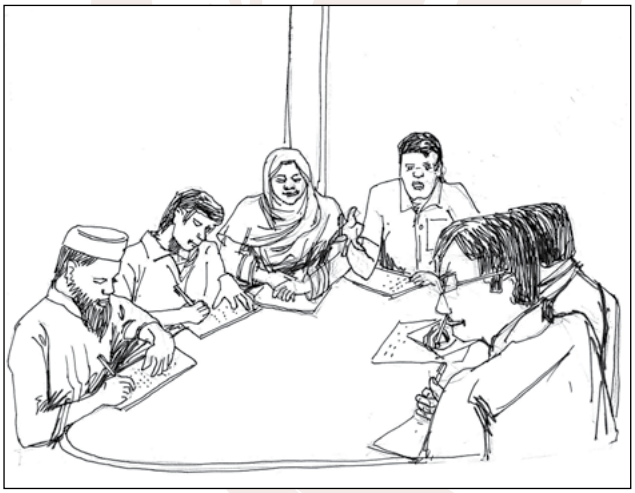
How to conduct the session on *Introduction, training objectives and pre-training evaluation*

For this session, you will need the following resources and materials:

- the participant registration form
- the flipchart *Session 1: Introduction, training objectives and pre-training evaluation*
- A4 printed copies of the flipchart for each participant
- a notebook and pen for each participant
- a copy of the pre-training evaluation questionnaire for each participant (see Annex 1)
- several sheets of blank poster paper or a whiteboard, whiteboard stand and dry marker/ whiteboard pens

Step 1 – Form groups (15 minutes)

Most adults learn best when they can work in groups. Participants in a small group can interact and share ideas with each other, which allows peer-to-peer learning, and can stimulate more entertaining and rich learning experiences.



An ideal size is a total of six to eight participants, divided into two groups of three or four.

Divide the participants into groups of three by asking them to number themselves 1, 2, 3 (or 4) and asking those with the same number to rearrange their seats and sit together (all the 1s together in one group, 2s in another and so on). This splits up participants who are sitting with people they already know.

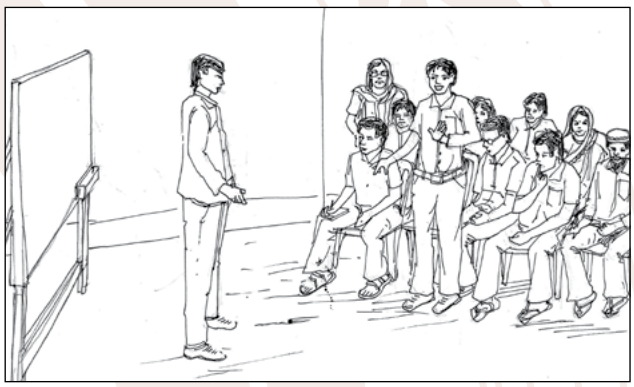
Next, ask each group to select a leader and choose a fun name for their group. It is helpful if the group leader can read and write, which is something the training facilitator can assess during the registration period of the training.

Ask each group to find five things they have in common with every other person in the group, and that have nothing to do with work. Please, no body parts, as we all have legs and arms! Also, no clothing, as we all wear clothes. Focus on more interesting commonalities; examples may include having worked as a mechanic for more than three years, working to repair engines for motorcycles or tractors, or interest in sports like cricket. This activity helps the group explore shared interests more broadly – it should be fun and anything of relevance can be included!

Ask the group leaders to take notes and be ready to read their list to the whole group at the end of the session. This should generate discussion, and a lot of laughter and fun, while encouraging each group to think more like a team.

Step 2 – What are the participants' expectations? (10 minutes)

This is one of the most effective tools for breaking the ice and enabling a new group of trainees to get to know each other. Each group member is an important source of knowledge. Each participant also has his or her own style of thinking and learning. This means that for effective learning it is important for the trainers to understand each participant's expectations of the training. It will also help the facilitator(s) be better equipped to deliver a successful learning experience throughout the training.



Use an icebreaker approach, during which participants can state what their learning expectations are at the beginning of the day. This will provide feedback from each participant about what they expect – and want – to get out of the training.

During the introduction to the training, when it is time for participants to introduce themselves following group formation, the facilitator should explain that participants' expectations are very important, and that understanding them will be crucial for ensuring quality outcomes from the training. These expectations can later be compared with the module outline, and modifications and changes can be made where necessary.

Ask participants to:

- introduce themselves individually
- share their expectations of the training course (which should be summarized and presented by the group leader after 2-3 minutes of discussion)

Here is an example:

"Hi, my name is Sudhanshu. Our group wants to know how to solve major problems with bed planters and how we can make money providing a bed planter repair service to farmers. Will we learn how to do that?" At the end of this session, review the list of expectations that the groups made. Discuss any points not covered in the course and explain whether their expectations will be met, and if not, why.

Step 3 – Introducing the training (10 minutes)

Use flipchart *Session 1: Introduction, training objectives and pre-training evaluation* to present a brief overview of the training course, the training methods the course uses, the rules, and the responsibilities of the participants. Allow time for both the trainer(s) and participants to ask questions.

Step 4 – Pre-training evaluation questionnaire (25 minutes)

Distribute the "Pre-training evaluation questionnaire" (see Annex 1) to each participant and allow 20 minutes or so to complete it. If necessary, helpless literate participants to understand and answer the questions. The questionnaire can also be printed and put up on flipchart paper. Collect the answers; they will be compared with the post-test evaluation answers at the conclusion of the training. They should be corrected before the end of the day, prior to the closing session, during which the evaluation scores will be given to all participants.

Session 2

Main parts of the bed planter and their functions

Learning objectives

At the end of this introductory session, participants should be able to:

- identify the main parts of the bed planter
- understand and state the functions of each part

How to conduct the session *Introduction to the main parts of the bed planter and their functions*

For this session, you will need the following resources and materials:

- the flipchart *Session 2: Main parts of the bed planter and their functions*
- A4 printed copies of the flipchart for each participant
- several sheets of blank poster paper or a whiteboard, whiteboard stand and dry marker/ whiteboard pens
- spare bed planter parts

Step 1 – Raise participant awareness and generate discussion (20 minutes)

Show the participants some used or old bed planters. Then initiate the session, warming up participants through an ice-breaking question-and-answer session.

Ask: Can anyone name the main parts of the bed planter? What are their functions? Encourage one or two participants to answer the questions. Listen carefully and list the parts they mention on blank poster paper or the whiteboard.

Step 2 – Generate discussion and learning (10 minutes)

Lead a discussion on the bed planter, using the flipchart *Session 2: Main parts of the bed planter and their functions* to ensure that participants can identify and state the functions of the main parts as follows:

Name of part	Functions
Bed former	Makes raised beds of a specific shape and size
Scraper	Scrapes clean the soil/mud from the bed former
Bearing housing	Holds/encases the bearing engaged in rotating the bed former
Mudguard	Keeps the soil from dispersing all around. Also acts as a safety guard to protect the operator from being hit by clods of earth
Tillage depth control lever	Controls the depth of tillage by selecting the appropriate hole in this perforated bar
Furrow opener	Makes the furrow; maintains line-to-line spacing and controls depth of seed placement during seeding
Rotavator	Rotates and thus tills the soil
Rotary chain sprocket	Transmits power from the seed cum fertilizer drill gearbox to the rotavator
Seed box	Holds the seeds prior to seeding
Seed meter	Meters the seed delivered to the seeding chutes
Seed on-off clutch	Controls the on-off seed flow to the seed tube
Power transmission chain	Transmits power from the front wheel spindle to the bevel gear shaft
Bevel shaft	Transmits power from front wheel spindle to the seed metering device with the help of the power transmission chain

Session 3

Common causes of bed planter failure and breakdown – practical solutions

Learning objective

At the end of the session, participants should be able to:

- understand and state the common causes of failure and breakdown in a bed planter
- repair and adjust a range of failures and breakdowns efficiently

How to conduct the session on Common causes of failure and breakdown and possible solutions

For this session, you will need the following resources and materials:

- flipchart *Session 3: Common causes of bed planter failure or breakdown – possible solutions*
- A4 printed copies of the flipcharts as a handout for each participant
- several sheets of blank poster paper/whiteboard, flipchart stand, whiteboard stand, dry markers/ whiteboard pens
- faulty/broken bed planter parts (if available)
- spare parts (if available)
- blank poster paper/whiteboard, whiteboard stand, white board pens

Step 1 – Raise participant awareness and generate discussion (20 minutes)

Show the participants a used or old bed planter. Then initiate the session, warming up participants by using an ice-breaking question-and-answer session.

Ask: What are the common causes of failure and breakdown in a bed planter? What type of failure and breakdown do service providers and farmers usually complain about to you?

Encourage one or two participants to answer the questions. Listen carefully and list the causes of failure and breakdown on the whiteboard or flipchart. Rank the problems based on the consensus of the trainees, focusing on participants who are hesitant to speak up or appear non-confident about providing a solution to the problems.

Next, encourage participants to contribute their experience solving each of the problems. Check whether the solution to each problem is on the flipchart. If not, make a note of it and return to this topic to discuss it with the group during the next session. Finally, check whether any common cause of failure or breakdown listed on the flipchart has not been encountered by any of the participants. If prompted, a participant may recall and be able to talk about it. If not, be prepared to talk about it yourself.

Step 2 – Demonstration by a skilled mechanic (30 minutes)

Next, if available, an experienced mechanic talks about (1) the faulty parts of the bed planter and how to repair or replace them, and (2) the maintenance and storage of the machines. If a mechanic is not available, an experienced service provider should be engaged; if this is not possible, the facilitator should complete this part of the training.

Quick review (15 minutes)

At the end of Session 3, bring participants together in their groups. Ask each group five to ten questions, encouraging each participant to answer 1 or 2 questions based on the information shared during this session. If a participant is unable to answer a question, invite other members of their group to answer. If no one in that group can answer, pass the question on to the next group.

Session 4

Common causes of bed planter failure or breakdown – possible solutions

Learning objectives

At the end of the session, participants should:

- be equipped to carry out repairs and be aware of essential safety measures
- be able to put together and dismantle the main parts of the bed planter (those which most commonly fail/breakdown)
- be able to resolve common failures/breakdowns by repairing the relevant parts or replacing them efficiently

How to conduct the session on *Common causes of bed planter failure and breakdown – practical solutions*

For this session, you will need the following resources and materials:

- 1 used bed planter
- faulty/broken bed planter parts (if available)
- spare bed planter parts (if available)
- blank poster paper/whiteboard, flipchart stand, whiteboard stand, dry markers/whiteboard pens
- the assistance of an experienced mechanic

Please note: there are no flipcharts for this session.

Step 1 – Demonstration by a skilled mechanic (or if not available, an appropriate expert) (75 minutes)

The skilled mechanic demonstrates (1) all the parts (putting together and dismantling) of the bed planter, and (2) the common issues as ranked below, along with ways to fix them:

1. Poor meshing of the gear pinion on the metering shaft.
2. The hitching gears do not work.
3. The seed on-off clutch does not work.
4. The rotavator chain and bearing break.
5. The bearings of the bed former jam and/or develop a fault.
6. The cone (the conical part of the bed former) becomes displaced.
7. The seed metering plate does not rotate or meter the seed.

Step 2 – Information sharing about spare parts and where to get them (15 minutes)

Next, present information about the prices of the different spare bed planter parts and where to get them. If possible, use actual spare parts to illustrate the discussion.

Step 1 – Consolidation of learning (150 minutes)

Encourage each participant to demonstrate his/her ability to identify solutions to each of the problems listed on the whiteboard, and that he/she can address each of the points below for each problem.

Step 1: Identify the most significant problem and state its cause(s).

Step 2: Dismantle the relevant part and inspect it to find the cause of the failure.

Step 3: Identify the appropriate spare part(s) needed or repair the faulty part.

Step 4: Replace the repaired/new part on the machine appropriately.

Repeat the above steps with the second and third most significant problem, and so on.

Session 5

Review of key messages, post-training evaluation and close of training

How to conduct the session on *Review of key messages, post-training evaluation and close of training*

For this session, you will need the following resources and materials:

- flipchart *Session 5: Review of key messages, post-training evaluation and close of training*
- A4 printed copies of the flipcharts as a handout for each participant
- several sheets of blank poster paper/whiteboard, flipchart stand, whiteboard stand, dry markers/ whiteboard pens
- a copy of the post-evaluation questionnaire for each participant (see Annex 1)
- handouts or other materials (e.g., leaflets, brochures, if available) for participants

Step 1: Generate discussion to recap and reflect on the key questions of the day (30 minutes)

Review each of the day's sessions by asking the participants the questions listed on the Session 5 flipchart. This will provide a good indication of whether all the participants have learned from the training, and to what extent.

Use the following questions to stimulate discussion and to make sure that everyone understands the essential messages:

- What are main parts of a bed planter? What are their functions?
- What are major causes of failure and breakdown of a bed planter?
- What should you do if the seeder on-off clutch does not work?
- Where can you get a new bed former?
- How would you address an issue with the hitching gears?
- What should you do if the seed metering plate stops working?

Next, ask participants directly if there is anything that needs further clarification. If the facilitator has been successful in making the day's training really participatory, trainees should have the confidence to speak up if they think some aspect was not covered during the day. As throughout the day, encourage any reticent trainee to speak (without making him/her feel awkward or self-conscious). Note down any issue that was not covered in the training – this will enhance the next training day for a new batch of trainees.

Step 2: Participants complete the post-training evaluation questionnaire (10 minutes)

Distribute the post-training evaluation questionnaire to participants and allow them 10 minutes to complete it. Be ready to answer questions and assist anyone who may need it. In particular, look out for any less confident participant who might need more help or who lacks the confidence to ask for it.

Step 3: Distribution of handouts, tool bags and any additional materials (5 minutes)

Distribute handouts, leaflets, brochures and other materials to participants.

Step 4: Acknowledgments and close of training (5 minutes)

Thank the participants and any guests, and close the training with concluding remarks. Inform participants that there are other training sessions for mechanics which they may find useful, such as the training on self-propelled multi-crop reapers, the power tiller operated seeder and the axial and mixed flow pumps. Make sure participants know whom to contact with any follow-up queries, and how to do so.

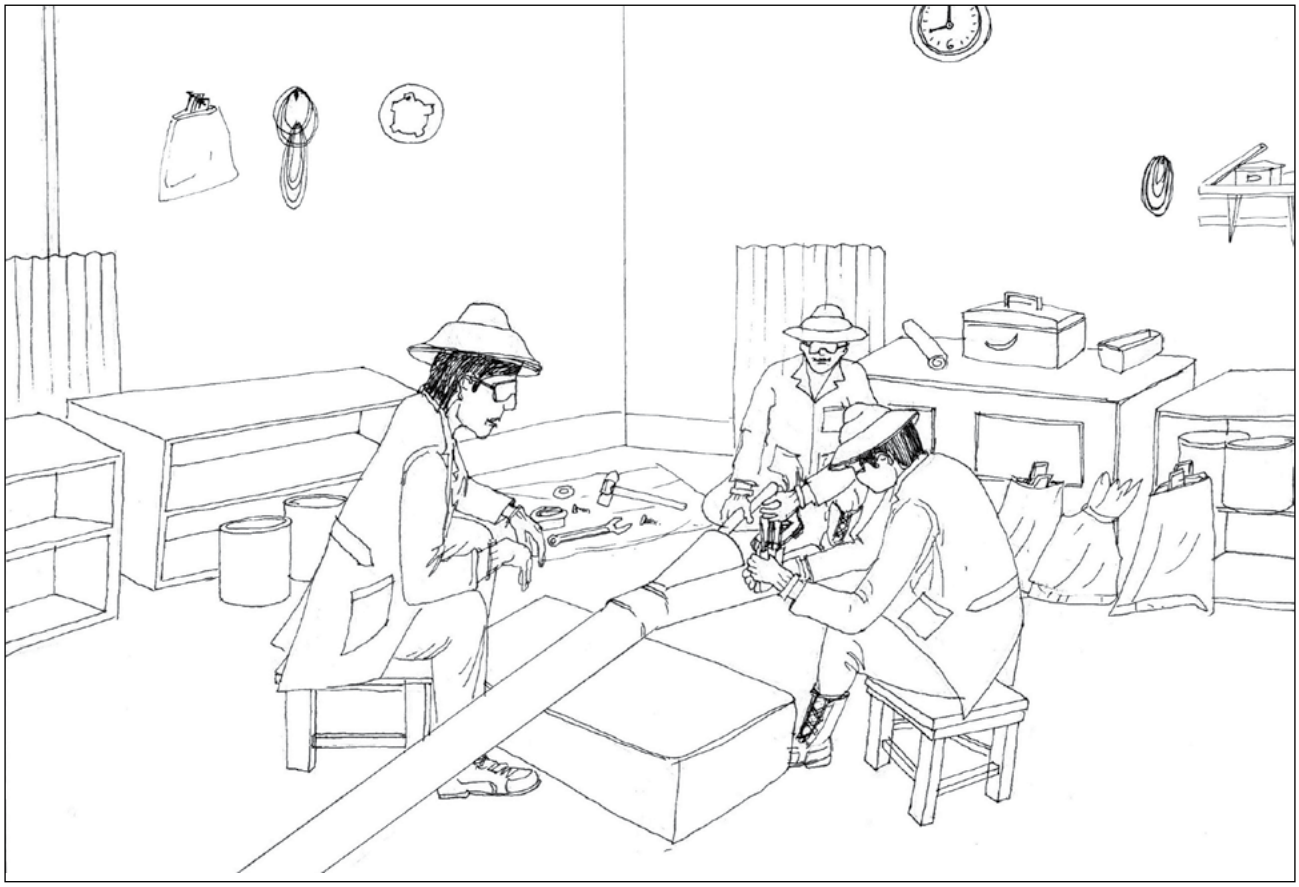
Flipcharts and handout materials*

* PowerPoint files of the flip charts in 'ready to present' format can be downloaded from here (for English language: https://bit.ly/2T7xcGj) or here (for Bangla language: https://csisa.org/wp-content/uploads/sites/2/2019/12/191204_BP-SP_190512-PP_BP-SP-smh.pdf).

Session 1

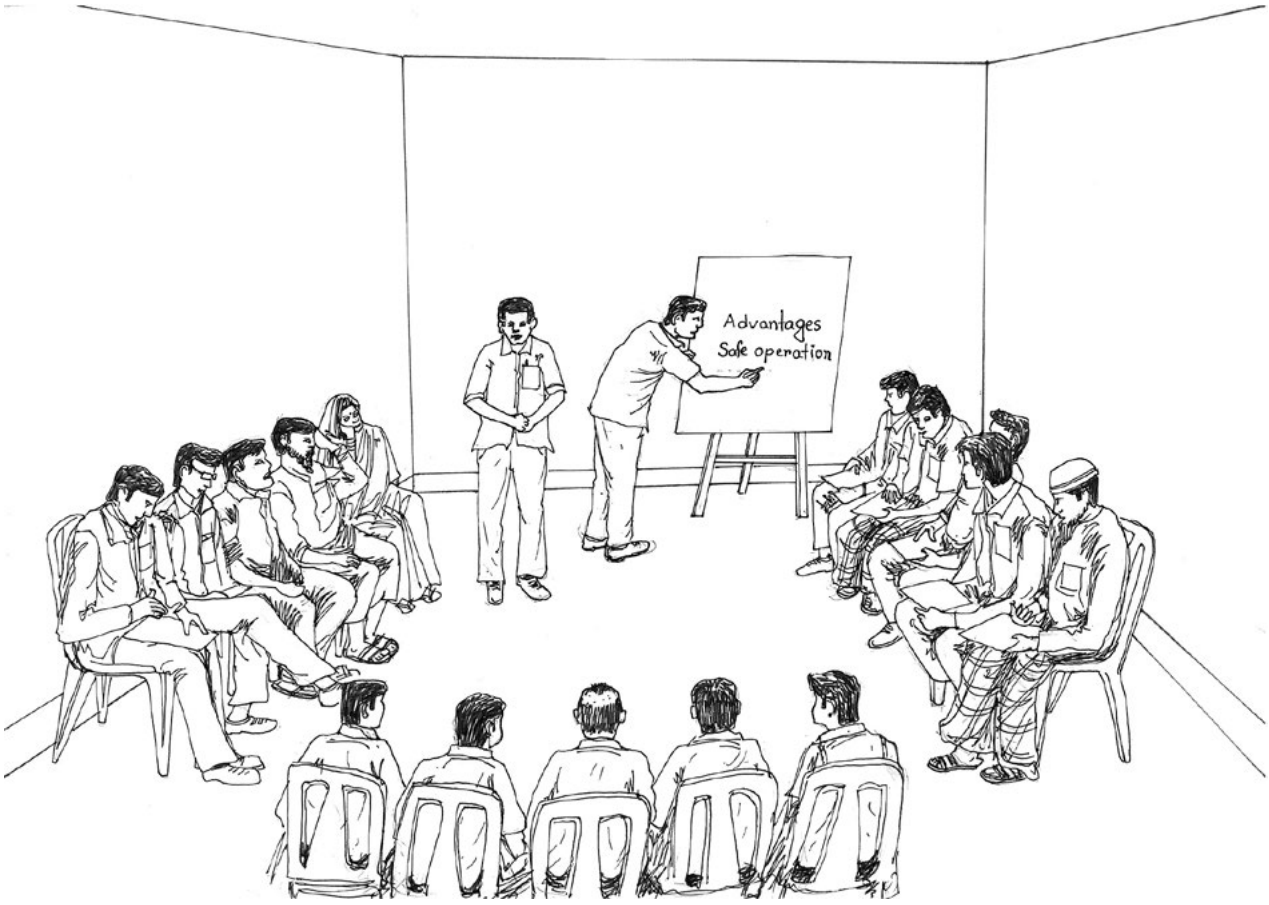
Introduction, training objectives and pre-training evaluation

Bed planter one-day training flipchart



What do you expect to learn from this training?

- In groups, discuss what you think you'll learn today.
- Choose someone from each group to speak for the group.
- Take notes.



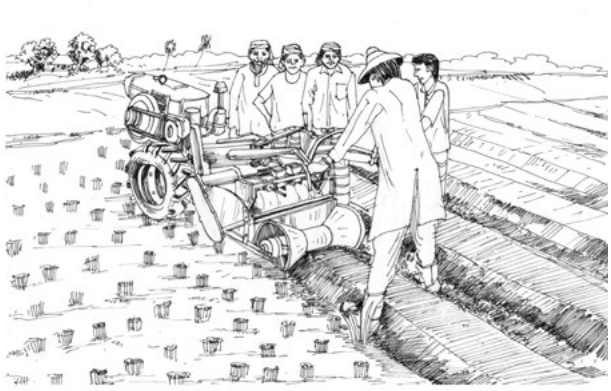
Today's sessions

1. Introduction, training objectives and pre-training evaluation
2. Main parts of the bed planter
3. Common causes of bed planter failure and breakdown – potential solutions
4. Common causes of bed planter failure and breakdown – practical troubleshooting
5. Review of key messages, post-training evaluation and close of training

What kind of training is this?

This is *participatory* training, so:

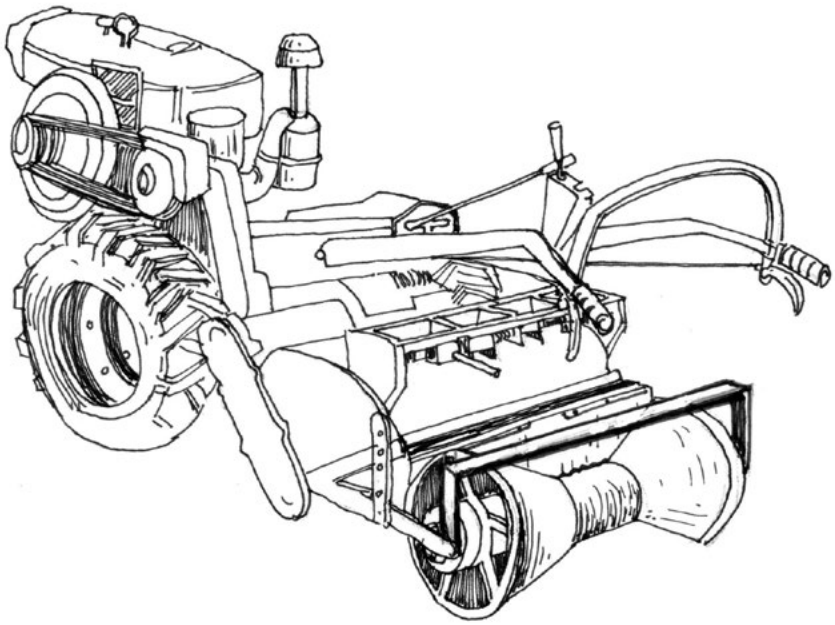
- Ask questions and speak up.
- Learn by experience – run a bed planter yourself and learn how to operate it.
- Learn by discussing each topic with your group.
- Speak up when the facilitator asks questions – and ask questions yourself. This way we can learn from each other.



What is a bed planter?

A bed planter:

- tills the soil and plants seeds at the same time
    - must be attached to a two wheeled tractor – usually a DongFeng or SiFeng
- has 24 blades for tilling the soil (16 are specially made and 8 are PTOS blades)
    - reduces the time needed to till and plant



- a field – only one pass, compared to the 2-4 passes a power tiller needs
- when used to plant farmers' fields, it can be profitable – both for the machine owner and the farmer!
- is usually 60 cm wide
- depth of tillage is adjustable
- usually weighs about 123.5 kg

What crops can be sown with a bed planter?

- wheat
- maize
- rice
- pulses (legumes)
- jute
- sesame
- sunflower
- barley
- vegetables, such as potato
- many other small and medium-sized crops

Different seeding mechanisms can be used with the machine for different crops.

Advantages of bed planting

- It can be used to plant raised beds.
- Crops are sown or planted in a line, enabling more efficient crop and weed management.
- One pass is enough for bed formation.
- Its use prevents short-term waterlogging of the plants.
- Its use saves time, seed and money.
- It facilitates judicious water use and drainage.
- Its use reduces turnaround time/ advanced sowing.

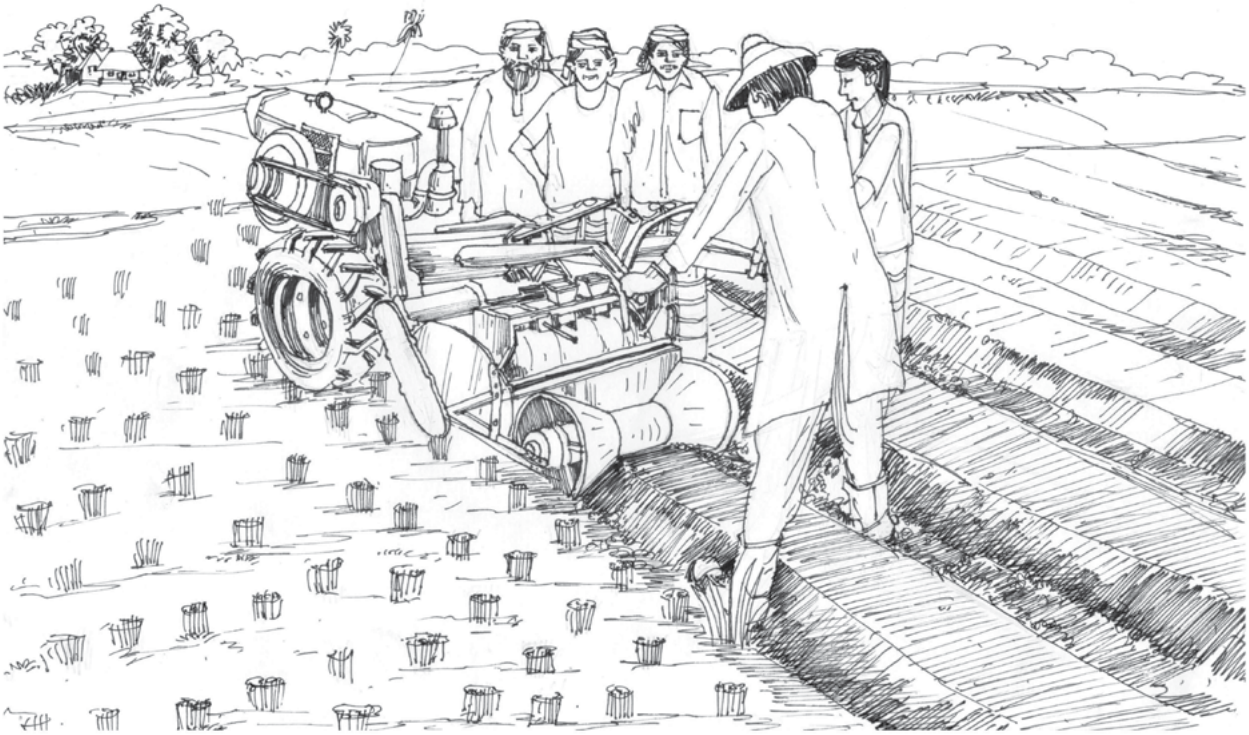
Please enjoy this training!

- Feel free to ask questions and to contribute your knowledge.
- Make sure you get time to practice putting together and dismantling the bed planter and its parts.
- Have fun!

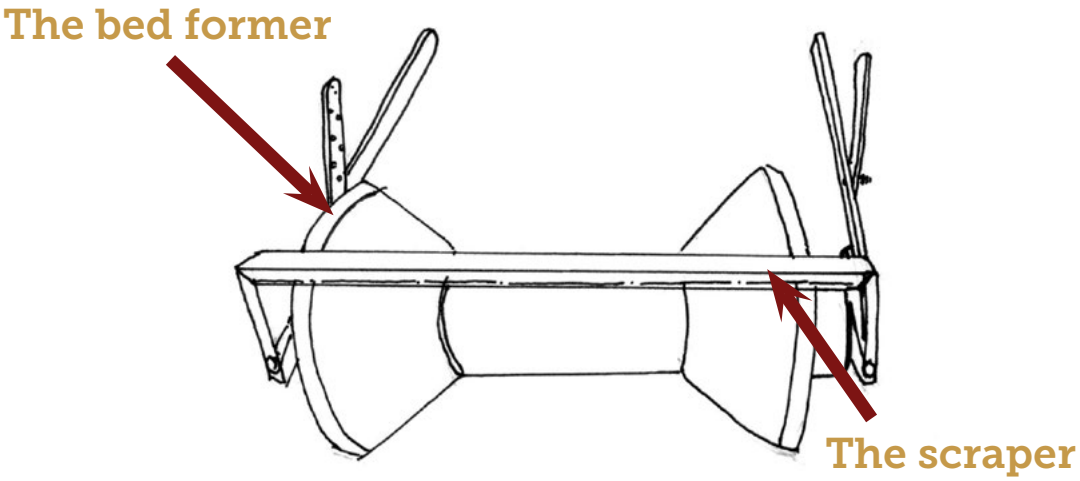
Session 2

Main parts of the bed planter and their functions

Bed planter one-day training flipchart



Main parts of the bed planter and their functions (1)



The bed former

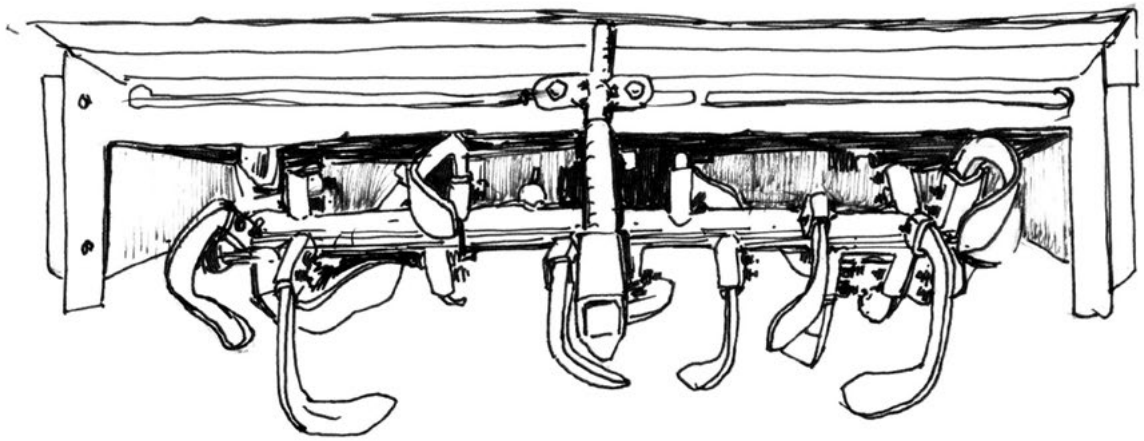
Functions: (1) makes beds of a specific shape and size (55-60 cm wide, 12-15 cm high); (2) covers seeds in the furrows (made by the furrow opener) with soil, then levels and compacts the soil.

The scraper

Function: cleans the soil/mud from the bed former with a scraping action.

Main parts of the bed planter and their functions (2)

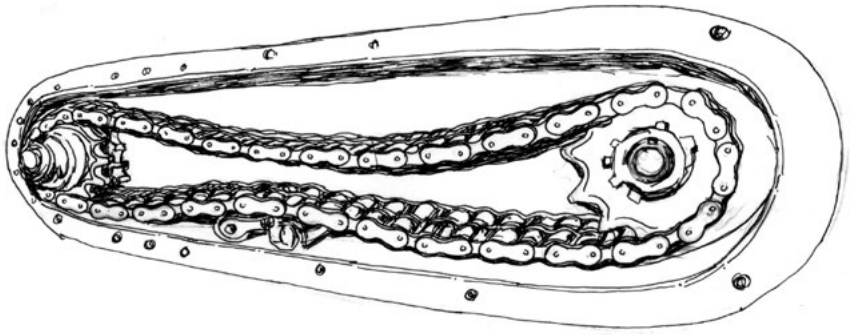
Tillage depth control bar: controls the depth of tillage by selecting the specific hole in this perforated bar
Mudguard: (1) prevents soil from dispersing all around, and (2) acts as a safety guard to keep the operator from being hit by clods of soil.



Rotavator
Function: rotates and thus tills the soil.

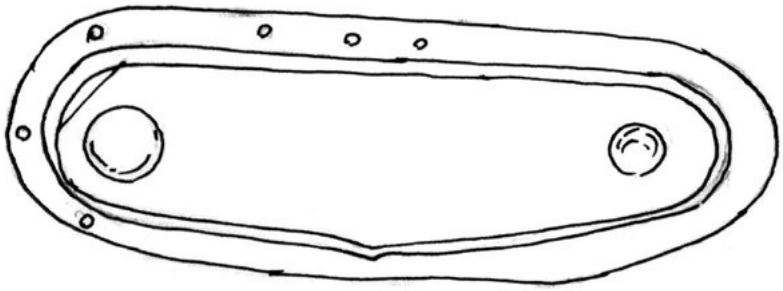
Main parts of the bed planter and their functions (3)

Rotavator chain-sprocket



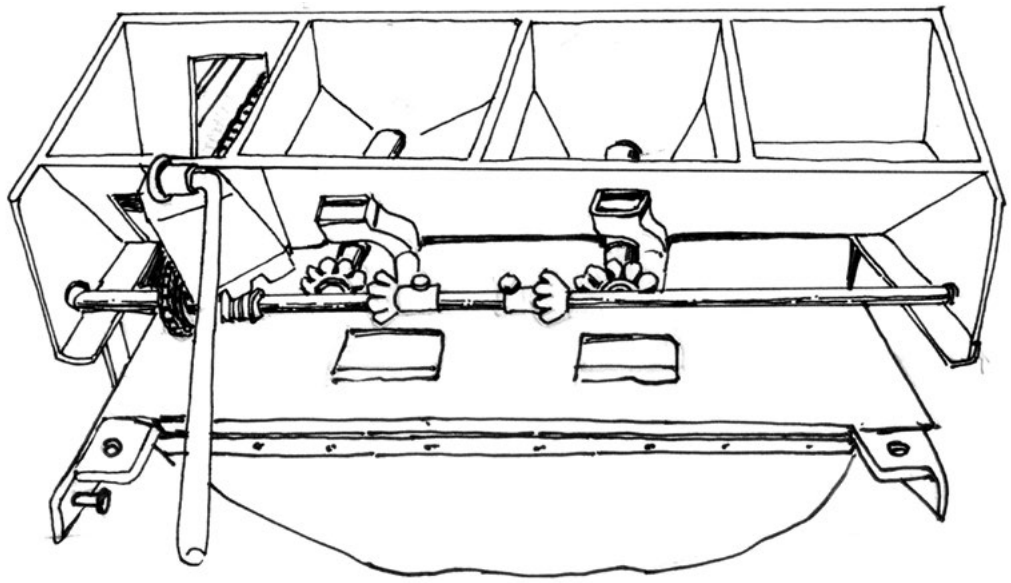
Function: transmits power from the seeder fertilizer drill gearbox to the rotavator.

Rotavator chain-sprocket cover



Function: protects the chain, sprocket and oil in the rotavator chain housing from dust, straw and other foreign particles.

Main parts of the bed planter and their functions (4)

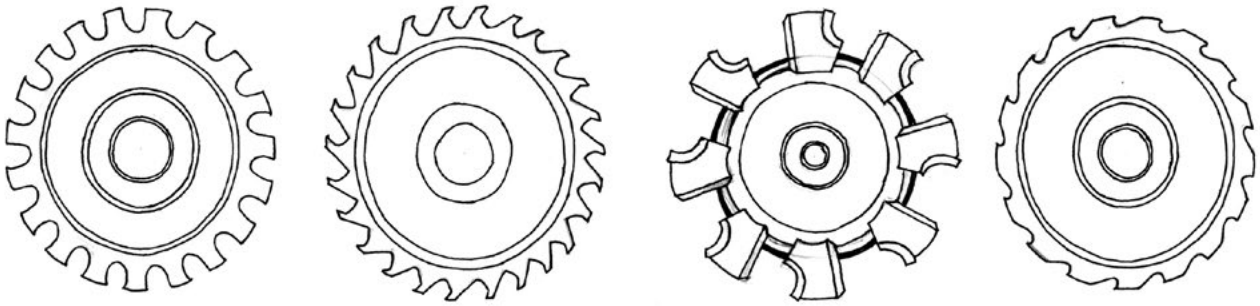


Seed-fertilizer boxes: seeds and fertilizers are kept in these boxes during the bed planting process.

Seed-fertilizer on-off clutch/lever: used to switch on and off the flow of seed and fertilizer to the seed and fertilizer tubes, respectively.

Seed-fertilizer meter

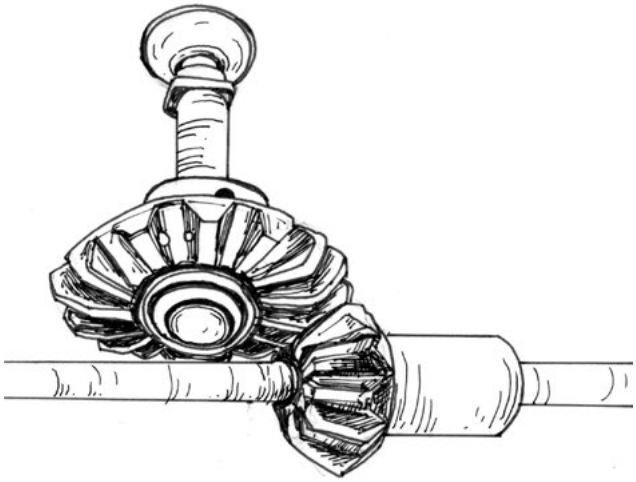
Function: meters seed/fertilizer and delivers it to the seed or fertilizer chute.

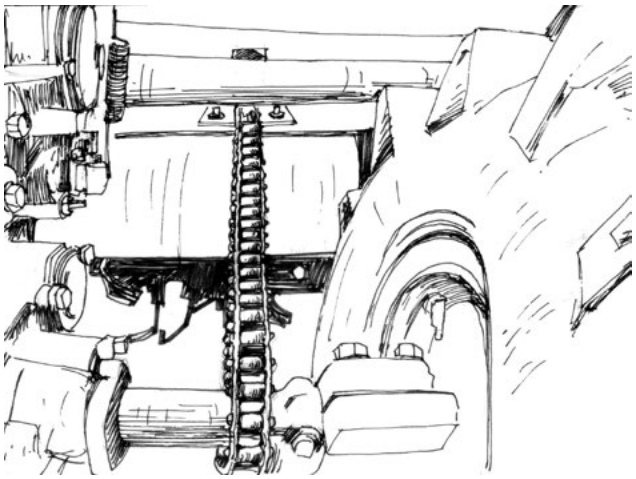


Above: inclined plate type meter

Main parts of the bed planter and their functions (5)

Seed metering/ bevel gear shaft Function: transmits power from the front wheel spindle to the seed metering device with the help of a chain.





Power transmission chain Function: transmits power to the bevel gear shaft from the front wheel spindle.

Review of key messages

The main parts of a bed planter are:

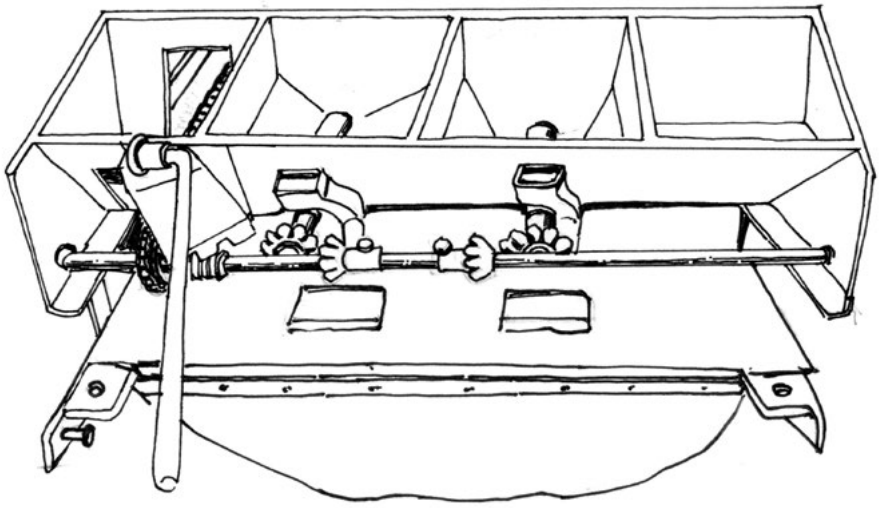
- bed former/shaper
- mudguard
- tillage depth control lever
- furrow opener
- rotavator
- rotavator casing
- rotavator chain-sprocket
- chain-sprocket cover
- seed box
- seed meter
- seed on-off lever
- seed metering shaft
- power transmission chain

Session 3

Common causes of failure and breakdown of the bed planter – potential solutions

Bed planter one-day training flipchart

Problem 1: Poor meshing of the gear pinion on the metering shaft



Symptoms:

(1) metering plate does not rotate properly; (2) there is an unusual gap between the gear and the pinion

Causes:

(1) jam in the metering system;
(2) long-term use

Effects:

poor or no seeding

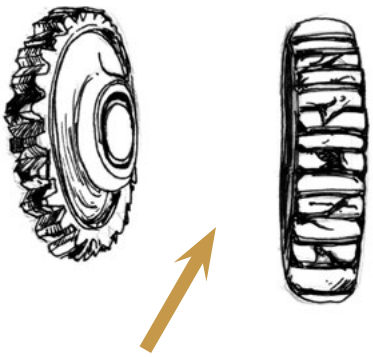
Solution:
(1) clean the metering system using diesel and apply lubricant as required; (2) straighten or change the shaft

Spare parts required: shaft

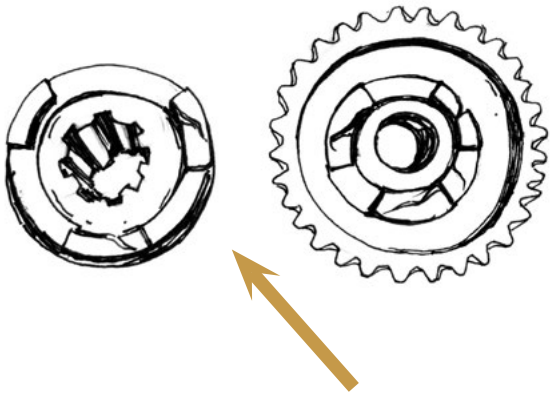
Where to get or make/repair spare parts:
collect a new one from a specialist machine parts dealer; have one made or repaired in a local workshop

Tools required:
hammer, pliers, dual wrench, adjustable wrench, screwdriver, flat/round filescrewdriver, hammer and puller

Problem 2: The gear teeth break and the gear sleeve becomes ineffective



unbroken teeth broken teeth



ineffective sleeve

Symptoms:

(1) the gear pinion slips and produces noise; (2) gear engagement is interrupted

Causes:

(1) overload on the gear pinion (due to tilling hard soil or tilling too deeply); (2) insufficient gear oil; (3) ineffective gear sleeves

Effects:
the bed planter fails completely and cannot be used

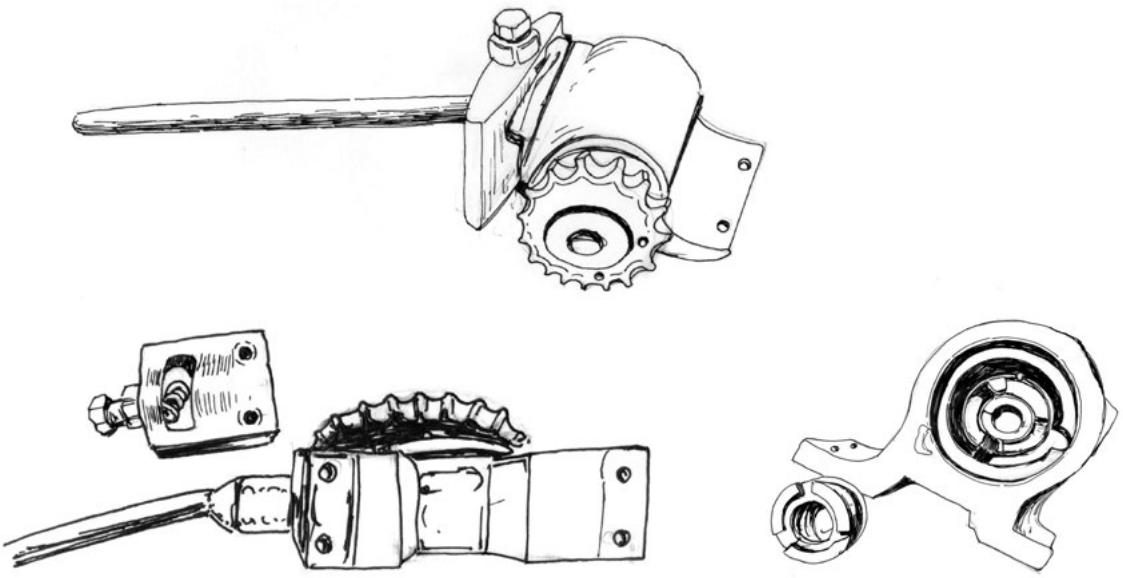
Solution:
(1) replace gears/pinion; (2) replace shaft/casing; (3) lubricate gears appropriately

Spare parts required:
oil seal, bearings

Where to get spare parts:
shop dealing in pump/engine spare parts

Tools required:
dual wrench, adjustable wrench, screwdriver

Problem 3: Seed on/off clutch does not work



Causes:

(1) clutch is worn out/broken; (2) clutch ball is worn out; (3) spring inside the clutch has loosened; (4) dog bush sleeves inside the pillow block are ineffective

Effects:

seed metering plates cannot be switched on or off

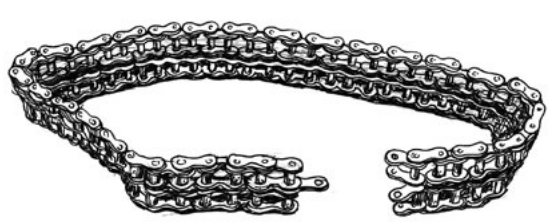
Solution:
(1) repair the faulty part and reset;
(2) replace the faulty part and reset;
(3) fit a new ball and spring

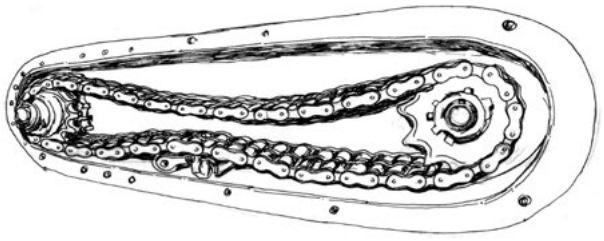
Spare parts required:
clutch ball, spring or clutch lever

Where to get spare parts or have them made:
at a specialist dealer, or shop dealing in power tiller parts; can be made in a local machinery workshop

Tools required:
duel wrench set, Phillips head/ flat head screwdrivers, adjustable wrench, Allen key

Problem 4: The rotavator chain and bearing break





Symptoms:

(1) rotary shaft does not rotate; (2) strange noise in the rotavator chain casing

Causes:

(1) inadequate gear oil in rotavator chain casing; (2) excessive load; (3) the bearing is wearing out; (4) incorrect chain tension

Effects:

(1) the rotary shaft stops rotating; (2) if not repaired in time, the rotavator chain casing may break

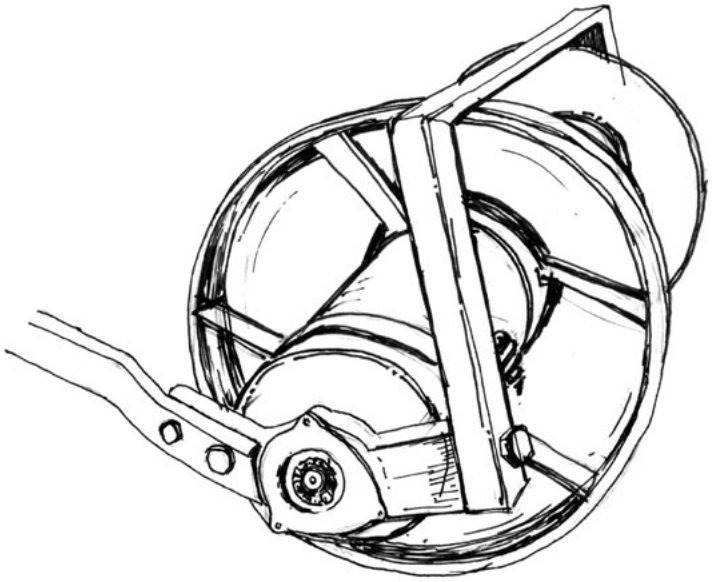
Prevention:
(1) make sure the gear oil level is maintained correctly at all times and replace as needed; (2) never overload the engine; (3) replace a worn or broken bearing immediately; (4) always maintain the correct chain tension using the chain tensioner

Spare parts required:
chain-link, chain, bearing, gasket

Where to get or make/repair spare parts:
from a dealer or shop dealing in spare power tiller parts

Tools required:
dual wrench, ring wrench, adjustable wrench, screwdriver, hammer, chisel

Problem 5: The bed former's bearings jam or become faulty



Symptoms:
the bed former does not move properly

Causes:
(1) rusting; (2) damage to the bearing seal; (3) bed former shaft is bent

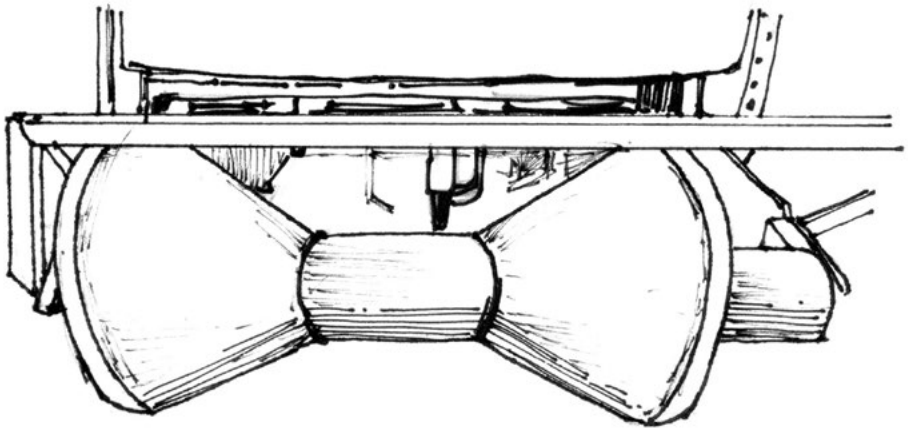
Effects:
(1) the bed former does not rotate freely, or (2) soil accumulates in front of the bed former during tillage resulting in a rough looking bed

Solution(s):
(1) remove the bearing and clean in diesel grease/oil (lubricant/Mobil), and (2) reset or replace bearing

Spare parts required:
bearing, cir-clip, paper gasket
Where to get spare parts:
local dealer

Tools required: duel wrench set, adjustable wrench, screwdriver, art paper cutter

Problem 6: Displacement of the bed former cone



Symptoms:
odd-looking, unexpectedly narrow or wide bed

Causes:
(1) size irregularity of the bed former;
(2) the tie of the cone is detached

Effects:
irregular bed shape and size

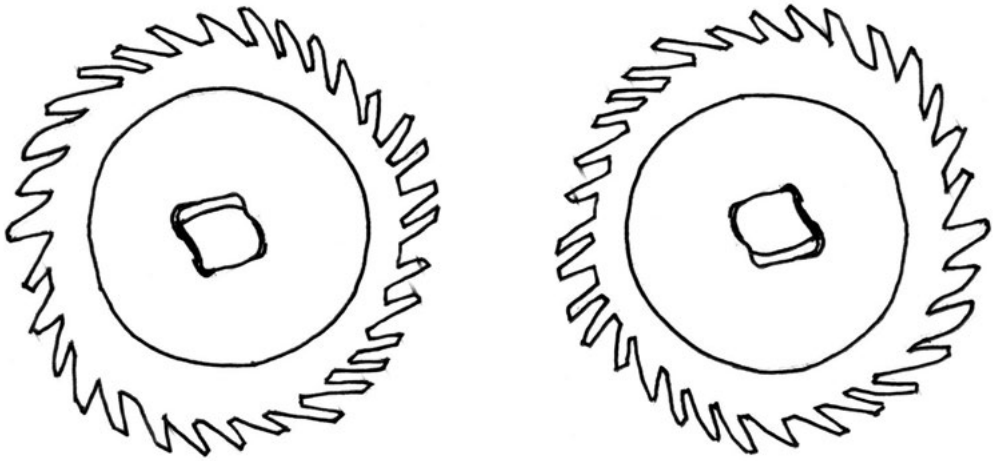
Prevention:
(1) re-adjust and tighten
(2) replace if necessary

Spare parts required:
mild steel (MS) sheet; MS flat bar

Where to get or make/repair spare parts:
purchase a replacement bed former from a selective dealer; repair/have a new one made at a local workshop

Tools required:
dual wrench set, adjustable wrench, hammer

Problem 7: The seed metering plate does not rotate and the seed fails to drop



Symptoms:

(1) the metering plate stops rotating;
(2) the seeds do not drop

Causes:

the central hole in the metering plate changes from rectangular to circular

Effects:

the operator is unable to meter the seed

Solution:
(1) replace the defective plate and set a new one; (2) bind a metallic pressure plate or plate-type washer with wire, by drilling the plate

Spare parts required:
wire, pressure plate/plate type washer, new plate

Where to get spare parts:
from a specialist plate supplier. Have the plate drilled locally and then join the pressure type washer with a wire hook

Tools required:
drilling/punching machine, pliers, chiselscrewdriver, hammer, puller and chisel

Session 4

Review of key messages, post-training evaluation and close of training

Bed planter one-day training flipchart

Review of key messages, post-training evaluation and close of training

- What are main parts of a bed planter and their functions?
- What are the major causes of failure and breakdown in a bed planter?
- What should you do if the seed on-off clutch stops working?
- Where can you get a replacement bed former?
- How would you address an issue with the hitching gears?
- What should you do if the seed metering plate stops working?

Annexes

Annex 1

Evaluation questionnaires and answers

Pre-training evaluation questionnaire

Venue:
(to be completed by the facilitator)

Batch:

Date:

Name: _____

Please check (√) or circle the correct answer **Total time: 10 minutes**

Question	Answer		
1. Which crops can be sown with a bed planter?	wheat, maize, rice, pulses,legumes, jute, vegetables-potatoes, sesame, sunflower, barley	all types of crops	sugarcane, sorghum
2. How many blades in the bed planter are for tilling the soil?	20	24	30
3. What kind of tractor is needed to attach the bed planter?	4-wheeled tractor	2-wheeled tractor	Both types of tractor
4. What is the function of a rotavator?	it rotates and tills the soil	covers seeds in the furrows with soil, then levels and compacts the soil	cleans the soil/mud from the bed former with a scraping action
5. What is the function of a seed metering/bevel gear shaft?	seed and fertilizers are kept in these boxes during the bed planting process	transmits power from the front wheel spindle to the seed metering device with the help of a chain	meters seed/fertilizer and delivers it to the seed or fertilizer chute
6. What may cause the seed on/off clutch not to work?	-clutch is worn out/ broken -clutch ball is worn out -spring inside the clutch has loosened	fit a new ball and spring	-repair the faulty part and reset -replace the faulty part and reset
7. What might cause the gear teeth to break?	-the gear pinion slips and produces noise; -gear engagement is interrupted	-overload on the gear pinion (due to tilling hard soil or tilling too deeply) -insufficient gear oil -ineffective gear sleeves	-the bed planter fails completely and cannot be used

(Continued on page 53)

(continued from page 52)

Question	Answer		
8. What happens when the bed former's bearings jam or become faulty?	the bed former does not move properly	damage to the bearing seal	the bed former shaft is bent
9. What is the solution, when the seed metering plate does not rotate and the seed fails to drop?	-the metering plate stops rotating	-the seeds do not drop	-replace the defective plate and set a new one and bind a metallic pressure plate or plate-type washer with wire, by drilling the plate
10. What is the operator's safety net during the operation of a bed planter in the field?	wear tight clothing and shoes	Wear shoes and loose fitting clothing	wear loose fitting clothing and go bare footed

Post-training evaluation questionnaire

Venue: **Batch:** **Date:**
(to be completed by the facilitator)

Name: _____

Please check (√) or circle the correct answer Total time: 10 minutes

Question	Answer		
1. Which crops can be sown with a bed planter?	wheat, maize, rice, pulses, legumes, jute, vegetables potato, sesame, sunflower, barley	all types of crops	sugarcane, sorghum
2. How many blades in the bed planter are for tilling the soil?	20	24	30
3. What kind of tractor is needed to draw the bed planter?	4-wheeled tractor	2-wheeled tractor	Both both types of tractor
4. What is the function of a rotavator?	rotates and tills the soil	covers seeds in the furrows with soil, then levels and compacts the soil	cleans the soil/mud from the bed former with a scraping action
5. What is the function of a seed metering/bevel gear shaft?	seed and fertilizers are kept in these boxes during the bed planting process.	transmits power from the front wheel spindle to the seed metering device with the help of a chain	meters meters seed/fertilizer and delivers it to the seed or fertilizer chute
6. Why might cause the seed on/off clutch not to work?	-clutch is worn out/ broken -clutch ball is worn out -spring inside the clutch has loosened	- fit a new ball and spring	-repair the faulty part and reset -replace the faulty part and reset
7. What are the causes that might break the gear teeth?	-the gear pinion slips and produces noise; -gear engagement is interrupted	-overload on the gear pinion (due to tilling hard soil or tilling too deeply) -insufficient gear oil -ineffective gear sleeves	-the bed planter fails completely and cannot be used
8. What happens when the bed former's bearings jam or become faulty?	the bed former does not move properly	damage to the bearing seal	the bed former shaft is bent
9. What is the solution, when the seed metering plate does not rotate and the seed fails to drop?	-the metering plate stops rotating	-the seeds do not drop	It can a -replace the defective plate and set a new one and bind a metallic pressure plate or plate-type washer with wire, by drilling the plate
10. What is the operator's safety net during the operation of a bed planter in the field?	wear tight clothing and shoes	wear shoes and loose fitting clothing	wear loose fitting clothing and go bare rooted
Overall training feedback from the participants			
Did you understand all the messages delivered by the facilitator(s)?)?	Yes/No	Partly	Fully
How do you rate the training?	Not very useful	Useful	Very useful
Do you feel confident that you can use the AFP/MFP profitably while also saving money for your farmer-clients?	Yes	Partially	Unsure

Answers to questions 1 to 10

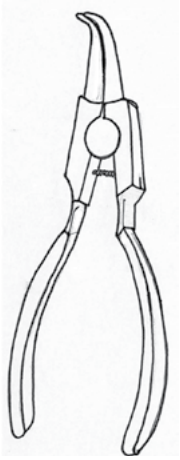
1. wheat, maize, rice, pulses-legumes, jute, vegetable-potato, sesame, sunflower, barley
2. 24
3. 2-wheeled tractor
4. rotates and tills the soil
5. transmits power from the front wheel spindle to the seed metering device with the help of a chain
6. clutch is worn out/broken, clutch ball is worn out and the spring inside the clutch has loosened
7. overload on the gear pinion (due to tilling hard soil or tilling too deeply), insufficient gear oil, ineffective gear sleeves
8. the bed former does not move properly
9. replace the defective plate and set a new plate and bind a metallic pressure plate or plate-type washer with wire, by drilling the plate
10. wear tight clothing and shoes

Annex 2

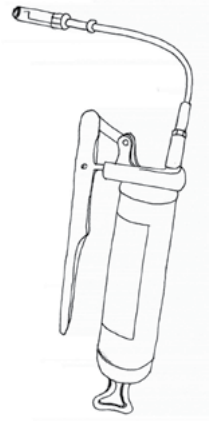
Common tools used to repair bed planters (1)

Adjustable wrench: An adjustable tool for gripping hexagonal nuts with an adjusting screw.

Hammer: A hand tool with a heavy head used for striking objects.

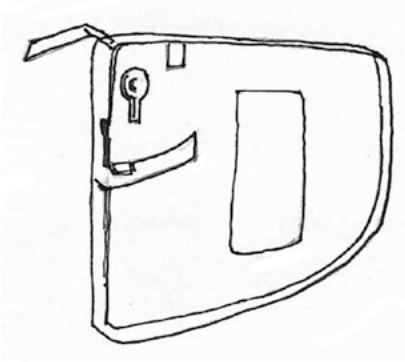


Pliers/cutting pliers: Used to grasp small objects, and to insert/extract or turn them. Pliers often have small cutting blades that can also be used to cut wire or other materials.

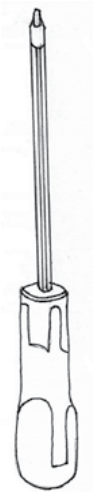


Grease gun: A common workshop and garage tool used to apply lubricant to machinery.

Common tools used to repair bed planters (2)



Measuring tape: A flexible scale used as a common measuring tool.



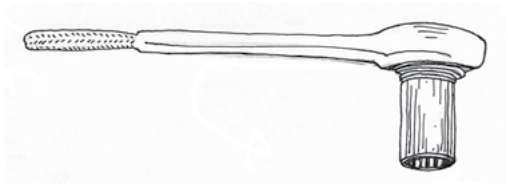
Screwdriver (star/Phillips head): Used to screw in or out screws with a + shape at the head of the screw.

Screwdriver (flat head): used to screw in or out screws with a flat – shape at the head of the screw.

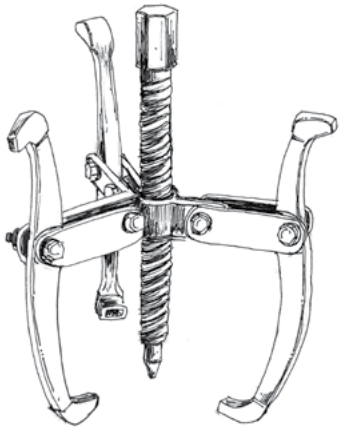
Dull wrench: Used to turn bolt heads to the left or right. This one has two ends, the circular one has the best grip.

Common tools used to repair bed planters (3)

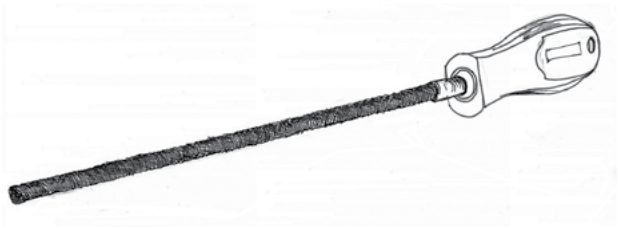
L-dull wrench: Used to grip bolt heads. This one has two gripping areas at each end.



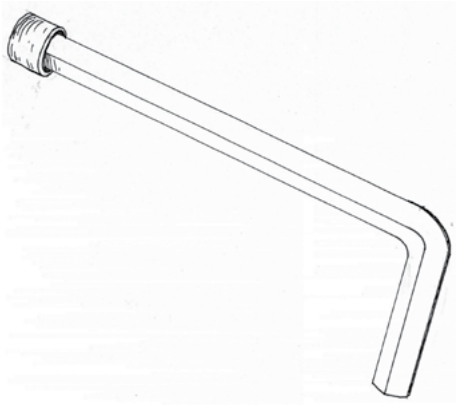
Rachet: Used to turn the head of a bolt in one direction but not the other. It makes it easy to tighten or loosen bolts without having to take off the tool each time (as with pliers or wrenches).



Three-jaw puller: Useful for removing components such as a gears, pulleys or bearings from a shaft.



Files (flat and round): Used to grind or file different metal parts to the shape required. They can be useful in difficult repair jobs.



Allen key (hex key) wrench set: Used to tighten or loosen bolts that have an 8-sided hex shape at the head of the bolt.

Notes:

Notes:

This set of training modules focuses on ensuring that mechanics are able to make repairs to the bed planter efficiently and correctly. This booklet is designed so that anybody who uses these materials can easily conduct training – even those with a limited background in and understanding of agricultural engineering or machinery. This training uses an experiential and hands-on modular format. It is based on a foundation of experiential and hands-on work, combined with discussion and reflection among participants.

This means that although the facilitator is instructed on how to carry out the training and how to present materials, the format in which this is done should be horizontal and participatory, with room for adaptation and modification. The technical materials included in this document should therefore be seen as a guide to supplement the already in-depth knowledge of the trainee mechanics. By the conclusion of the training module, participant mechanics will be well-equipped to repair bed planters as part of their ongoing agricultural machinery service-providing business. Nonetheless, users of this booklet should carefully read all the instructions on how to implement the training effectively in order to ensure the best learning experience possible for participants.

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