

Self-propelled multi-crop reaper for mechanics

*Experiential learning modules for sustainable
intensification and agricultural service provision*

BOOK II



Timothy J. Krupnik, Kamrun Naher, Kh. Shafiq Islam,
Md. Abdul Matin, Syed Mahmudul Huq, Shamim Ara Begum,
Muhammad Arshadul Hoque, Sheikh Md. Nazim Uddin, Scott Justice,
Khondker Murshed-E-Jahan, Md. Israil Hossain



Self-propelled multi-crop reaper for mechanics

*Experiential learning modules for sustainable
intensification and agricultural service provision*

BOOK II

Timothy J. Krupnik
Kamrun Naher
Kh. Shafiq Islam
Md. Abdul Matin
Syed Mahmudul Huq
Shamim Ara Begum
Muhammad Arshadul Hoque
Sheikh Md. Nazim Uddin
Scott Justice
Khondker Murshed-E-Jahan
Md. Israil Hossain



Cereal Systems Initiative for South Asia

SELF-PROPELLED MULTI-CROP REAPER FOR MECHANICS

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

Timothy J. Krupnik¹, Kamrun Naher², Kh. Shafiq Islam¹, Md. Abdul Matin³, Syed Mahmudul Huq¹, Shamim Ara Begum¹, Muhammad Arshadul Hoque³, Sheikh Md. Nazim Uddin⁴, Scott Justice^{5,6}, Khondker Murshed-E-Jahan⁷, and Md. Israil Hossain⁸

- 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 Research Institute (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.

This work is licensed under the Creative Commons Attribution 4.0 International License.



To view a copy of this license, visit <http://creativecommons.org/licenses/by/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA. The designations employed in the presentation of materials in this publication do not imply the expression of any opinion whatsoever on the part of CIMMYT or its contributory organizations concerning the legal status of any country, territory, city, or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries. The opinions expressed are those of the author(s), and are not necessarily those of CIMMYT or its partners. CIMMYT encourages fair use of this material with proper citation.

Correct citation: Krupnik, T. J., Naher, K., Islam, Kh. S., Matin, Md. A., Huq, S. M., Begum, S. A., Hoque, M. A., Uddin, S. M. N., Justice, S., Murshed-E-Jahan, K., Hossain, Md. I. 2020. Self-propelled multi-crop reaper for mechanics: *Experiential learning modules for sustainable intensification and agricultural service provision* (Book II). Cereal Systems Initiative for South Asia, Dhaka, Bangladesh: CIMMYT.

Cover and back cover photos: Md. Shahabuddin Shihab (cover) and Ranak Martin (back cover)

Drawings: S. M. Shaha Alam, Khaled Hossain, and Shabita Barma

Publication design: M. Shahidul Haque Khan, Md. Nazmul Islam Dulal

Editor: Frances Hunt

Published by: CIMMYT Bangladesh, House 10/B, Road 53, Gulshan 2, Dhaka 1212

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

Printed in Bangladesh. Published in 2020.

This publication was developed by the International Maize and Wheat Improvement Center (CIMMYT) as part of the Cereal Systems Initiative for South Asia (CSISA) project, which is made possible with generous support from the United States Agency for International Development Mission in Bangladesh and the Bill & Melinda Gates Foundation.

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 International 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 that 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.



USAID
FROM THE AMERICAN PEOPLE

BILL & MELINDA
GATES *foundation*

This publication was made possible through the support provided by the United States of Agency for International Development (USAID) and the Bill & Melinda Gates Foundation. The contents and opinions expressed herein are those of the author(s) and do not necessarily reflect the views of USAID, the United States government or the Bill & Melinda Gates Foundation, and shall not be used for advertising or product endorsement purposes.

Table of Contents

Introduction	1
Session 1 Introduction, training objectives and pre-training evaluation	7
Session 2 Major parts of the self-propelled multi-crop reaper and their functions	9
Session 3 Common causes of self-propelled multi-crop reaper failure or breakdown and possible solutions	11
Session 4 Common causes of self-propelled multi-crop reaper failure and breakdown – practical troubleshooting	13
Session 5 Review of key points, post-training evaluation and close of training	15
 Flipcharts and handouts	16
Session 1 – Introduction, training objectives and pre-training evaluation	17
Session 2 – Major parts of the self-propelled multi-crop reaper and their functions	26
Session 3 – Common causes of reaper failure and breakdown – possible solutions	35
Session 5 – Review of key messages, post-training evaluation and close of training	48
 Annexes	50
Annex 1 Evaluation questionnaires and answers	50
Annex 2 Common tools used to repair multi-crop reapers	53

* PowerPoint files of the flip charts in 'ready to present' format can be downloaded from here: <https://bit.ly/2T6Q9st> (for English language) or here: https://csisa.org/wp-content/uploads/sites/2/2019/12/191204_Reaper-mechanics-AM-smh.pdf (for Bangla language).

Introduction

The self-propelled multi-crop reaper is an innovative machine suitable for smallholder farmers growing small- and medium-grain crops like rice, wheat and barley. It can facilitate rapid and low-cost harvesting, and is of particular interest in areas where farmers lack sufficient labor or need to clear fields rapidly so they can replant the next crop. Its small size and ease of operation and movement makes it ideal for many farmers in South Asia, Southeast Asia and sub-Saharan Africa.

The self-propelled multi-crop reaper increases reaping efficiency, from 225 or more hours per hectare when manual labor is used, to about five hours per hectare. In South Asia in particular, where rice-wheat cropping systems are dominant, late rice harvesting also sets back dry season planting, and can cause large yield losses for the subsequent crop – for example, up to 57 kg per hectare lost per day when wheat is late planted. Use of the multi-crop reaper can thus save farmers time and money, and accelerate the turnaround time between crops.

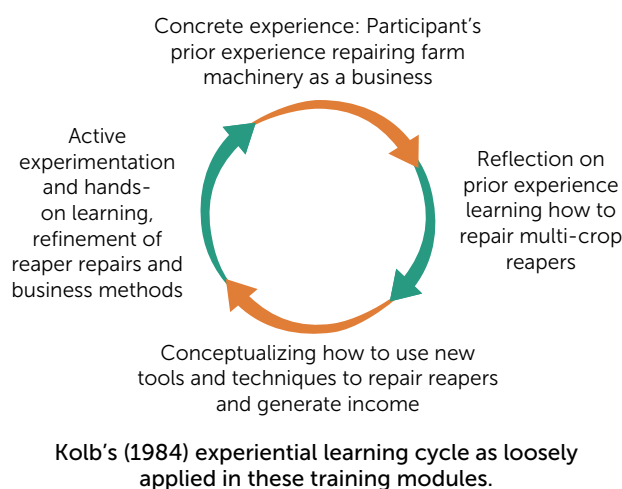
This set of training modules focuses on ensuring that mechanics are able to make repairs efficiently and correctly to self-propelled multi-crop reapers. It builds on other books in this series, and is designed so that anybody who uses these materials can easily conduct training – even those with limited background 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 self-propelled multi-crop reapers as part of their ongoing agricultural machinery servicing business. However, users of this book should carefully read all instructions on how to implement the training effectively in order to ensure the best learning experience possible for 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 is discussion-based and experiential, to encourage critical reflection and learning among participants. This means that although the materials need to be presented by a facilitator, the format in which this is done should be horizontal and participatory. We also underscore that farmers and agricultural machinery service providers – who are the target of this training – are experts: they work daily in their fields and have considerably more experience than most university-educated technicians, researchers or extension agents. Listening to their

opinions and working with them to facilitate learning is essential and will enhance the quality of a training session. In this sense, it is the responsibility of the training facilitator to elicit training participants' input, opinions and ideas, and to use them interactively to shape discussion and learning. The technical materials included in this document should therefore be seen as a guide to supplement the already in-depth knowledge of the trainee farmers and agricultural machinery service providers.

The training format used here is based loosely on the experiential learning cycle described by Kolb (1984)¹, who proposed that adults learn differently than children, with learning based on having a concrete experience, reflecting on this experience, conceptualizing this experience, and then experimenting, after which the cycle of learning is repeated. He further hypothesized that there are generally four types of adult learners and learning styles which should be accommodated: those who learn by watching demonstrations (whom he 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 discussion, reading or visual materials, hands-on experiential and experimental opportunities, and opportunities to watch demonstrations and to learn. 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 learning. In this training, we loosely attempt to formulate Kolb's learning styles, as shown below.



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

Therefore, at every step of the process, facilitators should work to generate discussion and hands-on learning through practical activities, to provide opportunities to demonstrate the reaper and show participants how to use it, and to encourage critical but constructive reflection among the training participants. There is a certain art to this process, and facilitators should practice beforehand with their peers different techniques for eliciting discussion among trainees.

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 simply asking participants "How do you repair a broken cutter bar?", ask "Why is it important that a cutter bar works properly and how can you most efficiently repair a broken bar?" 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 ask participants "What is the benefit of cost-effective reaper repair?", ask "How can you arrange your mechanic business to serve customers with reapers, and how can you show potential clients how you can be of benefit to them?"
- 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 provide an 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 it. If, however, a particular participant is naturally quiet or reserved, avoid asking them 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 ensure that participants are equipped to respond to specific and relevant questions.
- 6. Provide space for under-represented students to speak.** In many training courses, men speak over women or dominate conversation. Members of a particular religious group or caste may also speak over those who are not part of their group. Facilitators should recognize this, and work to give

space to under-represented groups to learn and to speak out. This may require giving individuals an opportunity to contribute by asking other participants to wait to reply.

The field is the best classroom for learning

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 machinery safely and effectively. It is only by calibrating the self-propelled multi-crop reaper for different crops that trainees can learn how to benefit from it. To facilitate this, the flipchart material provided in this book can be printed on large paper and taken to farmers' fields, where electricity for PowerPoint presentations or other formats may not be available.

Emphasis should be given to these participatory activities throughout the training. Last but not least, training and education do not end at the conclusion of the day. Participants should be encouraged to experiment with, learn from, modify and adapt the training techniques and approaches to repair in their own mechanic businesses, emulating the cycle of continual learning articulated by Kolb. For this reason, training facilitators should share their contact information with training participants so they can backstop and assist with technical matters when needed.

Organization of this book

This book is organized as follows: after a general introduction to the training format and style, and materials needed for a one-day training course, an introduction and four independent learning sessions are presented, each covering a different topic, as follows:

1. Introduction, training objectives and pre-training evaluation
2. Main parts of the self-propelled multi-crop reaper and their functions
3. Common causes of failure or breakdown – possible solutions
4. Common causes of failure or breakdown – practical troubleshooting
5. Review of key messages, post-training evaluation and close of training

Instructions are then given to the training facilitator on how to implement each session. This includes a review of the learning objectives, key messages, required

materials and step-by-step instructions on how to conduct the training session from start to finish, while working to encourage experiential learning as articulated above. Each session includes a component during which the facilitator is expected to give a brief presentation on the topic. Presentations are intended to be discussion-oriented, so 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 for each of these presentations. Facilitators should simply follow the flipcharts and use the materials presented to initiate discussion and make sure 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. Flipchart sessions should be conducted in the field and not in a classroom. The same flipcharts are also intended to be printed on normal-sized paper, stapled together and provided as handouts and reference material for participants.

Lastly, training should begin with a pre-training evaluation of participants' knowledge, and end with a post-training evaluation of their knowledge at the end of the day. The change in participants' scores gives an indication of their progress in learning. Ready-made pre- and post-training evaluation questionnaires are provided in Annex 1. Simply print them on regular-sized paper for use.

Training aims and objectives

The aims of this training are to (1) increase participants' knowledge of the common causes of reaper failure and breakdown experienced by farmers and service providers, and (2) improve their skills in repairing the machine effectively and efficiently, with an emphasis on operating a viable rural business providing a self-propelled multi-crop reaper service to farmers.

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

- understand and explain the usefulness of the self-propelled multi-crop reaper;
- identify the major mechanical parts of the self-propelled multi-crop reaper and state their functions;
- identify and explain the most common causes of the failures/breakdown of multi-crop reapers;

- select the appropriate spare parts and tools/workshop facilities needed to repair the reaper;
- demonstrate an awareness of where to buy spare parts; and
- demonstrate that they can repair the machines effectively and efficiently.

Whom is this training designed for?

Mechanics with experience repairing multi-crop reapers. Those with experience repairing two-wheeled tractors and motorcycles can also be considered (the reaper engine is similar to that of a motorcycle). They should be already running a business and have an interest in agricultural machineries.

Key considerations for training

Key considerations for planning, preparing and organizing are given below. The facilitator(s) should prepare well in advance (at least three weeks before the start of the training), reading each section carefully to make sure the training is implemented effectively and efficiently. The information presented here is 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 not exceed six. They should be mechanics who have experience (or who are interested in) providing mechanical repair services for reaper machine users. 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 to work, for example, under a tree. This outdoor area should be no more than a five-minute walk away from the place where participants meet at the start of the day. The space should be free from outside distractions. No seating is required, either for participants or for the facilitator(s), as the majority of this training is hands-on and practical – participants should be active!

Training aids

At least one month before the training is due to start, please review the detailed list of training aids below. Get together all the materials needed well before the training starts.

Facilitator(s)

If possible, an experienced local mechanic with the capacity to train others should be selected to assist in facilitation of the training, after having passed a training course that familiarizes them with (1) the principles of experiential learning, and (2) the training module and sessions. If not available locally, help may be taken from other research or extension institutes, or from machinery manufacturers. 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 easily repair a self-propelled multi-crop reaper without having to refer to printed instructions. The key point is that the person who facilitates the training should be well-versed in how to lead an effective interactive and experiential learning-based training, as well as being a knowledgeable mechanic him or herself.

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.

Additional expert support

If possible, the facilitator should locate an experienced local mechanic to attend the training day and assist with Session 4. Again, start to look for this person well in advance.

Date of training

The date of the training should be decided following discussion and agreement with trainees to ensure their participation. It should be scheduled preferably 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 and go to the area allocated for training, which ideally should be outside or in a covered area near a field where participants can run and work on the self-propelled multi-crop reapers that this training provides. Registration should be completed before training begins, up to a maximum of 15 participants.

Group formation

As part of the introduction, the facilitator should divide participants into three groups. Ideally there should be five participants per group; however, the number of groups or number of participants per group may vary depending on (1) the total number of participants,

and (2) the number of self-propelled multi-crop reaper machines available. Working in smaller groups ensures a more action-oriented, hands-on approach to learning. Generally, four to five people should be assigned to one machine. Arrange any seating so these small groups can sit with one another. Participants will remain in the same group throughout the day, to take part in discussions, question-and-answer sessions, demonstrations and exercises. Do not set up the seats in classroom style; circular seating should always be used.

Participatory, experiential, and hands-on learning

The training approach should be participatory, with an emphasis on hands-on and experiential learning. This is why it is important to limit participant numbers relative to how many self-propelled multi-crop reapers are available, as each trainee should get an opportunity to have hands-on experience operating the machine. The facilitator should utilize techniques designed 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 the trainees find it useful and valuable, rather than a waste of their time. To achieve this goal, the facilitator should work to ensure that the training is enjoyable (using games, quizzes, sing-along sessions, or other techniques to get trainees motivated and involved). One-way lecture formats are not acceptable and are discouraged as they reduce participants' potential to learn effectively through discussion and experience. The facilitator should arrange a short break (about two minutes) after each ten minutes of presentation, discussion and/or 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

Pre-training evaluation at the start of the training and post-training evaluation at the end of the day are important and required to judge effective learning. Pre-and post-training questionnaires are provided in Annex 1.

Course preparation, duration, materials and setting

This course is designed for a one-day training session of approximately 6.5 hours (excluding lunch and breaks), including 2 hours and 30 minutes of discussion and review, and about 4 hours of demonstration and practical exercises (Session 4). This is an intensive course and should be held in the field, 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). Times should be kept flexible depending on the needs of the participants – some sessions may be shorter than allowed for, others may take longer. This is why it is important to remain flexible.

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

Session	Topic	Approximate duration (minutes)
1	Introduction, training objectives and pre-training evaluation	50
2	Main parts of the self-propelled multi-crop reaper and their functions	30
3	Common causes of self-propelled multi-crop reaper failure or breakdown – possible solutions	70
4	Common causes of self-propelled multi-crop reaper failure or breakdown – practical troubleshooting	240
5	Review of key points and messages, post-training evaluation and close of training	45

Required training aids

- ✓ 2 toolboxes, each containing: dual wrench set, adjustable wrench set, pliers, at least 1 flat and 1 Philips head screwdriver, measuring tape, Allen key (hex key) wrench set, hammer, three 10" jaw pullers, oil, grease gun, files, cloth, common sizes of nuts and bolts, chalk, and other common hand tools (see Annex 2)
- ✓ diesel (two liters), gasoline (two liters), grease (0.25 kg), lube oil (1 liter)
- ✓ rugs (*jhuts*) to sit on and work from, and to catch any spillages
- ✓ flipcharts for sessions 1-3 and 5
- ✓ flipchart stand, whiteboard, whiteboard markers, permanent markers
- ✓ 2 used self-propelled multi-crop reapers
- ✓ faulty or broken reaper parts (if available)
- ✓ 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 trainers and the other participants
- state the objectives of the training
- understand the rules of the training, and their responsibilities as participants
- understand the role(s) and responsibilities of the trainers
- assess their pre-existing knowledge of the training content

Key messages to convey to participants during this session

- The training comprises an introductory session and four instructional sessions.
- This training is participatory – both trainers and trainees learn from each other.
- The training is mostly hands-on – participants learn by doing.
- Participants take part in the pre-training evaluation process.
- Participants should be attentive in the class and participate either individually or in groups in each task/assignment/exercise.
- Participants and facilitators must keep their mobile phone switched off.

How to conduct this session

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

- the flipchart *Session 1: Introduction, training objectives and pre-training evaluation*
- a notebook, pen and pre-training evaluation questionnaire for each participant
- two or three sheets of poster paper and a marker pen (or a whiteboard and whiteboard pen)

Step 1 – Form groups (5 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 richer and more entertaining learning experiences.

An ideal size is a total of 10-15 participants, divided into smaller groups.

The training facilitator divides the participants into groups of three by asking them to number themselves 1, 2, 3 recurring 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 the facilitator can assess with each participant individually during registration. Also, try to ensure that someone in each group is competent in basic mathematics and calculations. This will be important later on when learning about machine calibration and business models.

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, or currently repairing motor engines for motorcycles or tractors, or being interested 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 new group participants 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 module. It will also help the facilitator(s) be better equipped to deliver a successful learning experience throughout the training.

During the introduction to the training module, 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's an example:

"Hi, my name is Hera. Our group is expecting to learn how to fix a seized motor on a reaper, and how to make new teeth for the reaper. 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 or not (and if not, why) their expectations will be covered in the course.

Step 3 – Introducing the training (10 minutes)

Use flipchart *Session 1: Introduction to the training course* 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 trainers and participants to ask questions.

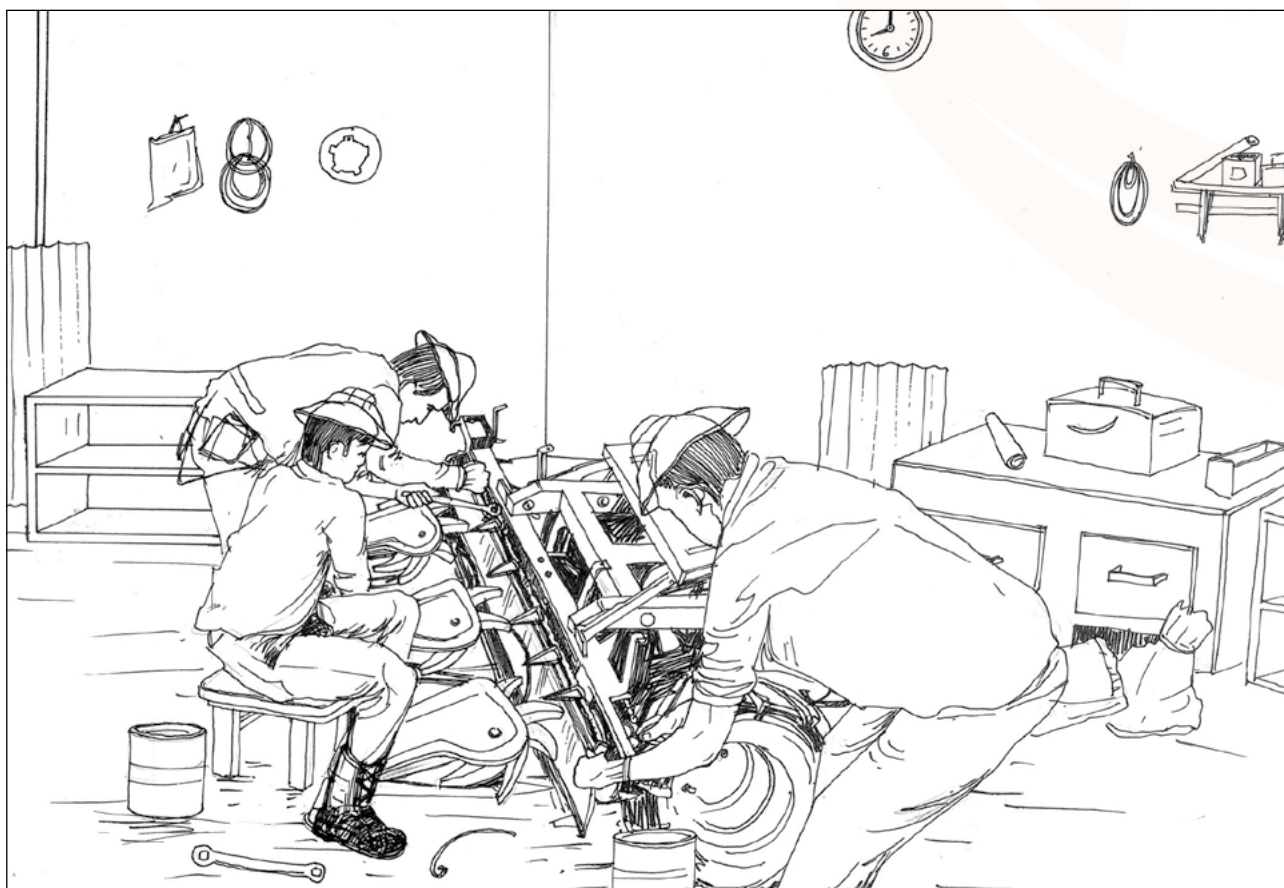
Step 4 – Pre-training questionnaire (25 minutes)

Distribute one pre-training questionnaire (see Annex 1) to each participant and allow around 20 minutes to complete it. If needed, the facilitator should help less literate participants to understand and answer the questions. The test can also be printed out and put up on flipchart paper. Collect the answers; they will be compared with the post-training questionnaires at the end of the training. They should be corrected before the end of the day, prior to the closing session, and handed back to participants.



Session 2

Main parts of the self-propelled multi-crop reaper and their functions



Learning objectives

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

- identify the main parts of a reaper
- understand and state the function of each part

Key messages to convey to participants throughout this session

The main parts of a self-propelled multi-crop reaper include the following:

- | | |
|------------------------------|------------------------------|
| • splitting cover/divider | • bevel gearbox |
| • splitting bracket | • main gearbox |
| • pressure spring | • wheels |
| • star wheels | • belt and pulley |
| • lug chain/forwarding chain | • throttle lever |
| • blade/cutter | • turning clutch |
| • blade binder | • gear changing lever |
| • cutter bar/flat bar | • lug spring/pressure spring |

How to conduct this session

For this session you will need the *Session 2: Major parts of a multi-crop reaper and their functions* flipchart, blank sheets of poster paper/whiteboard, whiteboard stand and two or three whiteboard pens.

Step 1 – Generate reflection and discussion (20 minutes)

Show the participants a used, old self-propelled multi-crop reaper machine and initiate the session using the ice-breaking question-and-answer technique.

Ask: *Can anyone name the main parts of a reaper and their functions?*

Encourage one or two participants to answer the question. Listen carefully and list the parts mentioned on poster paper or a whiteboard.

Step 2 – Generate discussion and learning (10 minutes)

The facilitator leads a discussion, (1) introducing the functional/main parts of a self-propelled multi-crop reaper (by pointing them out on the machine) which were either not identified correctly or not identified at all by the trainees, and (2) using the Session 2 flipchart to explain their functions.

Name of part	Functions
Splitting cover/divider	Divides, compresses, guides or distributes a regulated quantity of the standing crop towards the cutter blades when the machine moves forward
Splitting bracket	Hitches the splitting cover firmly to the main frame of the machine
Pressure spring	Holds the stems of the crop being harvested upright and exerts pressure on them to enable precise cutting
Star wheels	Guide the harvested crop into the machine, to the gap between the mainframe and the pressure spring, so it can be cut efficiently
Lug chain/forwarding chain	Helps the rotating star wheel to move in a specific direction; it also throws the harvested crop to one side of the machine
Blade/cutter	Cuts the stems of the crop being reaped
Blade binder	Aligns the upper and lower cutter bar/flat bar correctly
Cutter bar/flat bar	Holds the cutting blades (these look like teeth and cut the stalks of the crop being reaped)
Bevel gearbox	Transmits power from the engine to the cutter bar/flat bar
Main gearbox	Transmits power from the engine to the wheels (which move the reaper backwards and forwards)
Wheels	Enable the reaper to be moved around
Belt and pulley	Supply power from the engine to the gearbox
Throttle lever	Controls the engine speed
Turning clutch	Turns the reaper to the left or right
Gear changing lever	Used to change gears when turning the machine to the left and right

Session 3

Common causes of self-propelled multi-crop reaper failure or breakdown and possible solutions

Learning objectives

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

- understand and explain the common causes of failure/breakdown of the self-propelled multi-crop reaper
- make repairs and adjustments efficiently

Key messages to convey to participants during this session

- Star wheels can break if they are mishandled, overloaded (with too much crop residue caught between the wheels) because of excessive use, used on excessively wet crops, or because of material failure.
- The cutting bar can break if it jams because of material failure, or if the clearance between the blade and ledger plate is sub-optimal.
- The cutting blade can break if its teeth come into contact with hard objects (e.g., bamboo, wood or stones) during reaping. It can also break if the cutter bar/flat bar jams.
- If the chain in the transmission gearbox snaps, the cutter bar/flat bar will not move right or left and the reaper will break down completely.
- The lug spring (which is really an extended wire that is tensioned) can bend, altering the gap between the lug spring/wire and the lug chain/forwarding chain cover (or guard), which will result in poor reaping. This happens because of mishandling by the operator, loosening or aging of the nuts and bolts, or loosening of the spring.

How to conduct the session on *Common causes of reaper failure or breakdown – possible solutions*

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

- the flipchart *Session 3: Common causes of reaper failure or breakdown – possible solutions*
- faulty/broken reaper parts (if available)
- spare parts (if available)
- blank sheets of poster paper/whiteboard
- whiteboard stand, two or three whiteboard pens.

Step 1 – Initiate reflection and discussion (20 minutes)

Initiate the session through a warm-up question-and-answer session.

Ask: What are the common causes of self-propelled multi-crop reaper failure and breakdown?

What are the problems that service providers or farmers complain about to you?

What are the causes of these failures/breakdowns?

Encourage one or two participants to answer each question. List the most common causes of failure and breakdown on the whiteboard and rank them based on the consensus of the trainees. Focus on participants who are quiet or do not appear confident about solving the problems.

Encourage participants to discuss their experience solving each of the problems. Check whether the solutions are on the Session 3 flipchart. If not, make a note of this, as it will be necessary to return to this topic and discuss it with the group during the next session.

Step 2 – Demonstration of common faults, repairs and storage (30 minutes)

If available, an experienced mechanic should demonstrate: (1) the faulty parts of the machine and how to repair or replace them, and (2) how to maintain and store the reaper. If a mechanic is not available, an experienced service provider should be engaged;

otherwise, only highly experienced facilitators with adequate mechanic skills and knowledge of machinery should complete this part of the training.

Step 3 – Quick review (20 minutes)

At the end of the session, bring participants together in their groups and ask each group five to ten questions. Each participant should be encouraged to answer one or two questions. If they are unable, encourage other members of their group to answer. If none of the participants of any one group can answer, pass the question on to the next group.

Session 4

Common causes of self-propelled multi-crop reaper failure and breakdown – practical troubleshooting

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 (those which most commonly fail/breakdown) of the reaper
- be able to resolve common failures/breakdowns by repairing the relevant parts or replacing them efficiently

Key messages to convey to participants during this session

Common causes of failure and breakdown of the self-propelled multi-crop reaper include:

- Star wheels can break due to: (1) mishandling, (2) being overloaded, (3) bearings jamming, or (4) straw jams not being cleared away regularly.
- The flat bar (which the cutting blades are riveted to) can break due to: (1) coming into contact with hard objects during operation, (2) straw jams not being cleared away regularly, or (3) the gap between the blade and ledger plate being smaller than required (0.5 mm).
- The chain in the transmission gearbox can break due to: (1) lack of proper lubrication, or (2) the gearbox being overloaded because of a straw jam.
- The cutting blade can break if (1) hard objects get into the blade areas during operation, (2) straw jams around the cutter bar/flat bar are not cleared away regularly, or (3) the gap between the blade and ledger plate is too small (less than 0.5 mm).

- The lug spring (which is really an extended wire that is tensioned) may bend, altering the gap between it and the lug chain/forwarding chain cover/guard, because of: (1) mishandling, (2) loosening of nuts and bolts, or (3) the spring losing its strength.

How to conduct the session on *Common causes of self-propelled multi-crop reaper failure and breakdown – practical troubleshooting*

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

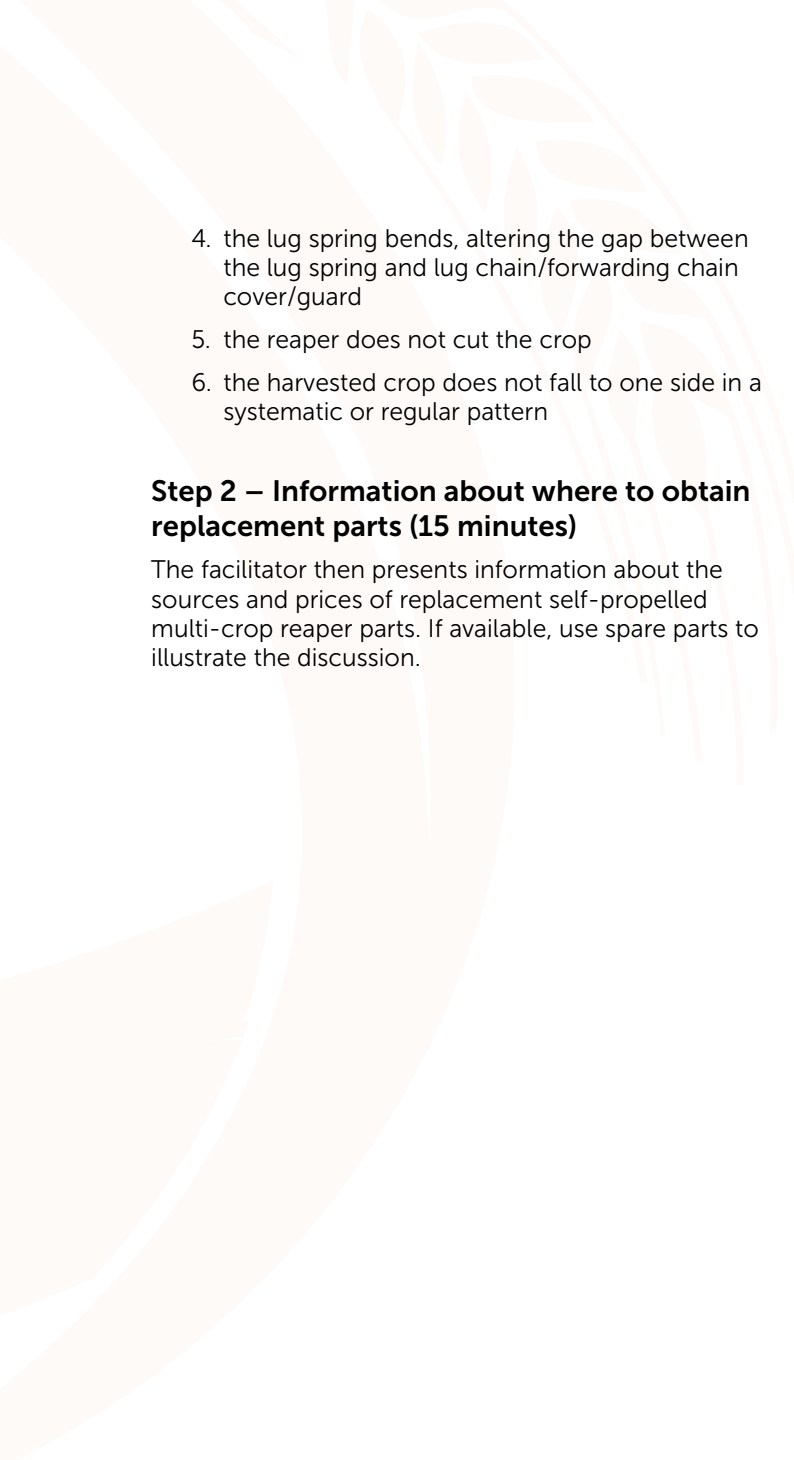
- a used self-propelled multi-crop reaper machine
- faulty/broken parts reaper parts (if available)
- spare parts (if available)
- blank poster paper/whiteboard, a whiteboard stand, whiteboard pens
- the assistance of an experienced mechanic

There are no flipcharts for this practice session.

Step 1 – Demonstration by a skilled mechanic (75 minutes)

First, the mechanic should demonstrate: (1) how to put together and dismantle each part, and (2) the issues as ranked below, and their potential remedies. The list is likely to look like this:

1. the star wheel breaks
2. the cutter bar/flat bar breaks
3. the cutting blade breaks

- 
4. the lug spring bends, altering the gap between the lug spring and lug chain/forwarding chain cover/guard
 5. the reaper does not cut the crop
 6. the harvested crop does not fall to one side in a systematic or regular pattern

Step 2 – Information about where to obtain replacement parts (15 minutes)

The facilitator then presents information about the sources and prices of replacement self-propelled multi-crop reaper parts. If available, use spare parts to illustrate the discussion.

Step 3 – Consolidation of learning (150 minutes)

Encourage each participant to demonstrate that they can identify solutions to each of the problems listed on the whiteboard, following the steps below:

- Step 1: identify the most significant problem and state its cause(s).
- Step 2: dismantle the relevant part and inspect it for the cause of the failure.
- Step 3: obtain a spare part(s) and/or repair the faulty part.
- Step 4: replace the repaired/new part on the machine.

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

Session 5

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

Materials required

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

- the flipchart *Session 5: Review of key points, post-training evaluation and close of training*
- a post-training evaluation questionnaire and a pen for each participant

Step 1 – Reflection on and discussion of the training's key messages (20 minutes)

Review each session by questioning the participants on the key messages of the training, to make sure they have been understood. These questions may be asked:

- What are the main parts of a self-propelled multi-crop reaper and their functions?
- What are the most significant causes of failure or breakdown of self-propelled multi-crop reapers?
- What is the solution if the star wheel or cutter bar/flat bar breaks or jams?
- Where can you get a new star wheel or cutter bar/flat bar?

- What is the solution if the chain in the transmission gearbox snaps?
- How will you solve the lug spring/chain bending?

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

Distribute a post-training test and training evaluation questionnaires to each participant and allow about ten minutes to complete it.

Step 3 – Distribute any additional materials (5 minutes)

Give out handouts, leaflets, brochures and any other materials to participants.

Step 4 – Close the training (10 minutes)

Thank participants and guests, and close the training with concluding remarks.



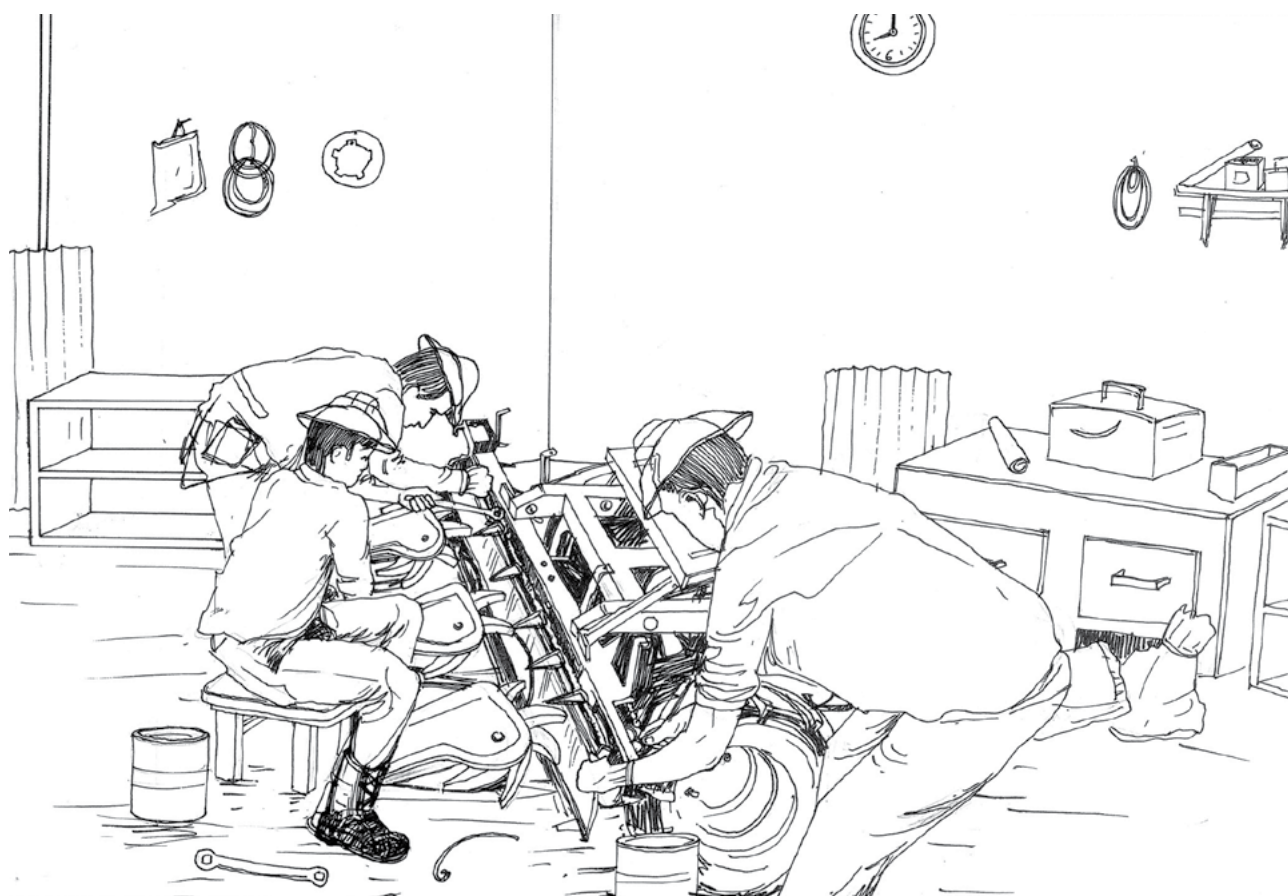
Flipcharts and handout materials*

* PowerPoint files of the flip charts in 'ready to present' format can be downloaded from here: <https://bit.ly/2T6Q9st> (for English language) or here: https://csisa.org/wp-content/uploads/sites/2/2019/12/191204_Reaper-mechanics-AM-smh.pdf (for Bangla language).

Session 1

Introduction, training objectives and pre-training evaluation

**Self-propelled multi-crop reaper (M)
one-day training flipchart**



What do you expect to learn from this training?

- ◆ In groups, discuss what you think you will learn today.



- ◆ Choose one person in your group to speak for the group.

- ◆ Choose someone to make notes on flipchart paper when needed.

Today's sessions

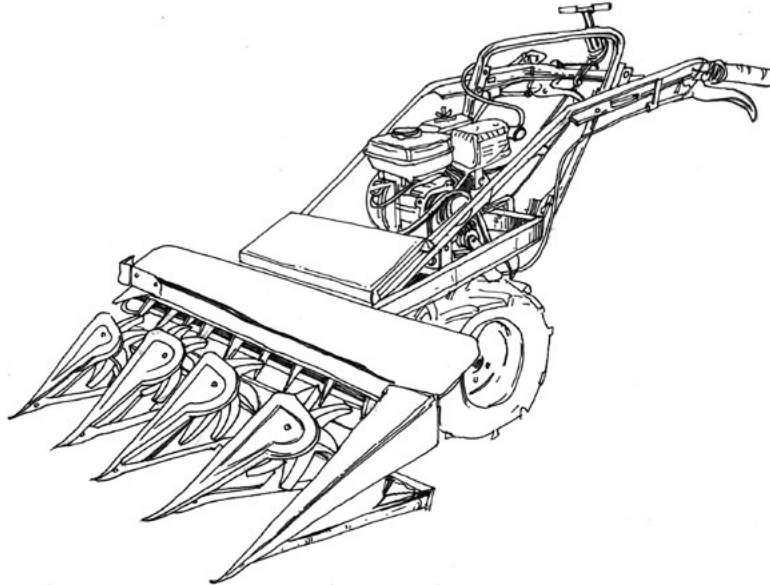
- 1. Introduction, training objectives and pre-training evaluation**
- 2. Main parts of a self-propelled multi-crop reaper and their functions**
- 3. Common causes of failure or breakdown – potential solutions**
- 4. Common causes of failure and breakdown – practical troubleshooting**
- 5. Review of key messages, post-training evaluation and close of training**

What kind of training is this?

This is participatory training, so:

- ◆ **Please ask questions and speak up.**
 - ◆ **Learn by experience – run the reaper yourself and learn how to operate it.**
- ◆ **Discuss each topic with the others in your group – this improves everyone's learning.**
 - ◆ **Speak up when the facilitator asks questions – and ask questions yourself. This way we can learn from each other.**

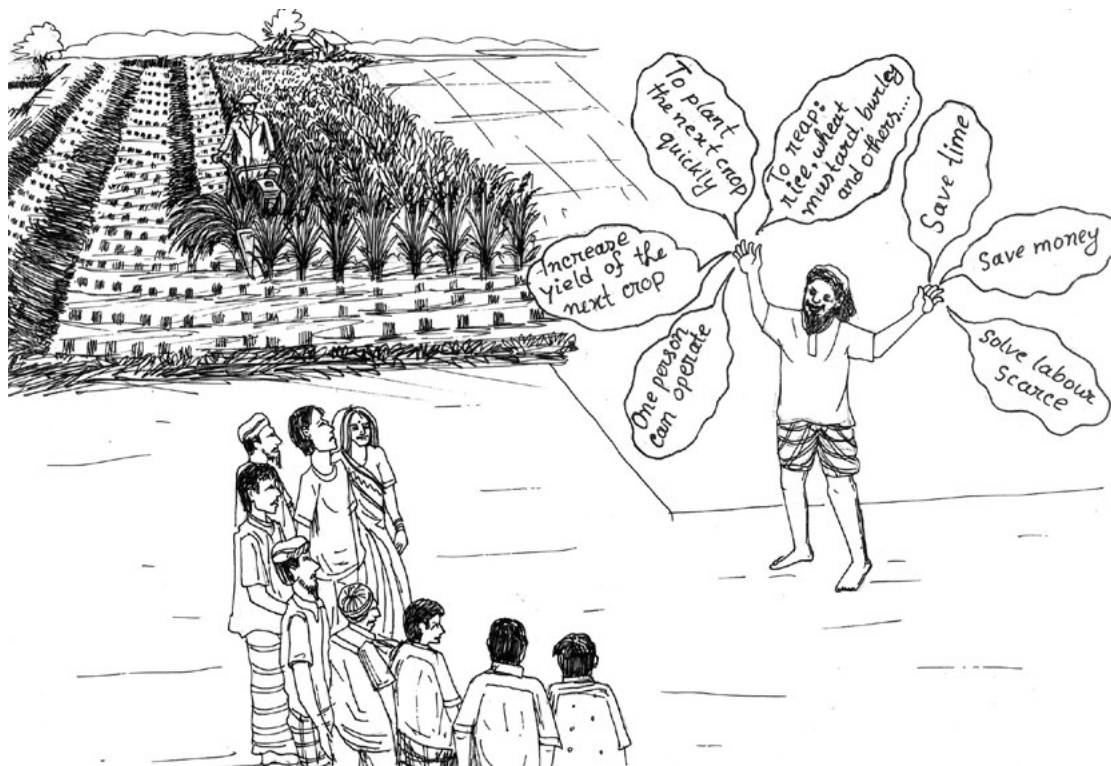
What is a self-propelled multi-crop reaper?



A self-propelled multi-crop reaper:

- ◆ is a mechanized reaping machine that replaces manual harvesting
 - ◆ is fueled by gasoline or diesel
- ◆ harvests rice, wheat, barley and other crops
 - ◆ only needs one person to operate it and move it around
- ◆ can usually harvest partially (but not fully) lodged crops – up to 60°

Advantages of a self-propelled multi-crop reaper (1)



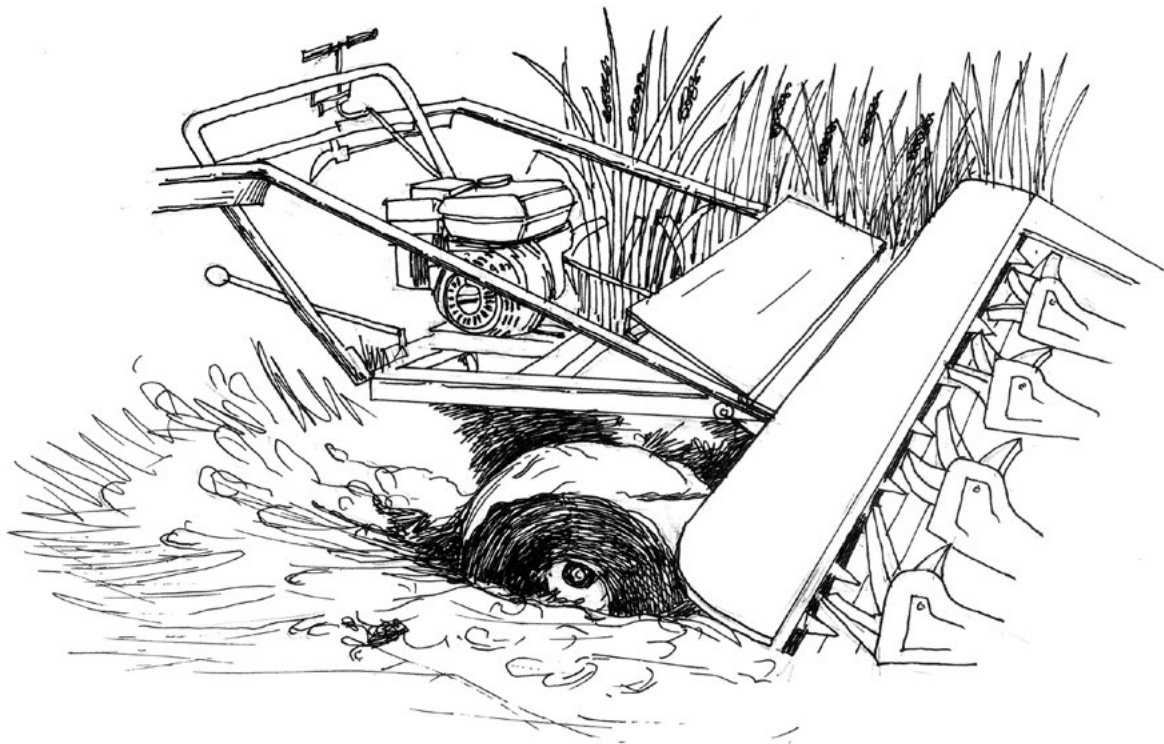
The self-propelled multi-crop reaper:

- ◆ **saves money and time – especially useful where labor is scarce or expensive, and where time is short (for example, where farmers grow more than one crop per year in the same field)**
- ◆ **makes harvesting far quicker than by hand**

Advantages of a self-propelled multi-crop reaper (2)

- ◆ **helps farmers plant the next crop quickly – which often increases that crop's yield**
 - ◆ **deposits crops to the side of the machine where they can be picked up easily for binding**
- ◆ **cuts the crop – and if it is a very advanced model, binds it too!**

Limitations of a self-propelled multi-crop reaper



The self-propelled multi-crop reaper:

- ◆ cannot harvest completely lodged crops
- ◆ is difficult to use in fields with excessively moist clay soil or standing water; add cage wheels to keep the machine from getting stuck in the mud

Enjoy this training!

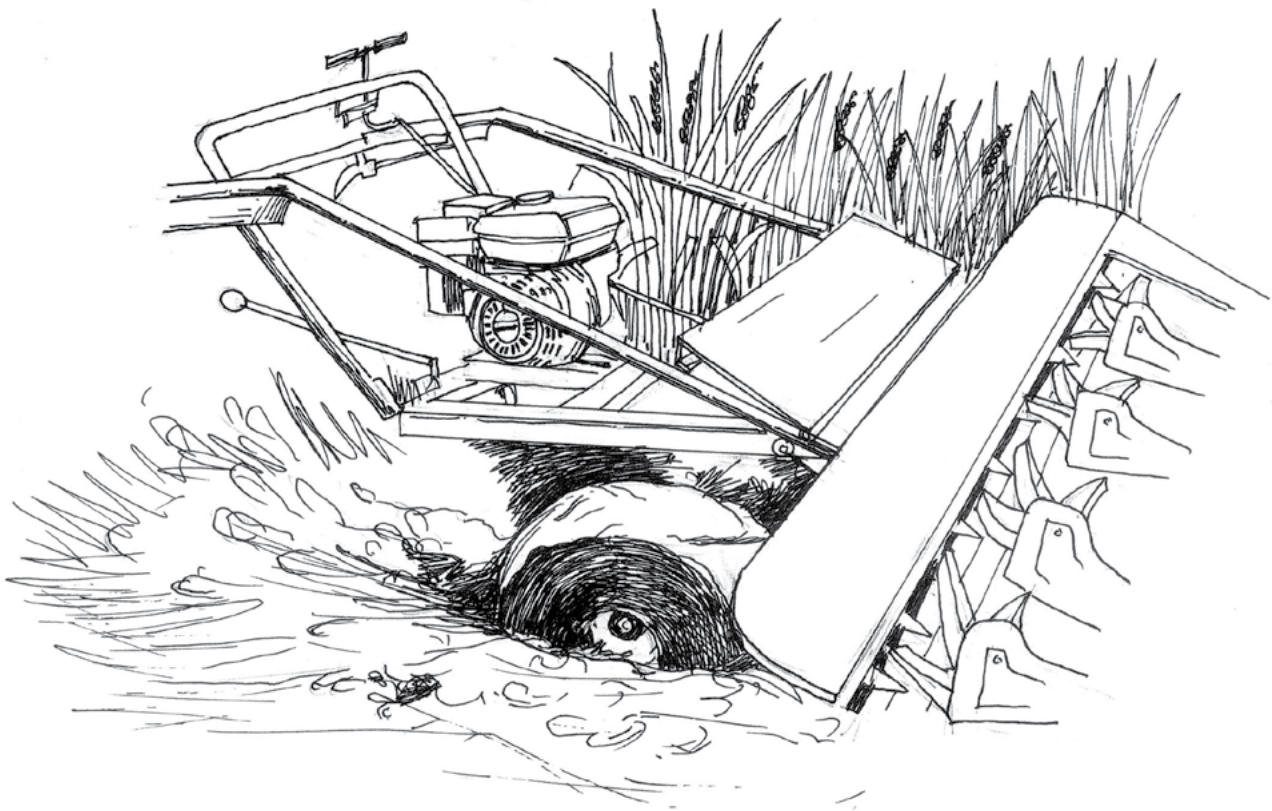
- ◆ Feel free to ask questions and contribute your knowledge.
- ◆ Make sure you get time to learn how to carry out repairs to the multi-crop reaper yourself.



Session 2

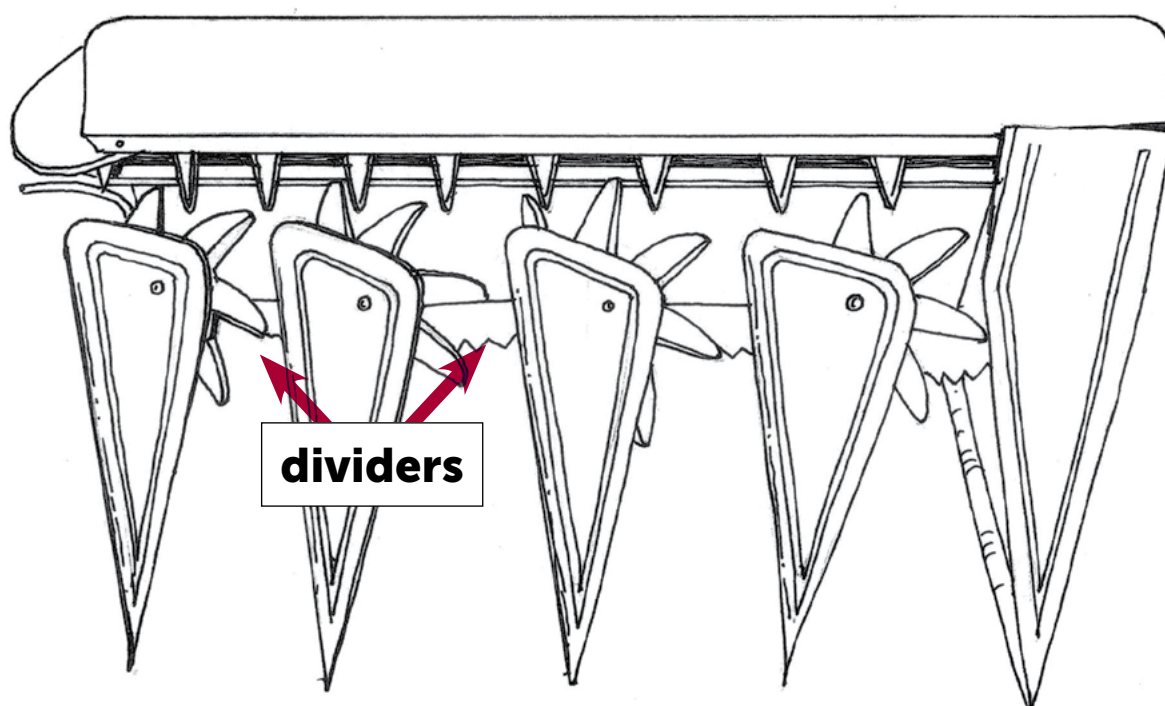
Main parts of the self-propelled multi-crop reaper and their functions

Self-propelled multi-crop reaper (M)
one-day training flipchart



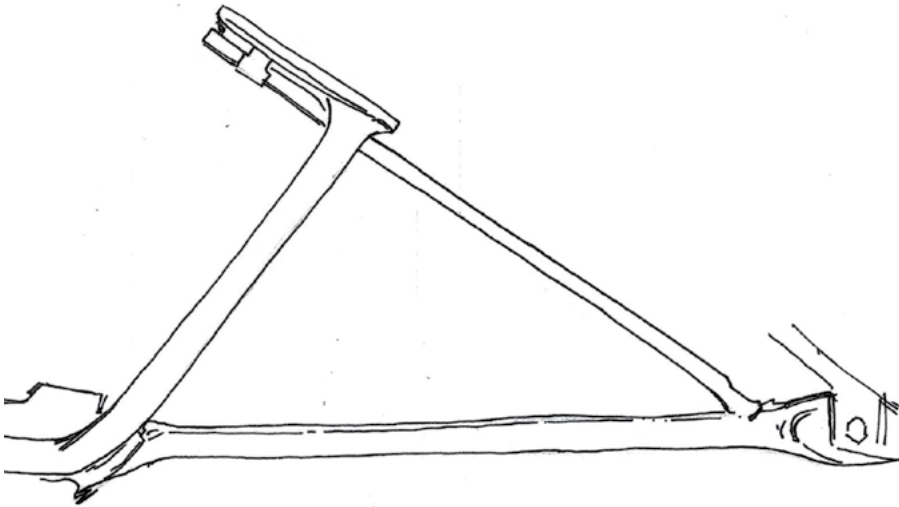
Parts that separate and divide the crop during reaping

Dividers



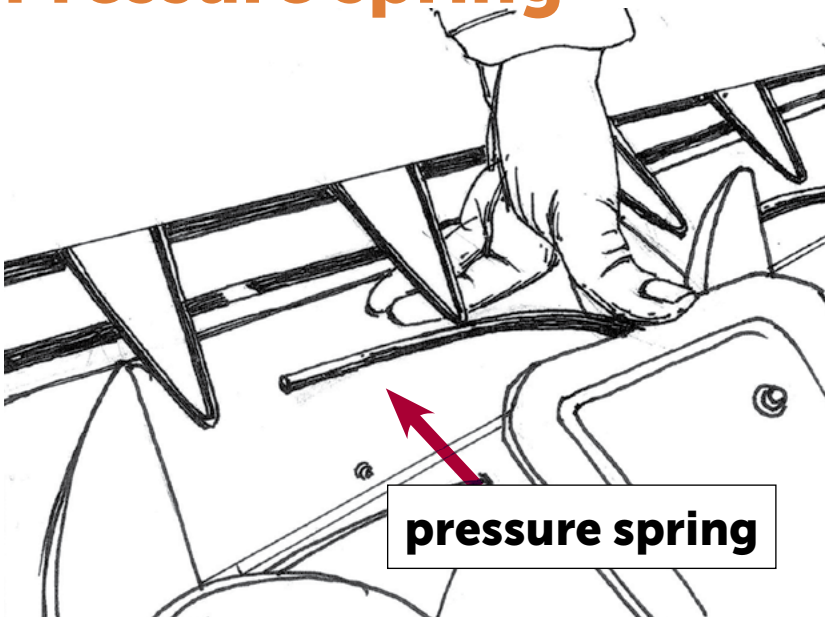
Function: these divide the uncut crop into equal sections ready for cutting and move it towards the cutter bar/flat bar.

Splitting bracket



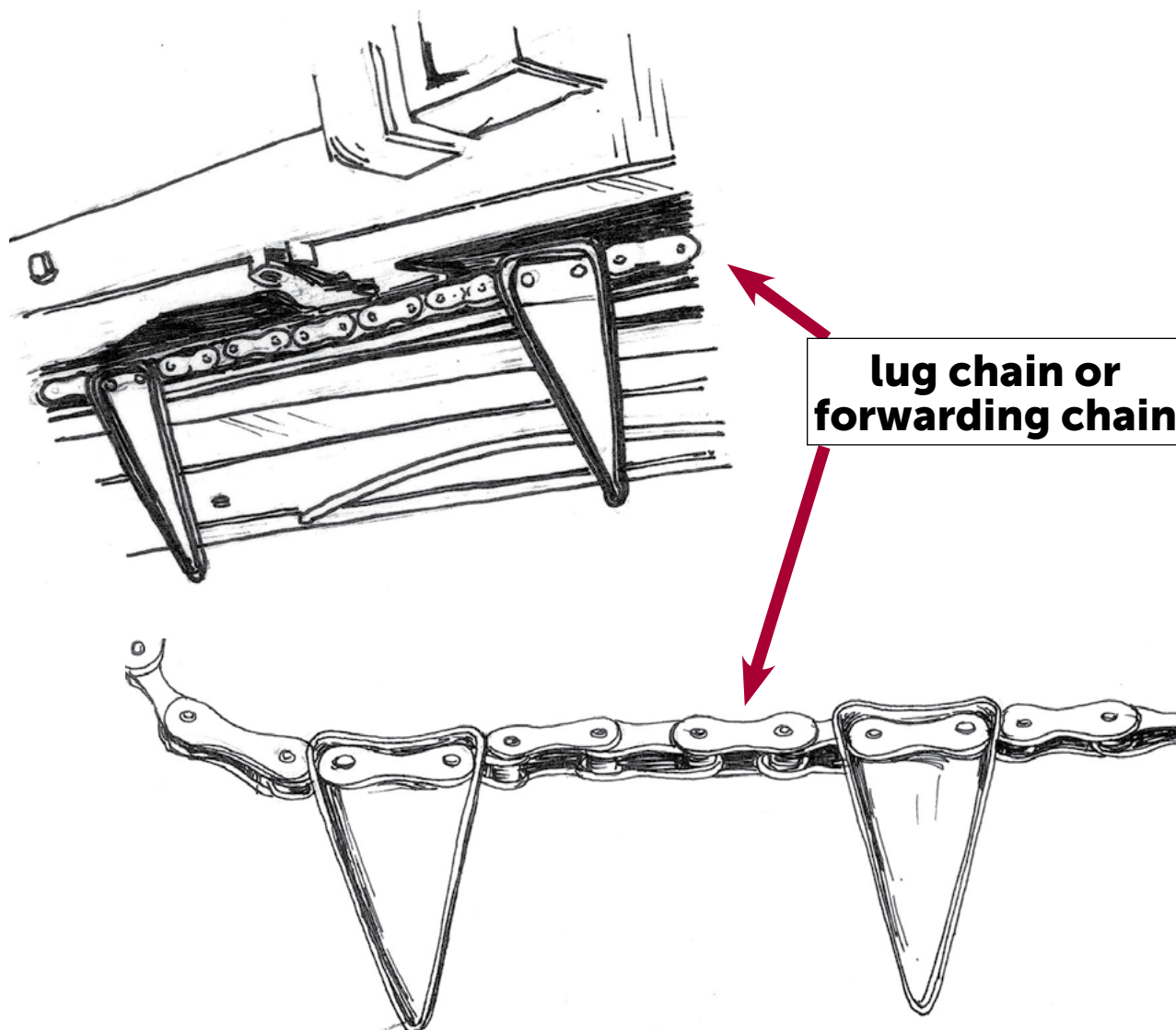
Function: hitches the splitting cover to the main frame of the reaper.

Pressure spring



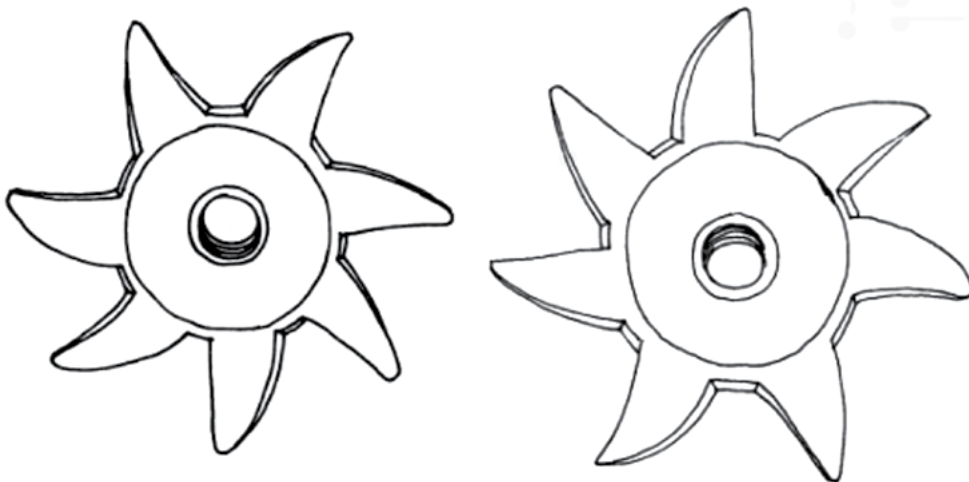
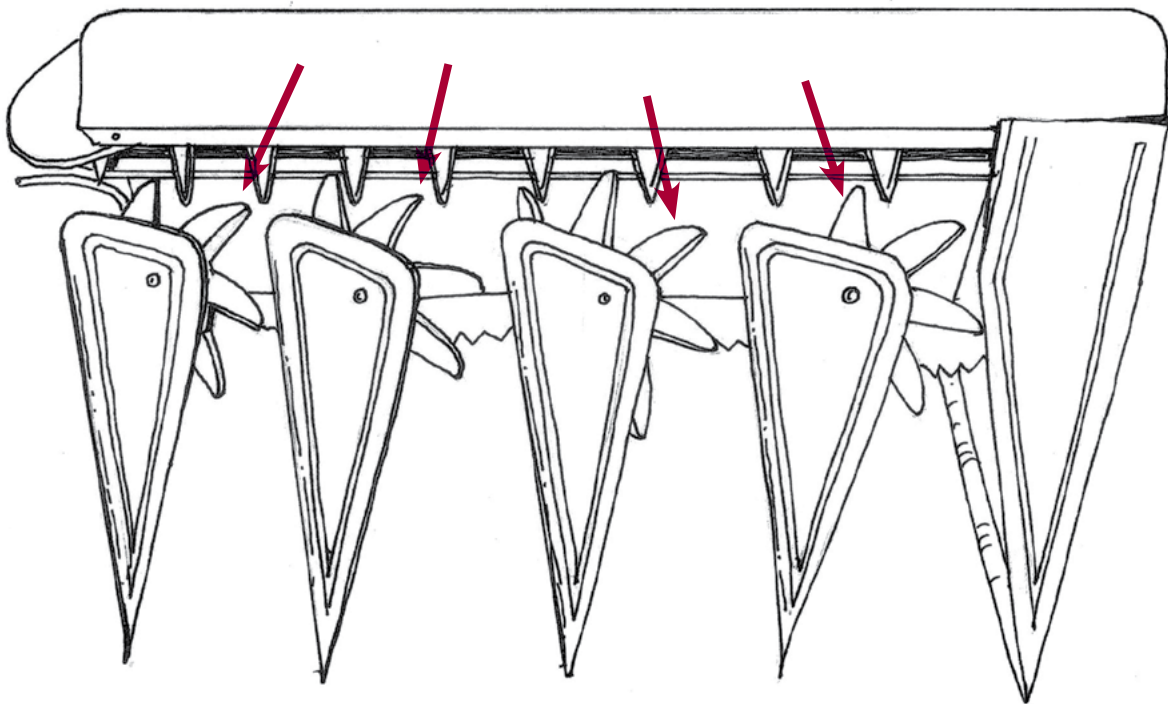
Function: exerts pressure on crop stems or tillers, aligning them upright for cutting.

Lug chain or forwarding chain



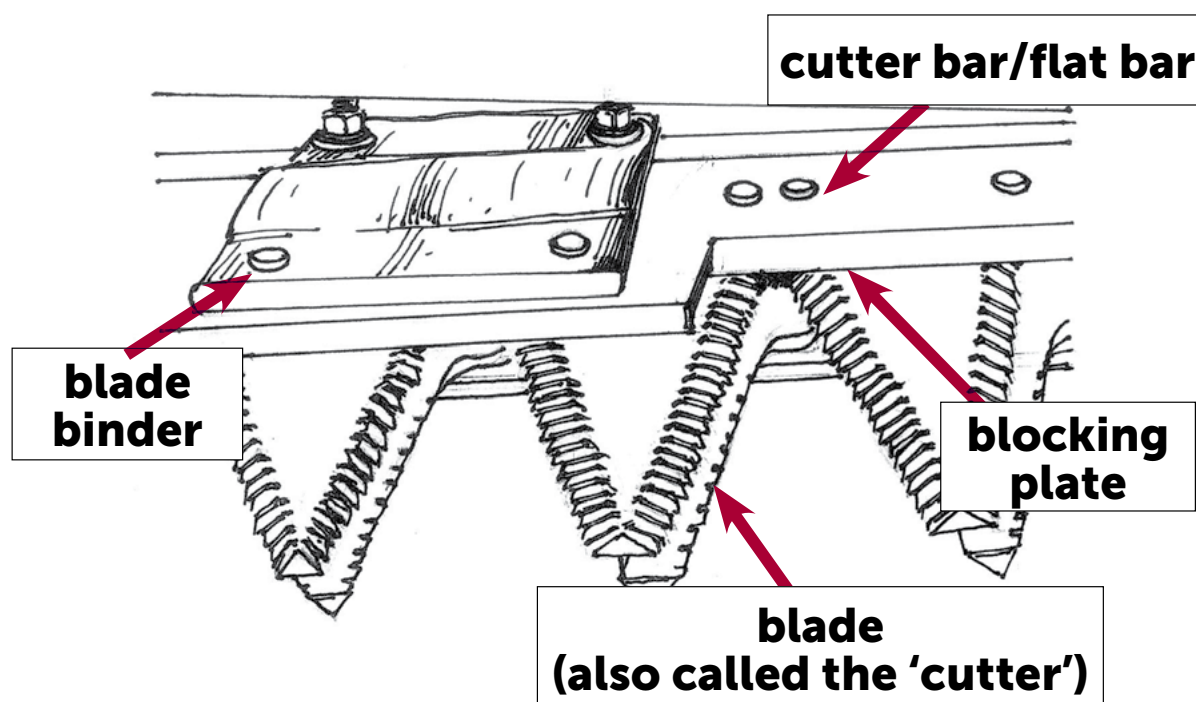
Function: keeps the star wheels moving in the correct direction; throws the cut crop to one side of the machine.

Star wheels



Function: the star wheels guide the harvested crop into the machine to be cut.

Parts that cut the crop



Functions:

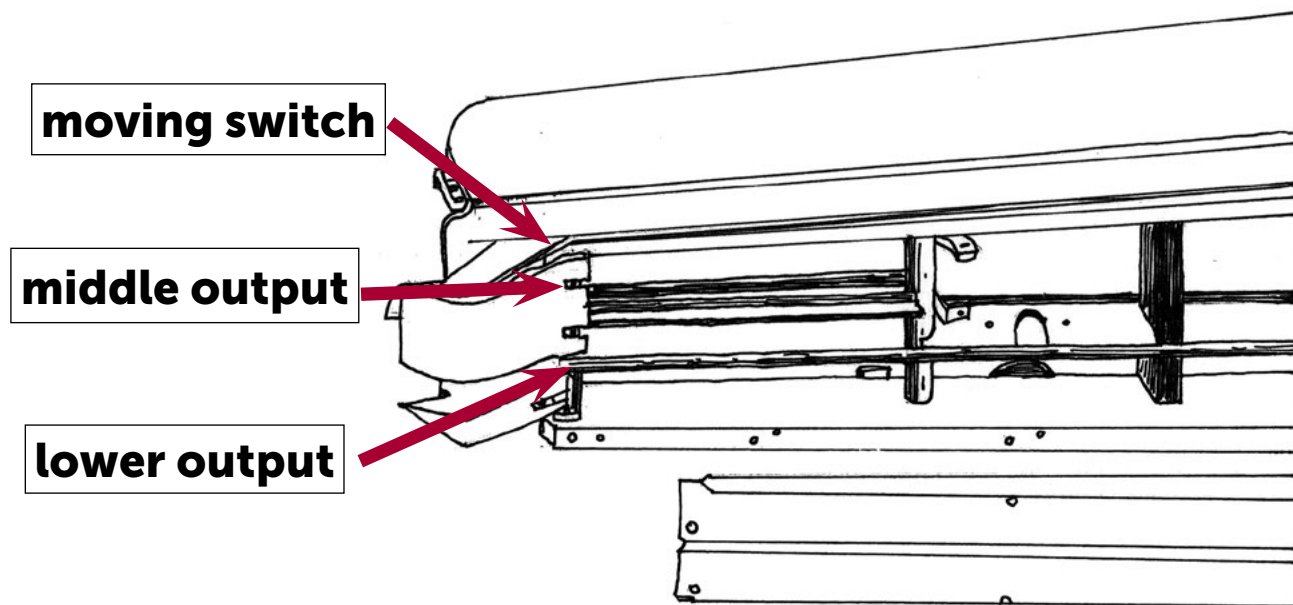
The blade (or 'cutter') cuts the crop.

The blade binder aligns the upper and lower cutter bars/flat bars.

The blocking plate helps the blade binder maintain a gap of 0.5 mm (maximum) clearance between two cutter bars/flat bars.

The cutter bar/flat bar holds the blades that cut the crop.

Output devices



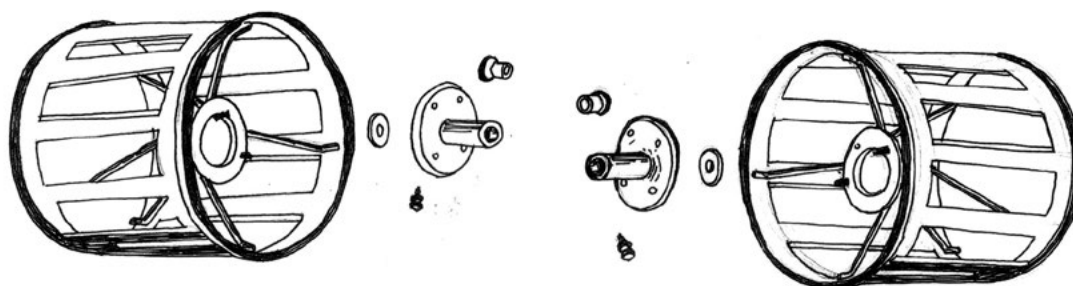
Function: these parts work together to enable the self-propelled multi-crop reaper to lay down the crop horizontally after being cut (allowing it to be picked up easily).

Wheels

Rubber wheels

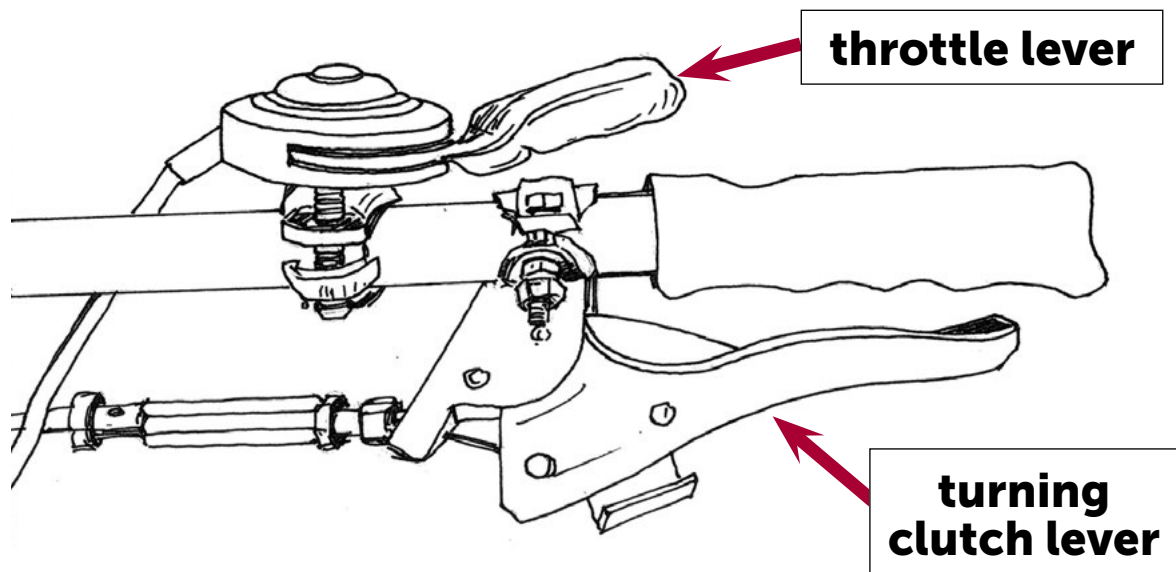


Cage wheels



Function: these enable the self-propelled multi-crop reaper to move forward or backward. Note: it is essential to fit 'cage' wheels when using the self-propelled multi-crop reaper in standing water or on moist soil, as sometimes happens during the early monsoon rice harvest. These keep the reaper from slipping or getting stuck.

Levers and switches (1)



Functions:

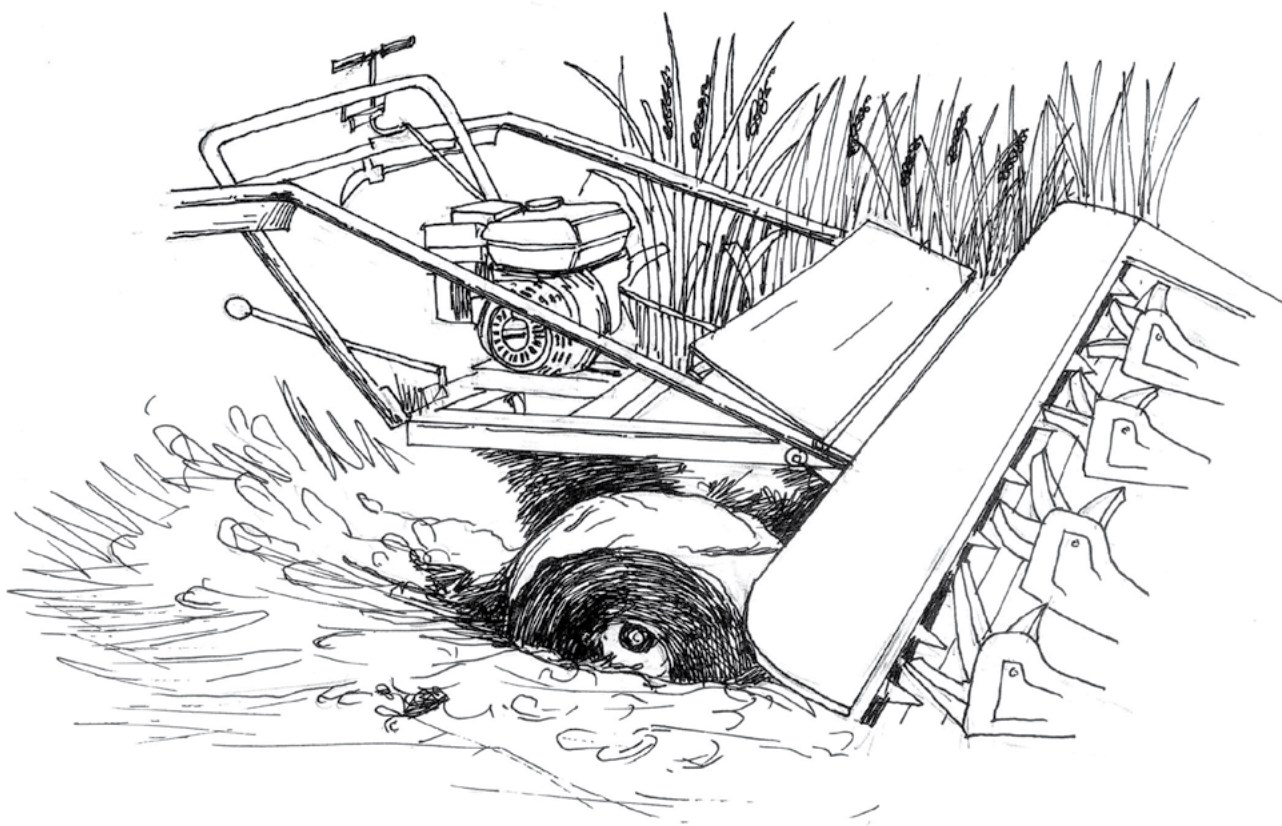
The throttle lever helps control the reaper's speed.

The turning clutch lever controls the clutch.

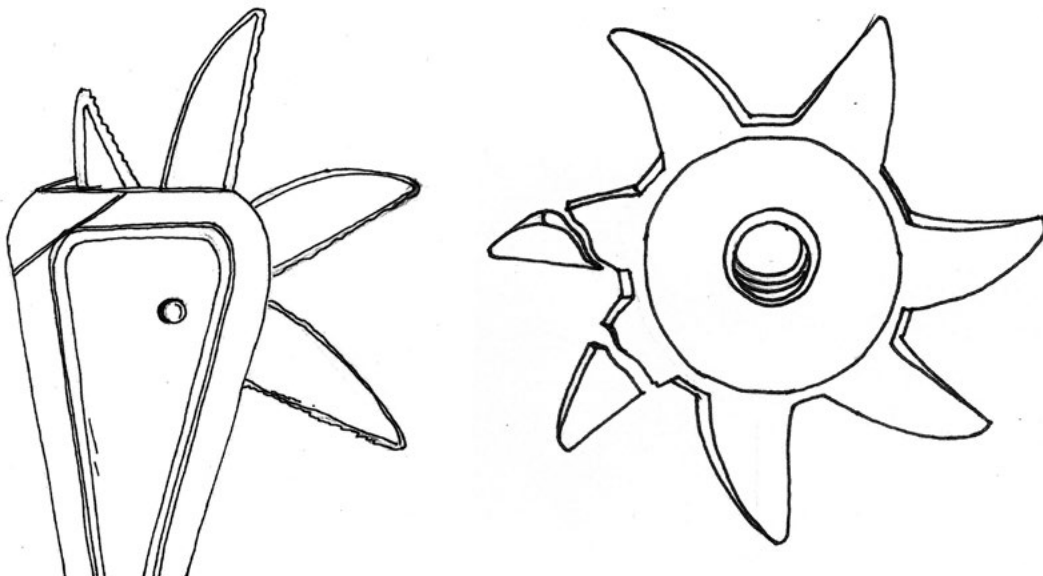
Session 3

Common causes of reaper failure and breakdown – possible solutions

Self-propelled multi-crop reaper (M)
one-day training flipchart



Problem 1: The star wheel breaks



Symptoms: the star wheel is visibly broken.

Possible causes: (1) the operator has mishandled the reaper; (2) overloading; (3) damaged bearings have kept the star wheel from moving, exerting excess pressure on it as the reaper continues to run; (4) the operator has not cleared away straw jams regularly.

Effects: jamming of the crop increases, making effective harvesting impossible.

Prevention: clear away straw jams regularly.

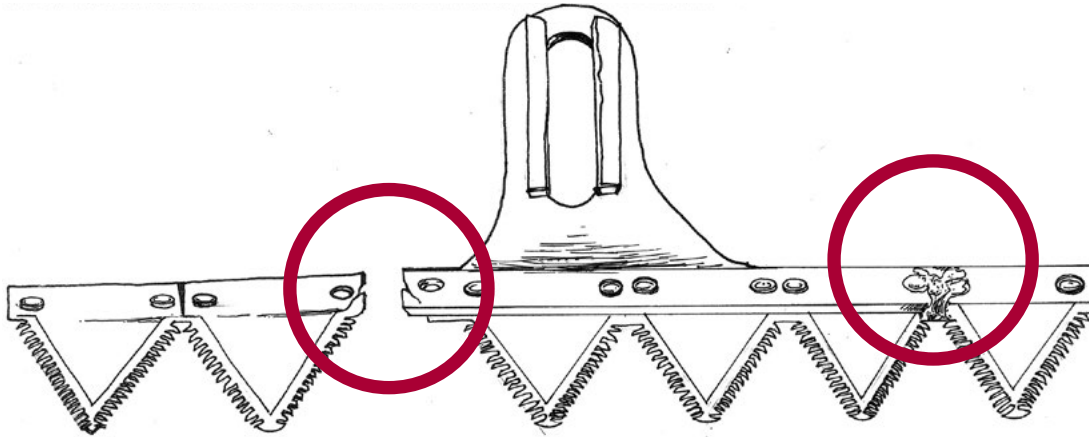
Solutions: (1) buy a replacement star wheel or have a new one made at a local workshop; or (2) replace any damaged bearings.

Spare parts required: star wheel, bearing(s)

Where to get spare parts or have replacements made: buy a replacement star wheel from a dealer; have a new one made at a local workshop.

Tools required: dual wrench, adjustable wrench, screwdriver

Problem 2: The cutter bar* breaks



Symptoms: the broken sections stop cutting the crop.

Possible causes: (1) the cutting blades come into contact with a hard object; (2) the operator fails to clear straw jams regularly, which puts stress on the cutter bar and weakens it over time; or (3) the gap between the blade and ledger plate is less than optimum (i.e., less than 0.5 mm).

Effects: the cutter bar/flat bar stops working.

Prevention: (1) clear straw away from the cutter bar regularly; (2) adjust the gap between blade and ledger plate to 0.5 mm.

Solution: replace the cutter bar/flat bar.

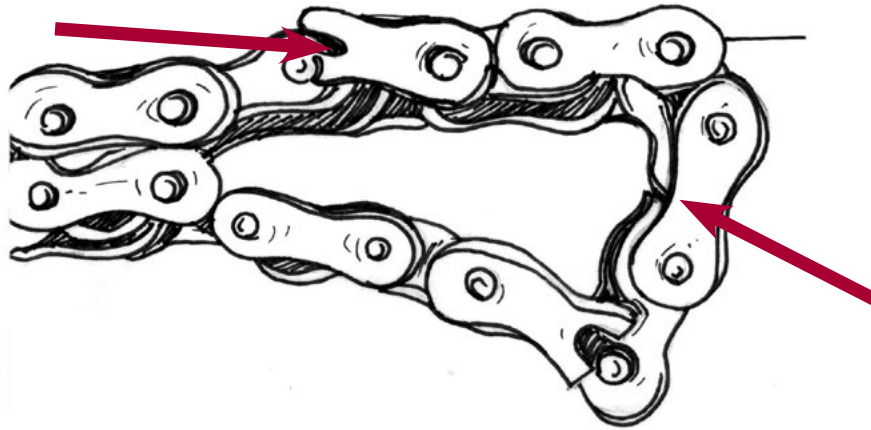
Spare parts required: cutter bar/flat bar, steel rivets

Where to get spare parts or have replacements made: buy from a dealer; have new ones made at a local workshop.

Tools required: dual wrench set, adjustable wrench, screwdriver, hammer, cutting disc, grinder and anvil

* The bar onto which the cutting blades are riveted (also known as a 'flat bar').

Problem 3: The chain in the transmission gearbox snaps



Symptoms: the cutter bar does not move right or left.

Possible causes: (1) lack of proper lubrication; (2) overloading of the gearbox because of straw jams; or (3) the chain is too tight.

Effects: the reaper stops completely.

Solutions: (1) if two links have come apart, re-join them if possible; (2) if a link is broken, replace it; (3) if the chain needs to be replaced but

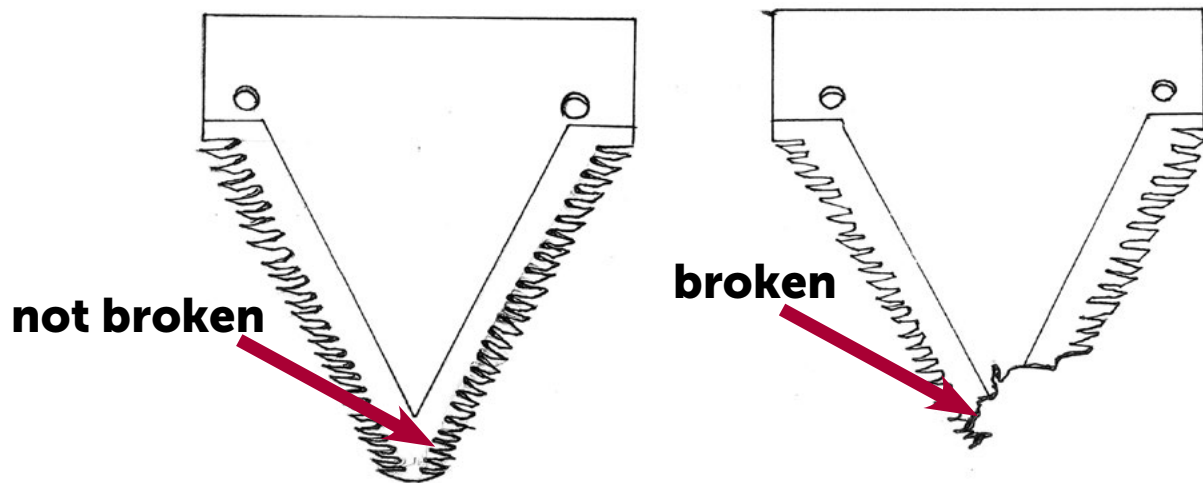
complete chains are unavailable on the market, replace the sprockets with sprockets available on the market or that you have as spare parts. Make sure the replaced or repaired chain is the same length as the original and has the same sprocket size.

Spare parts required: chain link or complete chain, sprocket(s)

Where to get spare parts: shops that deal in pump or engine spare parts – chains and chain links are common.

Tools required: dual wrench set, adjustable wrench, screwdriver, hammer, cutting disc and/or grinder (depending on severity of break)

Problem 4: The cutting blade breaks



Symptoms: the cutting blade is visibly broken.

Causes: (1) the teeth of the blade come into contact with hard objects (e.g., bamboo, wood or stones) during reaping; (2) the operator doesn't clear straw jams regularly enough; or (3) the gap between the blade and ledger plate is less than required (0.5 mm is desirable).

Effects: (1) the blade stops cutting, and (2) the crop jams during reaping.

Prevention: (1) clear straw jams from the cutter bar regularly; and (2) check the gap between the blade and the ledger plate regularly and keep it at 0.5 mm.

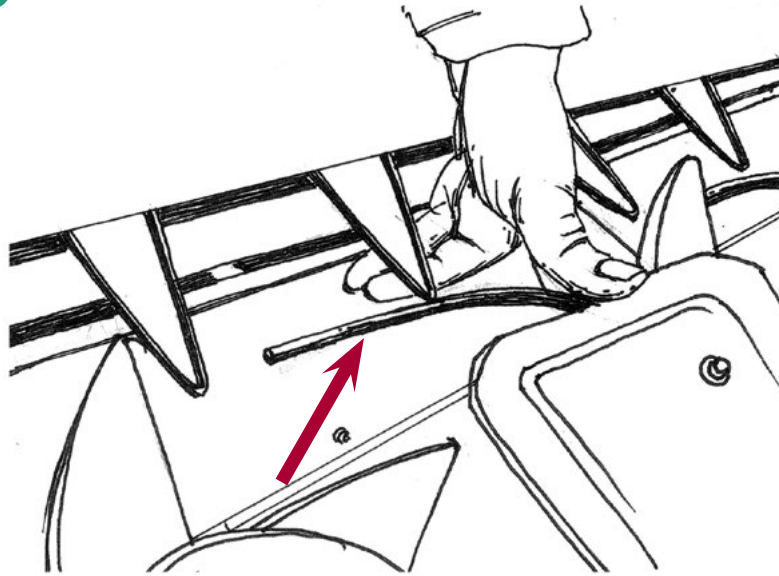
Solution: replace the blade.

Spare parts required: cutting blade

**Where to get a spare part/
have replacement made:** buy from a dealer or have a new one made at a local workshop.

Tools required: dual wrench set, adjustable wrench, screwdriver, hammer, cutting disc and grinder

Problem 5: The lug spring bends



Symptoms: stems of the crop bunch up while being cut.

Causes: (1) mishandling of the reaper and poor alignment with the crop being cut; (2) loosening of nuts and bolts; or (3) poor spring tension.

Effects: (1) reduction in the speed at which the crop is being cut; (2) clogging of the cut stalks/straw.

Prevention: (1) check and adjust the gap between the pressure spring and lug cover regularly; (2) tighten the nuts and bolts regularly.

Solution: (1) adjust the gap between lug spring and lug cover to 3-4 cm; (2) tighten the nuts and bolts regularly; (3) replace the spring when it has lost its tension.

Spare parts required: lug spring

Where to get spare parts: buy a lug spring from a dealer or have a new one made at the local workshop.

Tools required: dual wrench set, adjustable wrench, pliers

Key messages

- ◆ **Star wheels can break if they are mishandled, overloaded (with too much crop residue caught between the wheels), because of excessive use or use on excessively wet crops, or because of material failure.**
 - ◆ **The cutting bar (or flat bar) can break if it jams because of material failure, or if the clearance between the blade and ledger plate is sub-optimal.**
- ◆ **The cutting blade can break if its teeth come into contact with hard objects (e.g., bamboo, wood or stones) during reaping. It can also break if the cutter bar jams.**

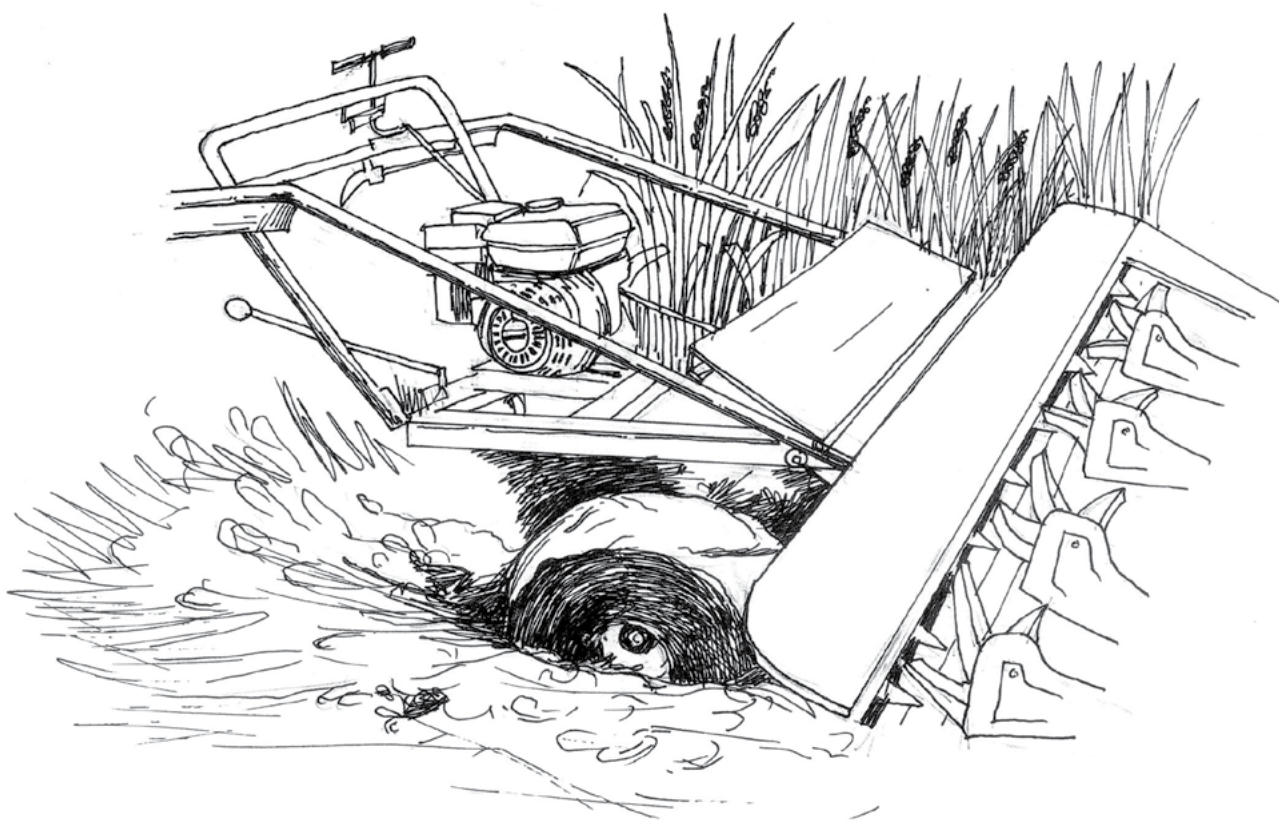
Key messages (2)

- ◆ If the chain in the transmission gearbox snaps, the cutter bar will not move right or left and the reaper will break down completely.
- ◆ The lug spring and associated wires can bend, altering the gap between the lug spring/wire and the lug chain cover, which will result in poor reaping. This happens because of mishandling by the operator, loosening or aging of the nuts and bolts, or loosening of the spring.

Session 5

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

**Self-propelled multi-crop reaper (M)
one-day training flipchart**



Review

- ◆ What are the main parts of a multi-crop reaper and their functions?
 - ◆ What are most common types of failure and breakdown that farmers using the multi-crop reaper might experience – and what are their causes?
- ◆ What should you do if the star wheel or cutter bar breaks or jams?
 - ◆ Where can you buy a new star wheel or cutter bar?
- ◆ What is the solution if the chain in the transmission gearbox snaps?

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. What does the pressure spring do?	Maintains pressure on the cutting blades so they move	Moves the wheels in the right direction	Helps make sure the rice or wheat plants are brought into contact with the cutting blades
2. What part helps rotate the star wheel in the correct direction?	Gearbox	Lug/forwarding chain	Pressure spring
3. The bevel gear transmits power from the engine to which part?	Main gearbox	Star wheel(s)	Cutter bar/flat bar
4. What is the function of the throttle lever?	Turns the machine to left or right	Controls the speed of the engine	Cuts the rice or wheat
5. Why might a star wheel break?	Excessive load on the engine	The stems of rice or wheat are too big or are wet, causing jamming	Cutter bar blades are not sharp enough
6. Where can you get spare star wheels?	From most machinery dealers, especially those who sell self-propelled multi-crop reapers	Local workshops	From both
7. Why might the cutter bar/flat bar break?	Overly tight nut-bolts	Lack of lubrication	Cutter bar/flat bar has not been cleaned regularly
8. Why might the cutter not move right or left?	Chain in the transmission gearbox snaps	One or more star wheel(s) break	Pressure spring jams
9. How can you repair the pressure spring if it bends?	Press it straight	Loosen the nuts and bolts, then straighten it	Replace it
10. If the cutting blade breaks, what happens?	Rice or wheat is not cut	Straw jam occurs	Both

Post-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. What does the pressure spring do?	Maintains pressure on the cutting blades so they move	Moves the wheels in the right direction	Helps make sure the rice or wheat plants are brought into contact with the cutting blades
2. Which part helps rotates the star wheel in the correct direction?	Gearbox	Lug chain/forwarding chain	Pressure spring
3. The bevel gear transmits power from the engine to which part?	Main gearbox	Star wheel(s)	Cutter bar/flat bar
4. What is the function of the throttle lever?	Turns the machine to the left or right	Controls the speed of the engine	Cuts the rice or wheat
5. Why might a star wheel break?	Excessive load on the engine	Stems of the rice or wheat are wet or too big, causing jamming	Cutter bar/flat bar blades are not sharp enough
6. Where can you get spare star wheels?	From most machinery dealers, especially those who sell self-propelled multi-crop reapers	Local workshops	From both
7. Why might the cutter bar/flat bar break?	Overly tight nuts and bolts	Lack of lubrication	Cutter bar/flat bar has not been cleaned regularly
8. Why might the cutter not move right or left?	Chain in the transmission gearbox snaps	One or more star wheel(s) break	Pressure spring jams
9. How can you repair the pressure spring if it bends?	Press it straight	Loosen the nuts and bolts, then straighten it	Replace it
10. If the cutting blade breaks, what happens?	Rice or wheat is not cut	Straw jam occurs	Both
• Did you understand all the points the facilitator(s) discussed?	No	Partly	Completely
• How do you rate the training?	Not very useful	Useful	Very useful
• Are you confident you can now address common failures/ breakdowns of a self-propelled multi-crop reaper?	Yes	No	Confused

Answers to questions 1 to 10

1. Helps to make sure that rice or wheat plants are brought into contact with the cutting blades
2. Lug chain/forwarding chain
3. Cutter bar/flat bar
4. Controls the speed of the engine
5. Stems of the rice or wheat are wet or too big, causing jamming
6. From both
7. Cutter bar/flat bar has not been cleaned regularly
8. Chain in the transmission gearbox snaps
9. Replace it
10. Both

Annex 2

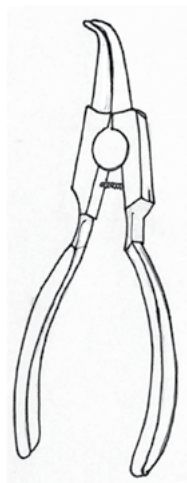
Common tools used to repair multi-crop reapers



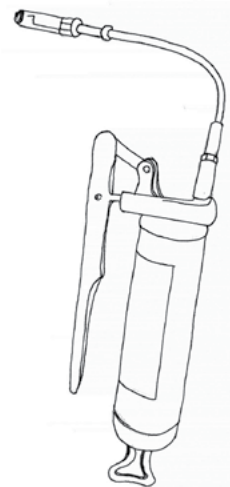
Adjustable wrench: An adjustable tool for gripping hexagonal nuts with an adjusting screw.



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

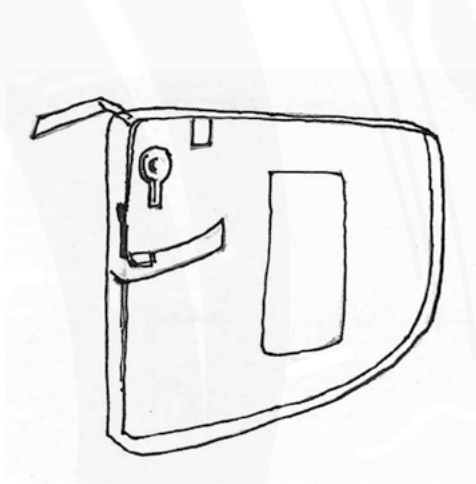


Pliers/cutting pliers: Used to grasp small objects, and to insert/extract or turn them. Pliers often have small cutting blades that can also be used to cut wire or other materials.



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

Common tools used to repair multi-crop reapers (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 – 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.

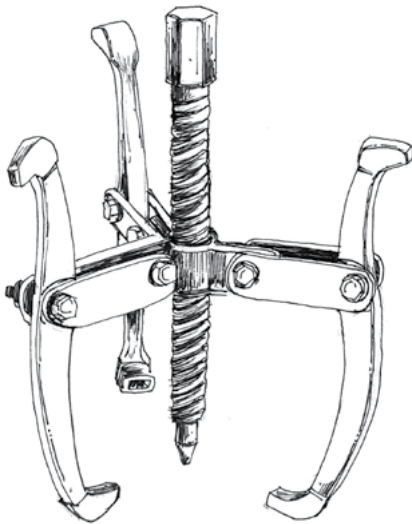
Common tools used to repair multi-crop reapers (3)



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



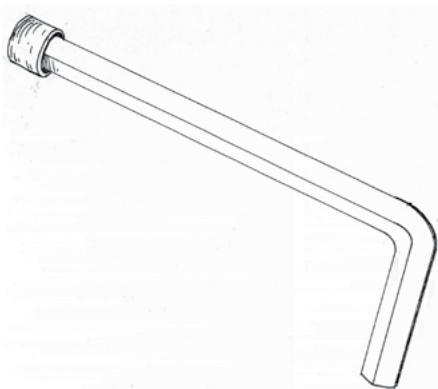
Ratchet: Used to turn the head of a bolt in one direction but not the other. It makes it easy to tighten or loosen bolts without having to take off the tool each time (as with pliers or wrenches).



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: a six-edged wrench used to tighten or loosen bolts that have a hexagon shape at the head of the bolt.



This set of training modules focuses on ensuring that mechanics are able to make repairs to self-propelled multi-crop reapers 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 the 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 in-depth knowledge that the trainee mechanics already have. By the conclusion of the training module, participant mechanics will be well-equipped to repair self-propelled multi-crop reapers as part of their ongoing agricultural machinery service 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 the participants.

Funded by



USAID
FROM THE AMERICAN PEOPLE

**BILL & MELINDA
GATES foundation**

Partners



CIMMYT^{MR}
International Maize and Wheat Improvement Center

IFPRI
INTERNATIONAL
FOOD POLICY
RESEARCH
INSTITUTE

IRRI