

Exchanging Experience with Conservation Agriculture

Towards Climate Resilience

Authors: LI Hongwen, XIE Mei, HE Jin

Art drawing: JIANG Heping

Exchanging Experience with Conservation Agriculture

Towards Climate Resilience

Authors: LI Hongwen, XIE Mei, HE Jin

Assisted by: HUAN Yu

Art drawing: JIANG Heping



科学普及出版社
POPULAR SCIENCE PRESS



THE WORLD BANK
IBRD • IDA



科学普及出版社
POPULAR SCIENCE PRESS



THE WORLD BANK
IBRD • IDA

图书在版编目 (CIP) 数据

保护性耕作经验交流 - 应对气候变化: 英文 / 李洪文, 谢玫, 何进著; 蒋和平绘 .

—北京: 科学普及出版社, 2014. 8

ISBN 978-7-110-08724-4

I . ①保… II . ①李… ②谢… ③何… ④蒋… III .

①资源保护—土壤耕作—英文 IV . ①S341

中国版本图书馆 CIP 数据核字 (2014) 第 172830 号

策划编辑 吕建华 许英

责任编辑 赵晖 杨丽

责任校对 何士如

封面设计 蒋和平

责任印制 李春利

出 版 科学普及出版社

发 行 科学普及出版社发行部

地 址 北京市海淀区中关村南大街 16 号

邮 编 100081

发行电话 010-62173865

传 真 010-62179148

投稿电话 010-62176522

网 址 <http://www.cspbooks.com.cn>

开 本 889mm×1194mm 1/24

字 数 20 千字

印 张 2.25

版 次 2014 年 8 月第 1 版

印 次 2014 年 8 月第 1 次印刷

印 刷 北京盛通印刷股份有限公司

书 号 978-7-110-08724-4/S · 548

定 价 20.00 元

Acknowledgements

Technical and Language Editor: William CRITCHLEY

Special thanks to the following experts for their contributions during peer review : Saidi MKOMWA, Patrice DJAMEN, Peter KURIA (African Conservation Tillage Network); Martin SISHEKANU; Sandra CORSI.

Thanks also go to Mayya REVZINA (World Bank Publishing & Knowledge Unit); WU Yuehua and LI Sheng (World Bank Institute), who helped prepare the publication of this book.

Funding support for this publication: TerrAfrica program and Climate Change Group of the World Bank.

The conservation agriculture technology won four national scientific and technological awards in China, and is among the key areas of technological innovation in agriculture that the government is promoting domestically.

Exchanging Experience with Conservation Agriculture

Towards Climate Resilience

Copyright © 2014 by International Bank for Reconstruction and Development / The World Bank

The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of The World Bank, its Board of Executive Directors, or the governments they represent.

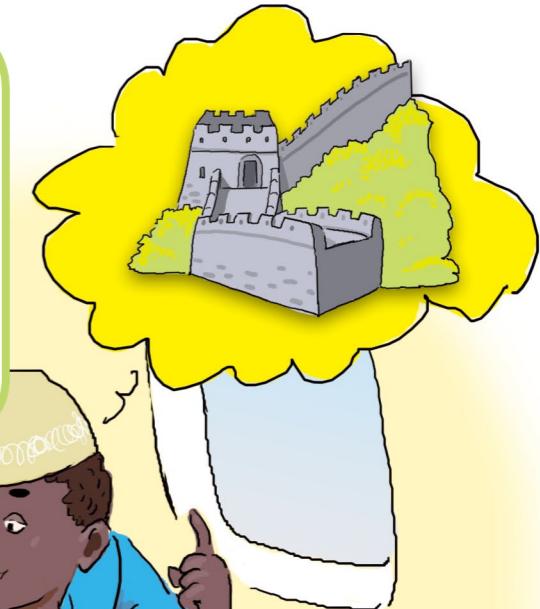
The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Rights and Permissions

The material in this work is subject to copyright. Because The World Bank encourages dissemination of its knowledge, this work may be reproduced, in whole or in part, for noncommercial purposes as long as full attribution to this work is given.

Any queries on rights and licenses, including subsidiary rights, should be addressed to World Bank Publications, The World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; e-mail: pubrights@worldbank.org.

Hello, My name is Maria. I work at the Ministry of Agriculture. I'm looking forward to hearing about China's experience, and bringing it back to Africa.



Pleased to meet you! I am Amos and I'm a farmer. I won a farming prize to visit China! I wonder how Chinese farmers manage to increase crop production. And I am excited to climb the Great Wall.

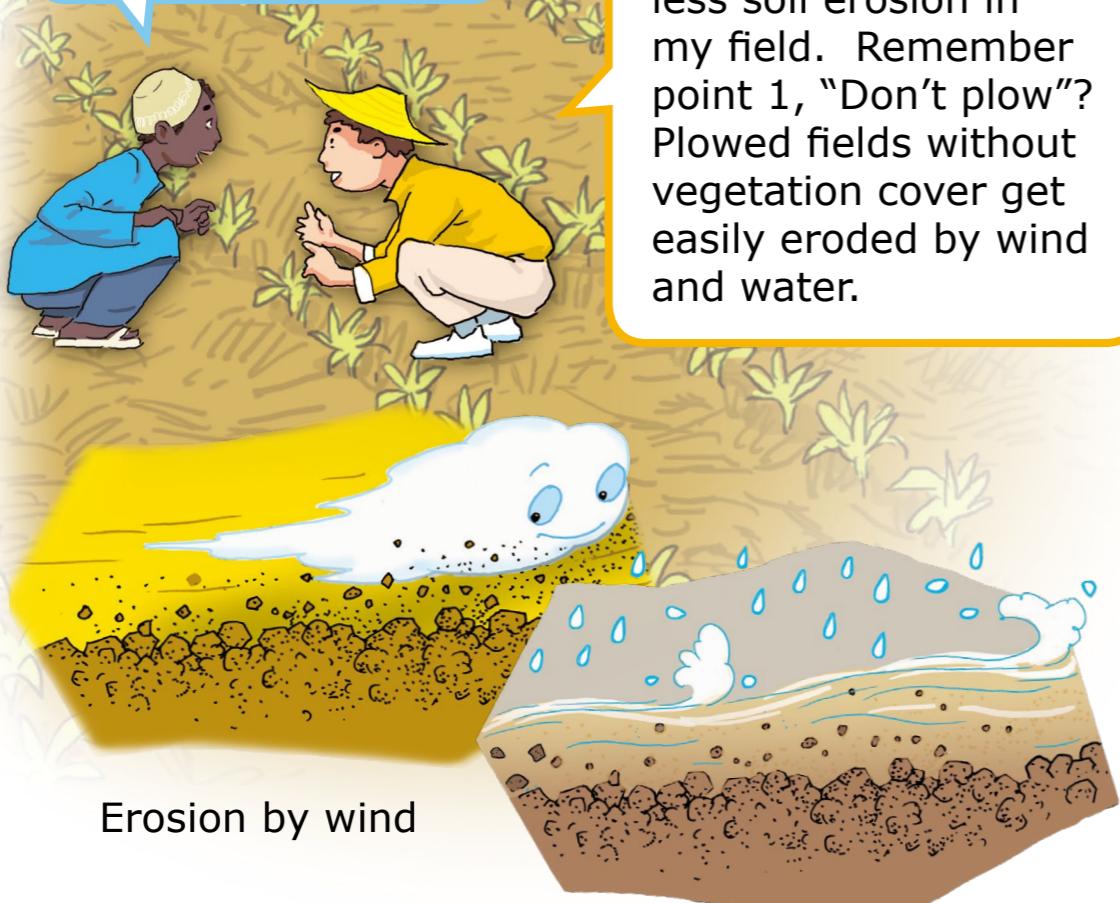
Welcome south-south knowledge sharing delegation





How have you benefited from this new way of farming?

In a lot of ways! First, less soil erosion in my field. Remember point 1, "Don't plow"? Plowed fields without vegetation cover get easily eroded by wind and water.





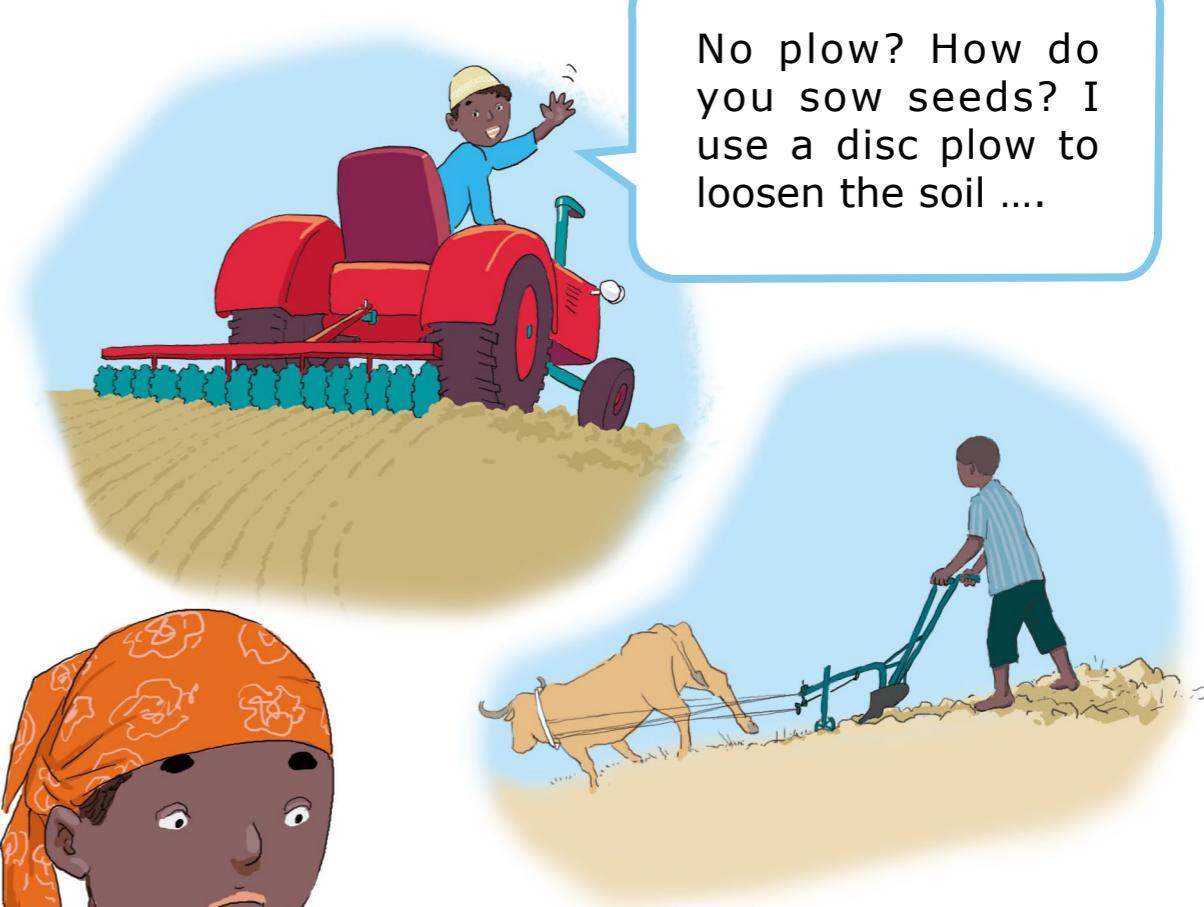
I heard about the "Great Dust Bowl" of the last century in the US. That was because of plowing large fields year after year. To address this problem, the US started no-till.



We also have bad dust storm problems, and they affect cities too. Soil erosion used to be my headache. That was partially why I decided to stop plowing.



Not even an animal-drawn plow?



No plow? How do you sow seeds? I use a disc plow to loosen the soil

Plowing creates a hard plough pan

Plowing reduces water infiltration and moisture holding

Plowing disturbs soil organisms

Plowing exposes organic matter, releases greenhouse gases

Actually, we say: "The deeper you plow, the more you lose!"

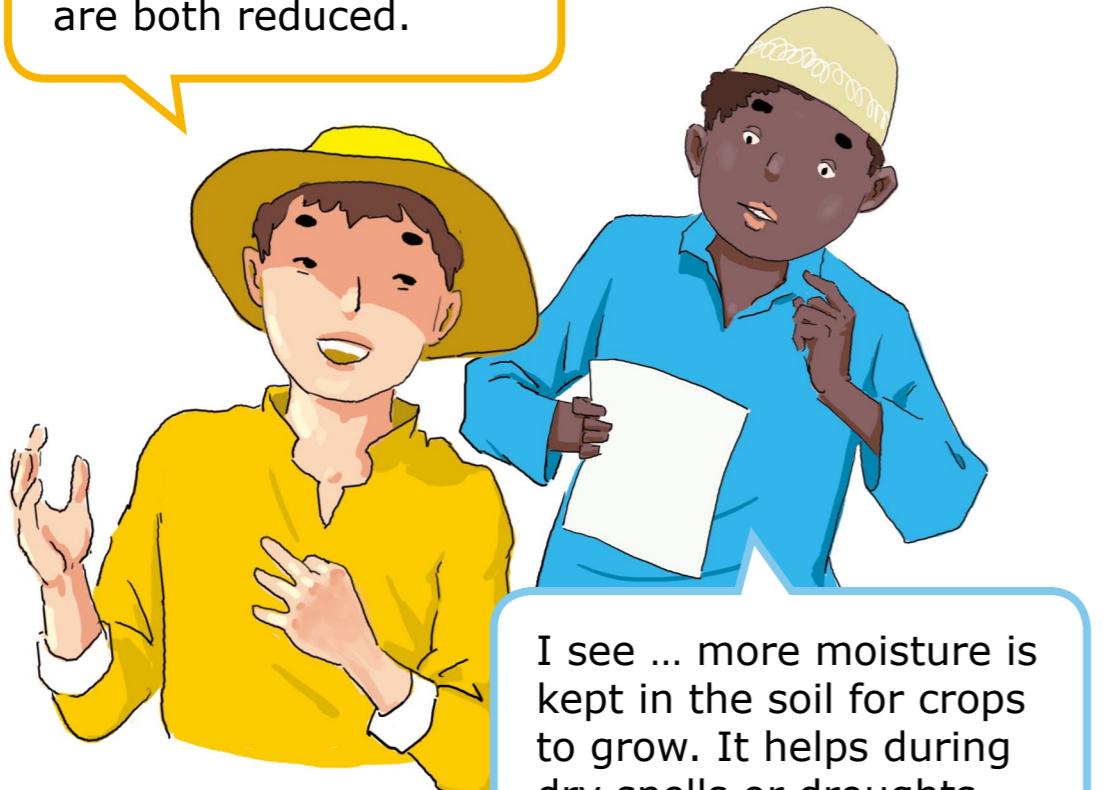
Li Long, in our region, when heavy tropical rains hit bare soil, the runoff washes away topsoil. Can conservation agriculture help?

Yes! Remember the second point of conservation agriculture?

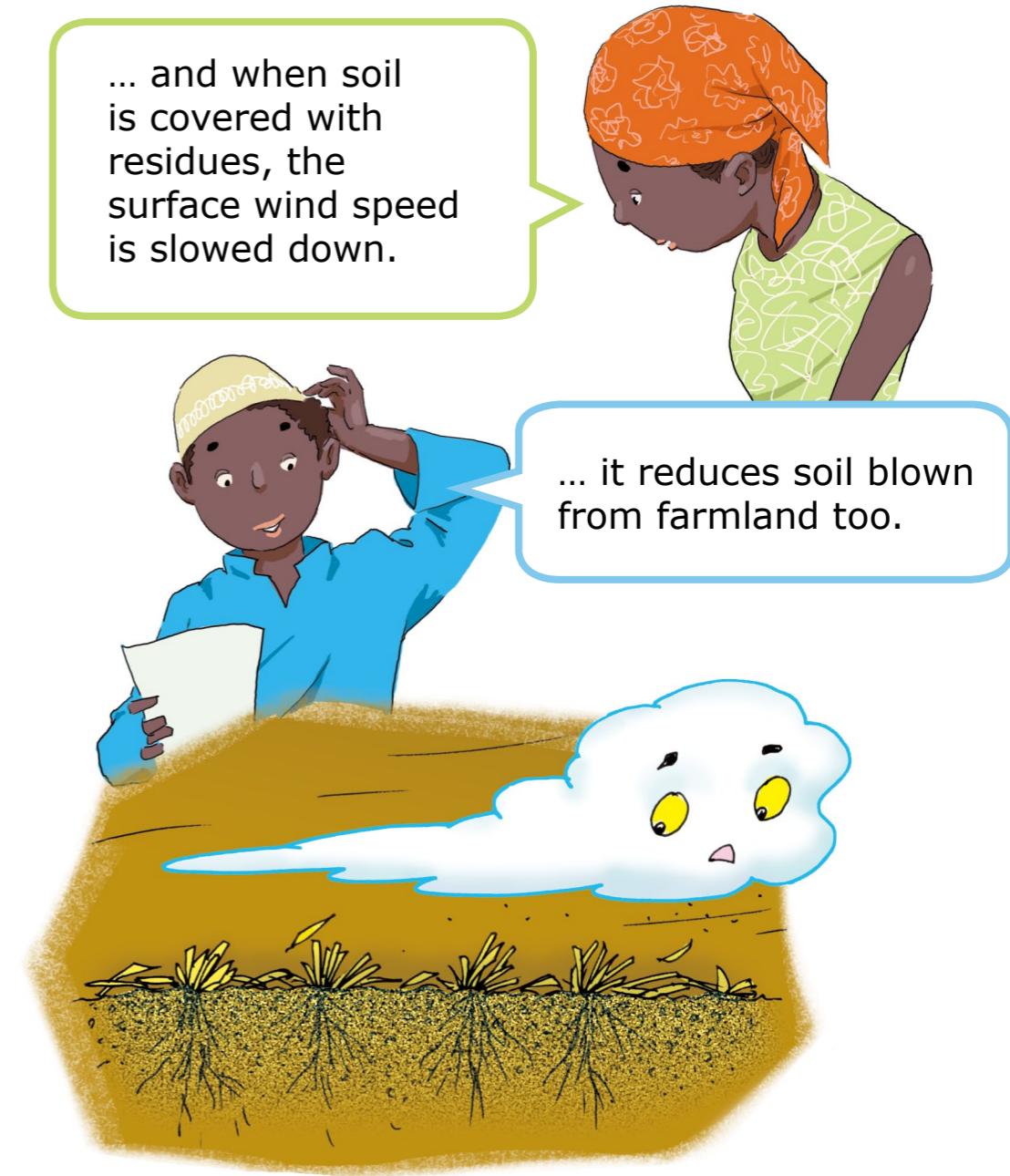
"Cover the field"

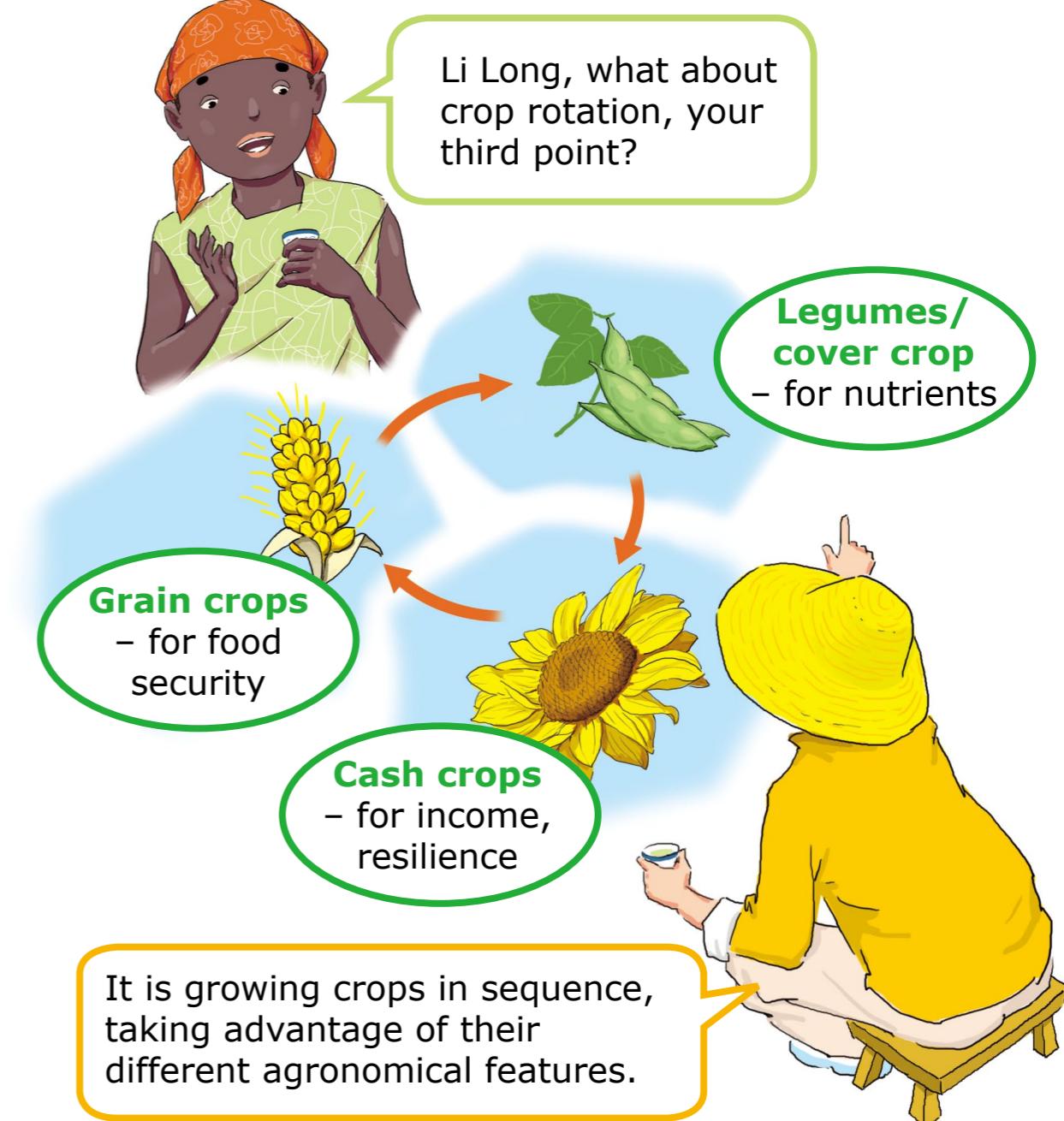
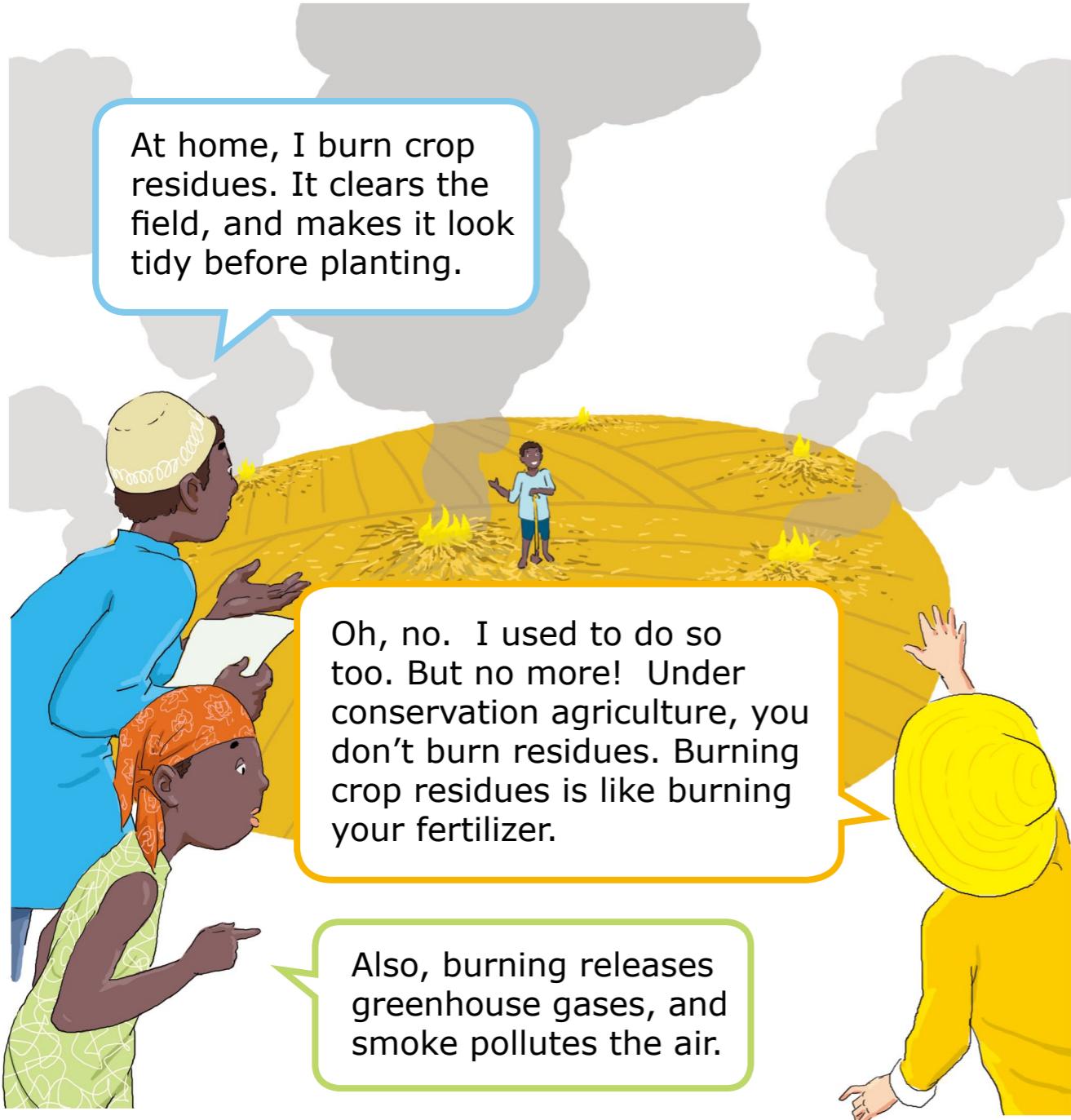
A man in a yellow shirt and hat is speaking. A speech bubble contains the text: "Actually, we say: 'The deeper you plow, the more you lose!'". To his left are three illustrations: a plant growing in a hard plough pan, a soil cross-section showing reduced infiltration, and a worm in disturbed soil. Below him is an illustration of organic matter (labeled 'C') being released from soil. To the right, a woman in a green patterned shirt and orange headscarf is speaking. A green speech bubble contains the text: "Li Long, in our region, when heavy tropical rains hit bare soil, the runoff washes away topsoil. Can conservation agriculture help?". Below her is an illustration of a field being washed away by heavy rain. In the foreground, two men are listening. The man on the left is holding a piece of paper and speaking. A yellow speech bubble contains the text: "Yes! Remember the second point of conservation agriculture?". The man on the right is gesturing with his hands and speaking. A blue speech bubble contains the text: "'Cover the field'".

Right, Amos. Under conservation agriculture, I leave crop residues in the field to cover bare soil after harvesting. So, runoff and evaporation are both reduced.



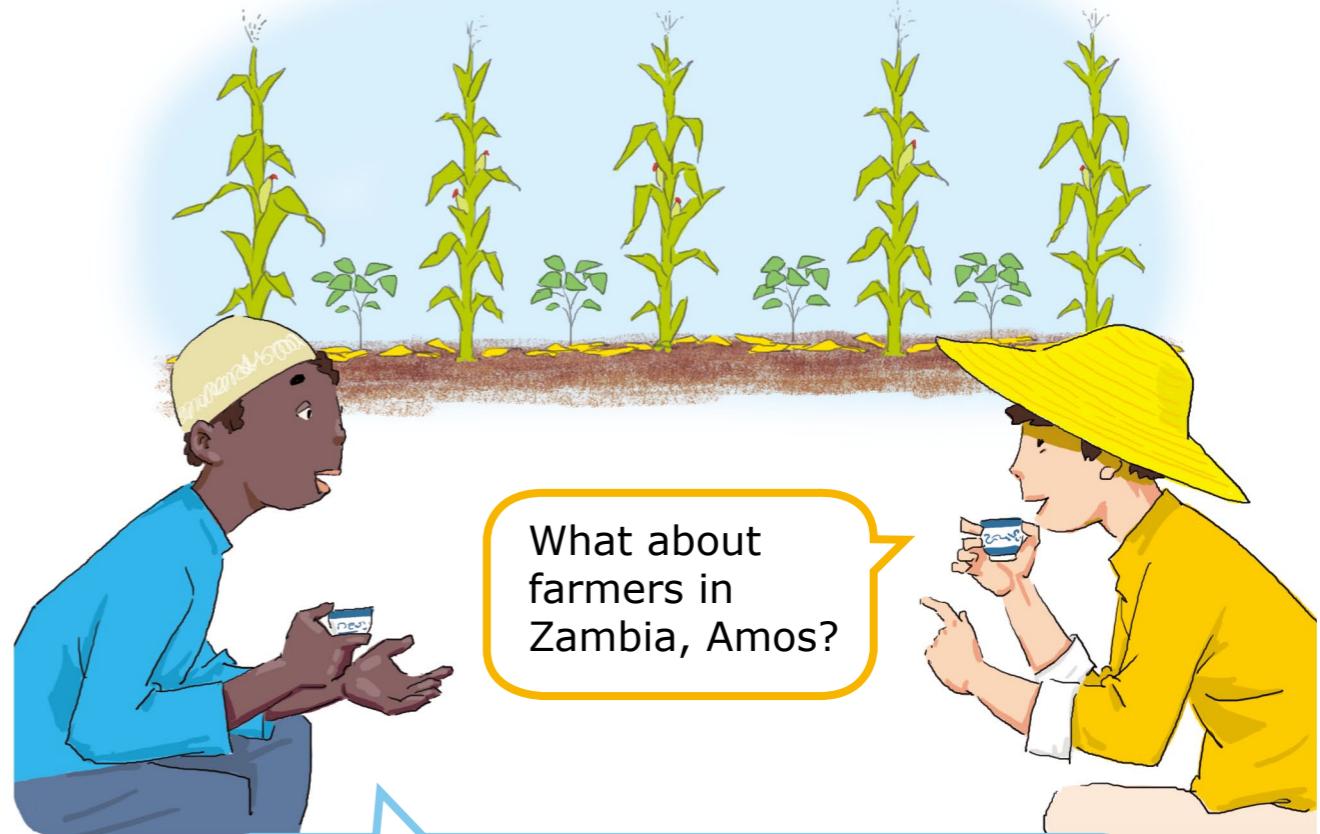
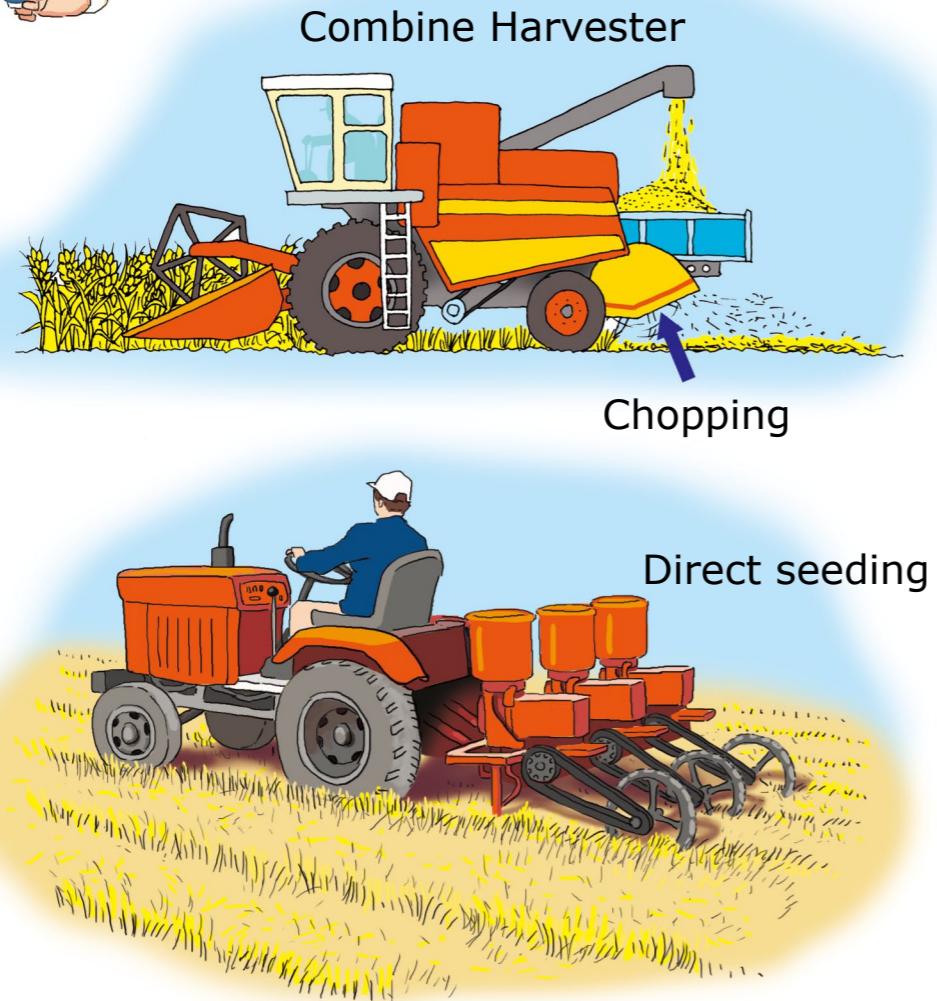
... and when soil is covered with residues, the surface wind speed is slowed down.



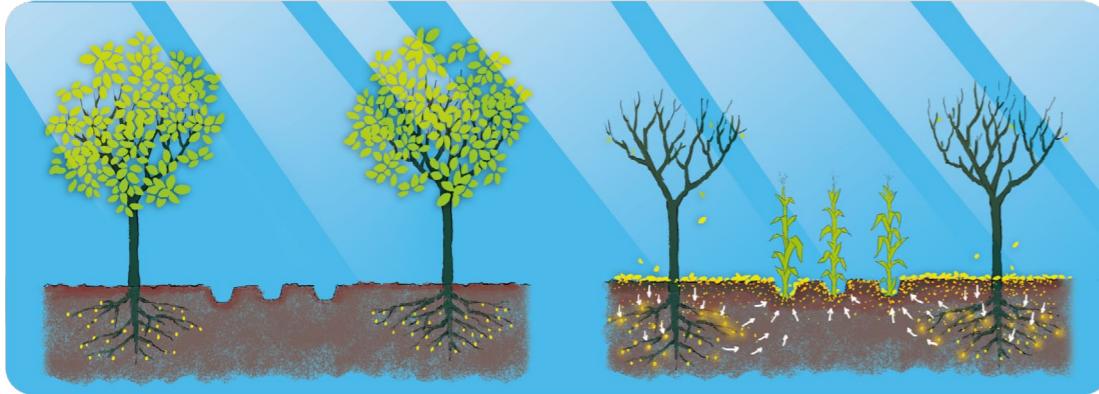




For me, after wheat harvest, I directly seed maize with no-till. Sometimes, I add a legume crop to improve soil nutrients and control pests.



Some farmers grow a cereal crop, followed by a cash crop like cotton...then, a legume crop, such as beans. In Africa, farmers often use crop association through intercropping rather than crop rotation.



Some innovative farmers practice agroforestry, using faidherbia trees in croplands. They call them fertilizer trees, whose nitrogen-rich leaves drop on the ground during the cropping season, enriching soil, and making crops stronger.

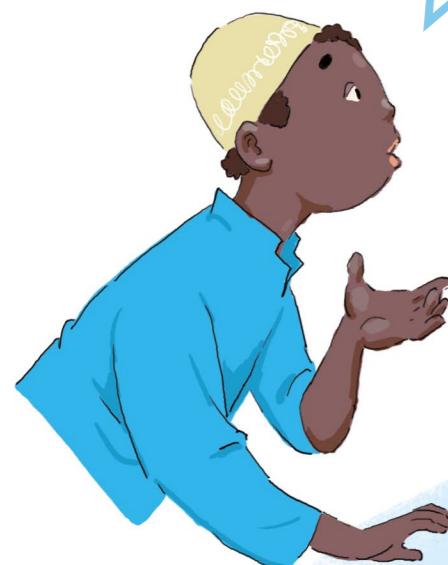


What crops work well under conservation agriculture?

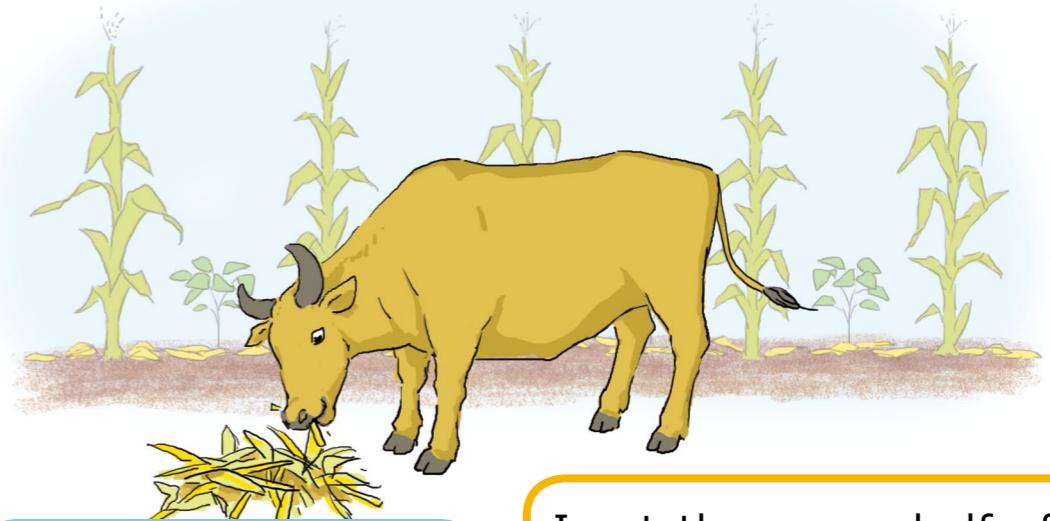
You can use it for most crops. I grow maize, wheat, groundnuts, soybeans, and even rice.



Li Long, this is all wonderful. Now let us get to specifics. What do you advise me to begin with if I want to do conservation agriculture?



Well, you should begin at harvest. Either you harvest your crops manually or by machine, leave 20 cm height of residue on the ground.



What if we need crop residues to feed livestock? How do you manage it?

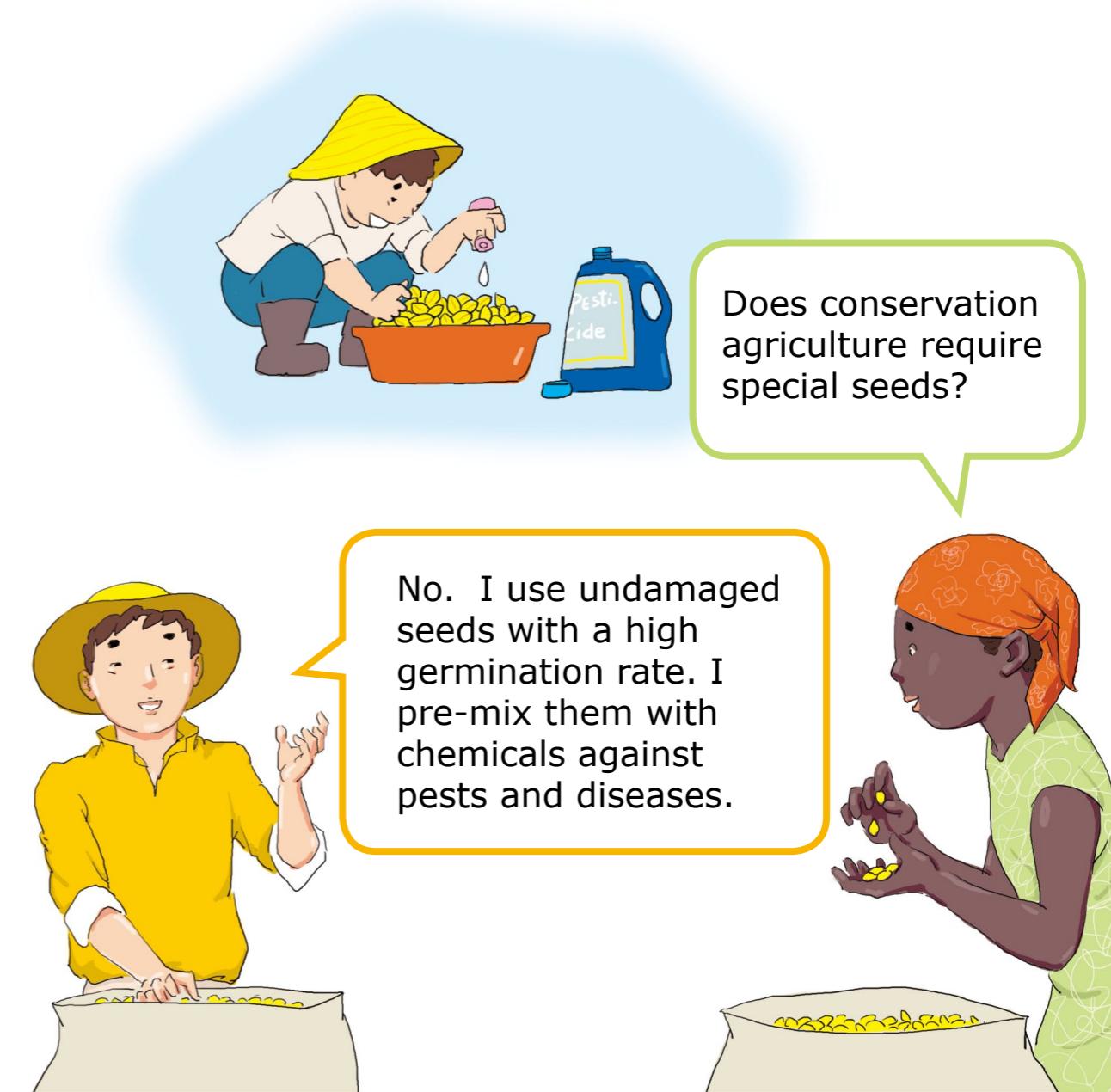


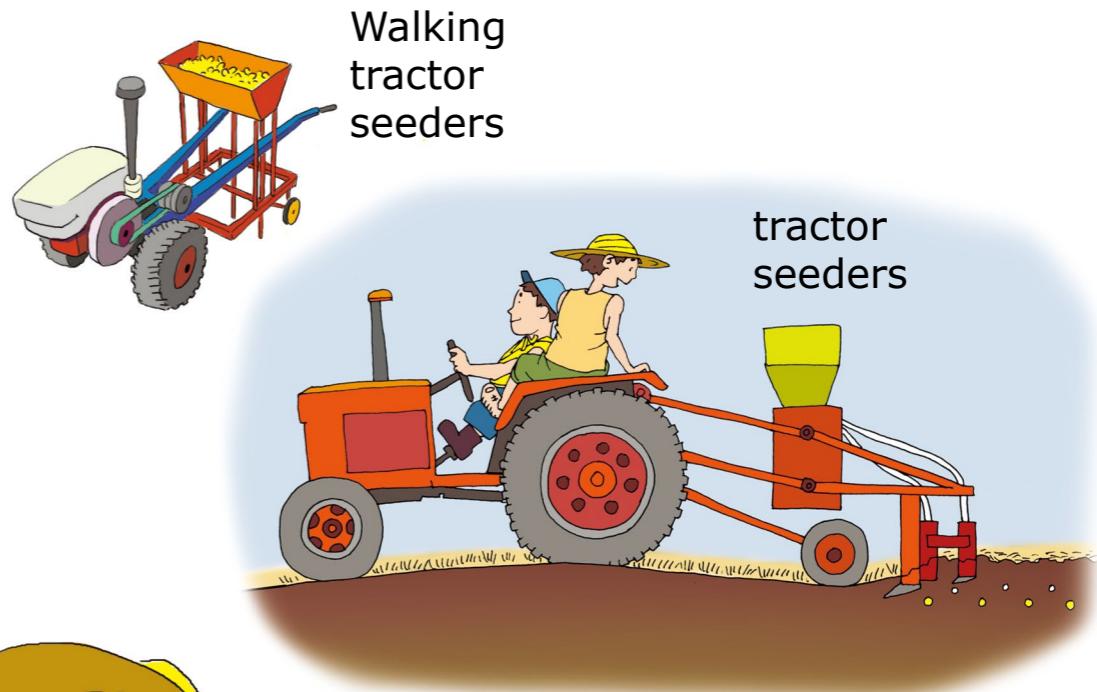
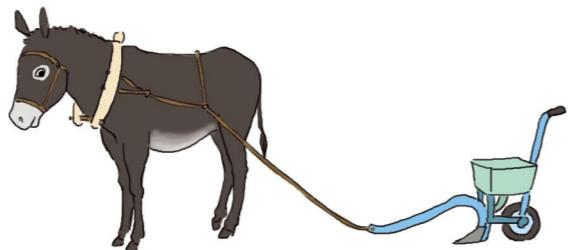
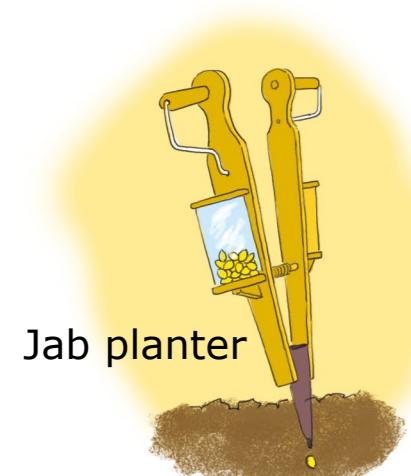
I cut the upper half of my maize crop for livestock, leaving the lower half on the ground. I also started to grow a fodder crop this year.

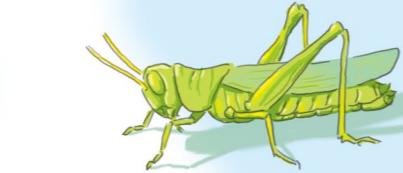
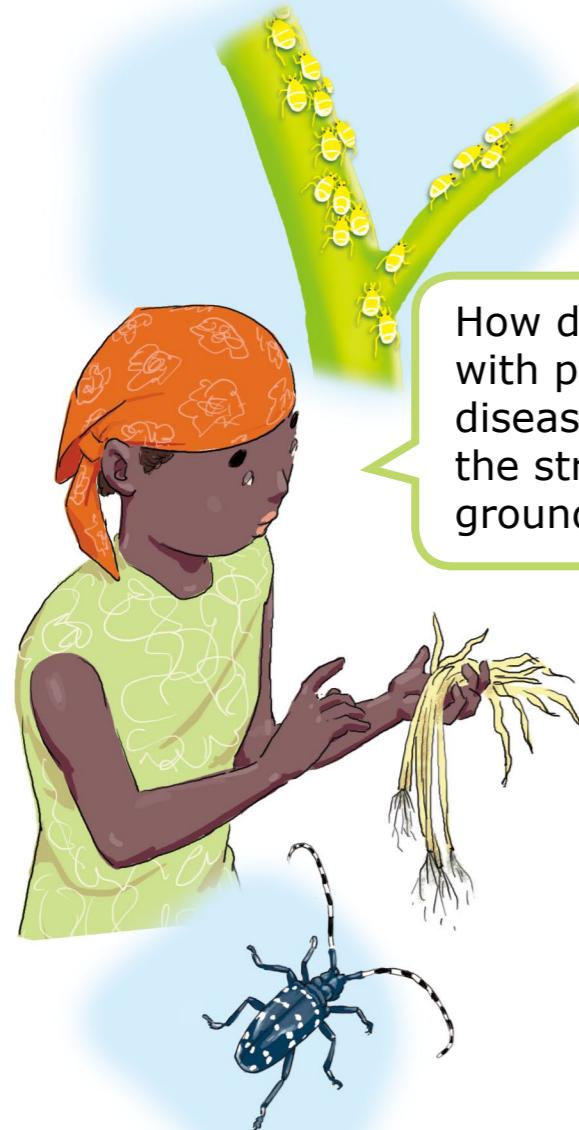


How much residue should I leave in the field?

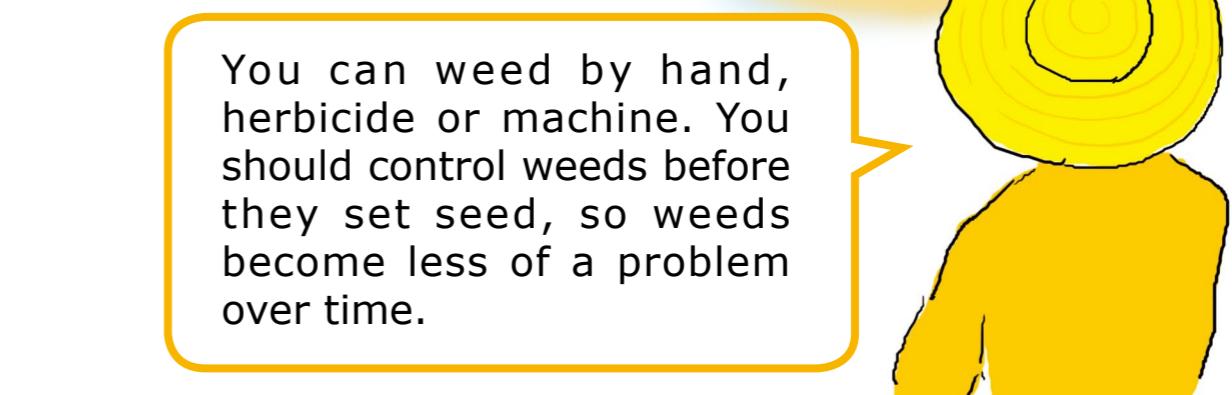
The more, the better. If you don't have enough, you should at least cover 30% of the field. Distribute the residues evenly.

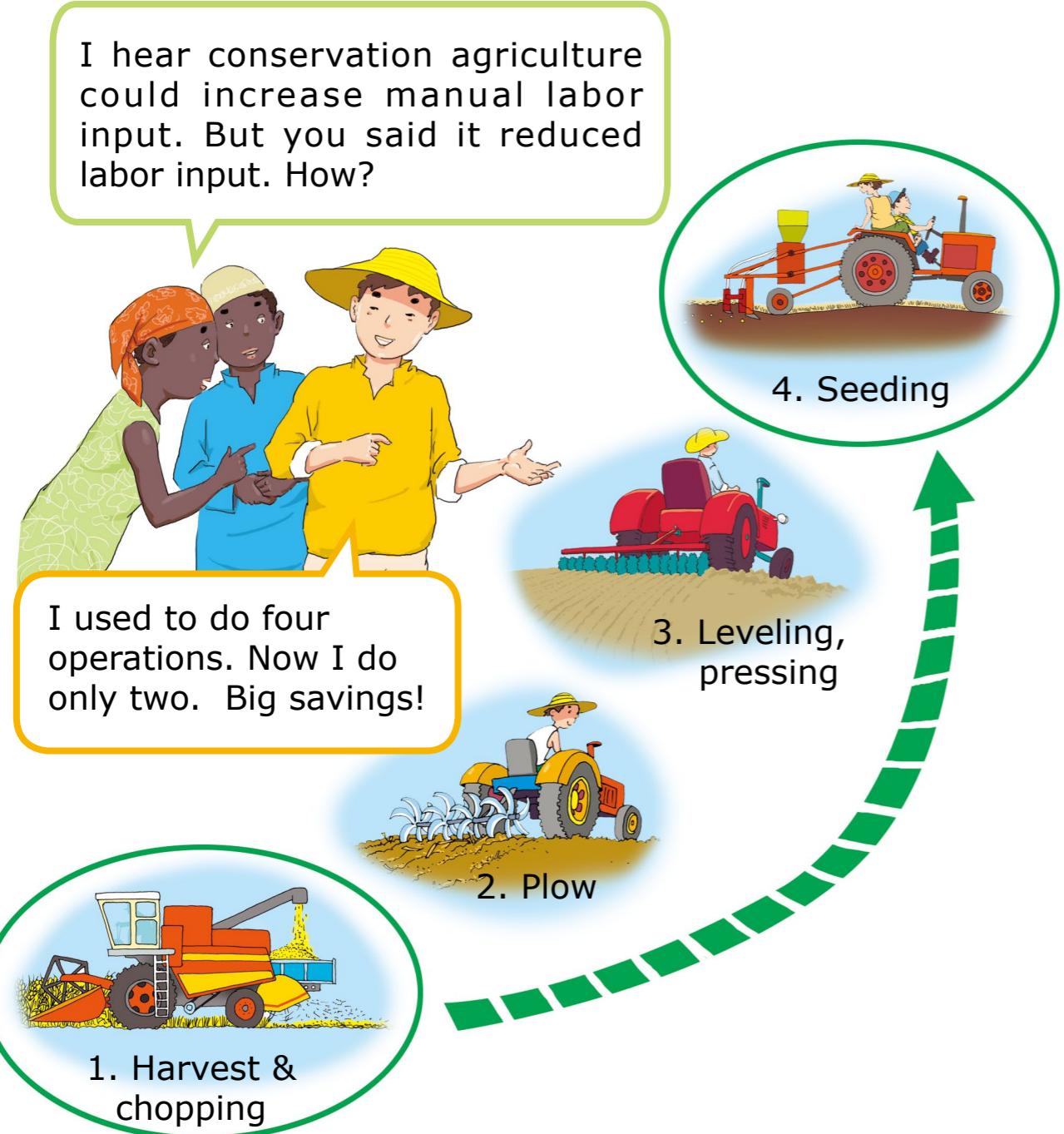


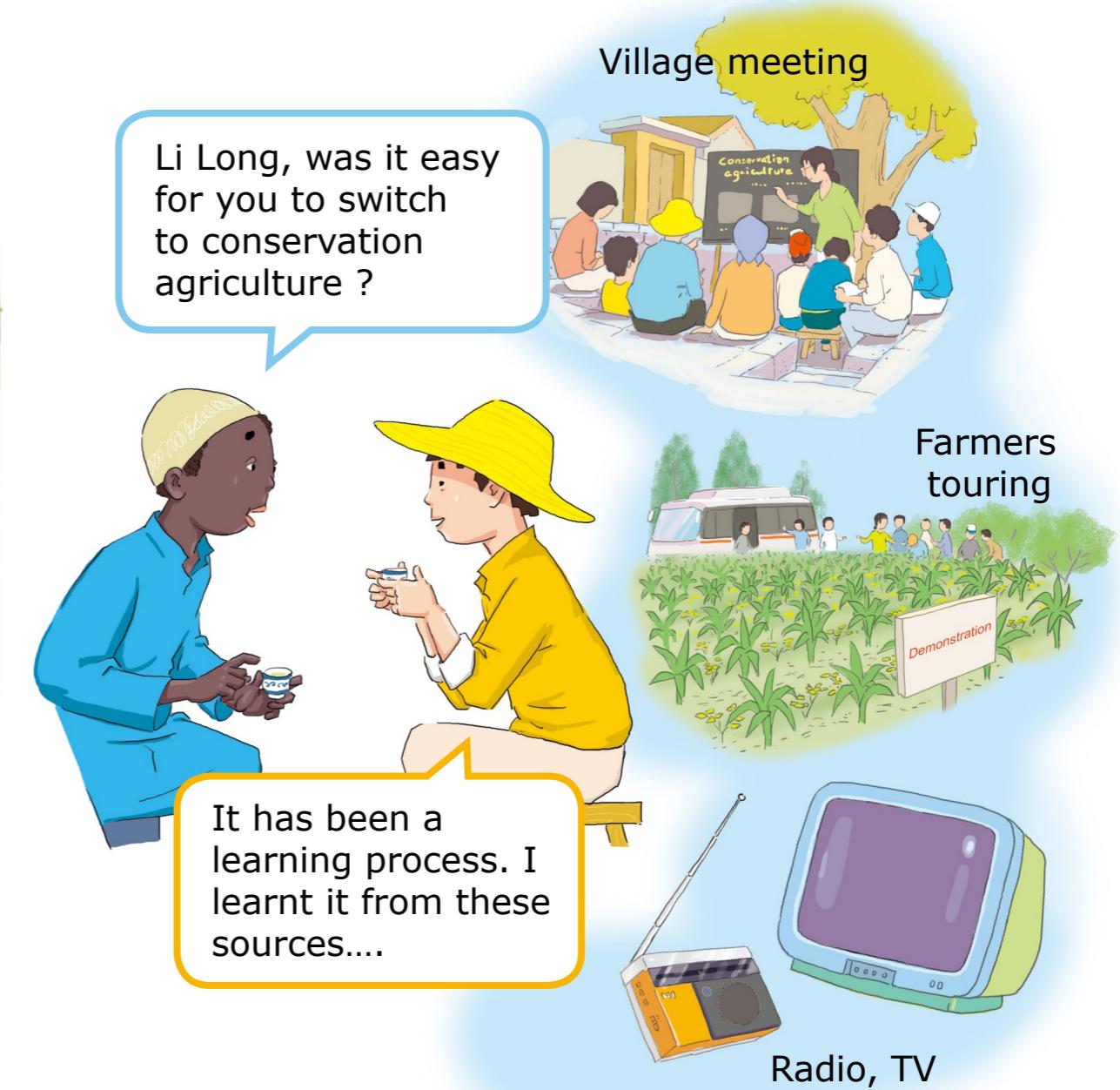




I spray pesticide. But best to use integrated pest management measures.





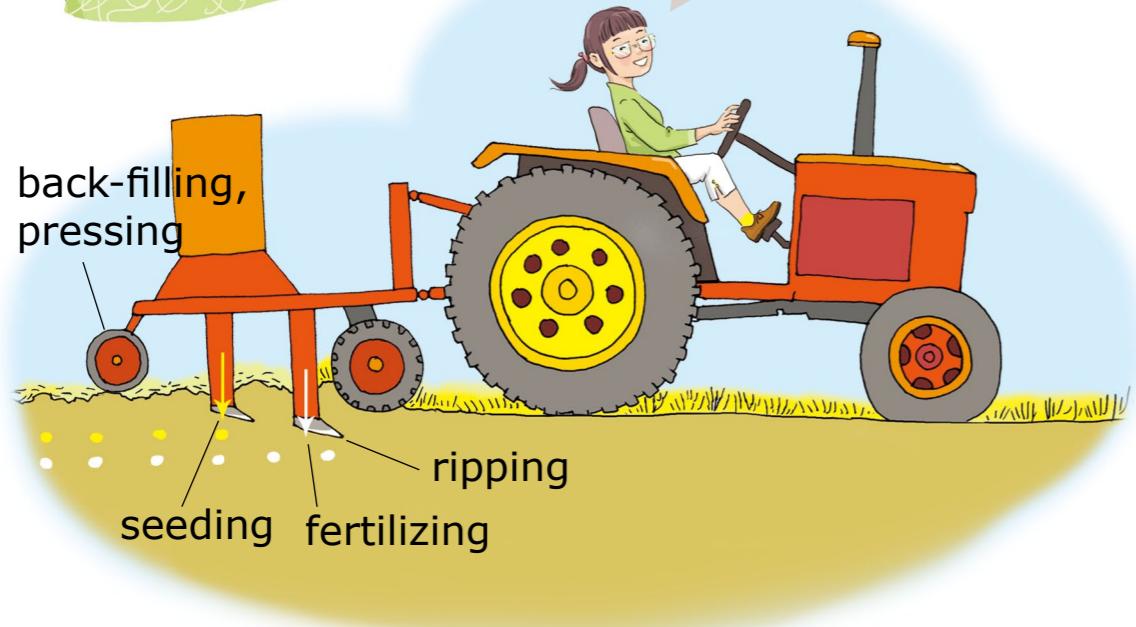






Can you explain more about machinery?

First look at this seeder, specially designed for no-till. It does everything in one operation. It has also anti-blocking, stubble breaking, and depth control functions.

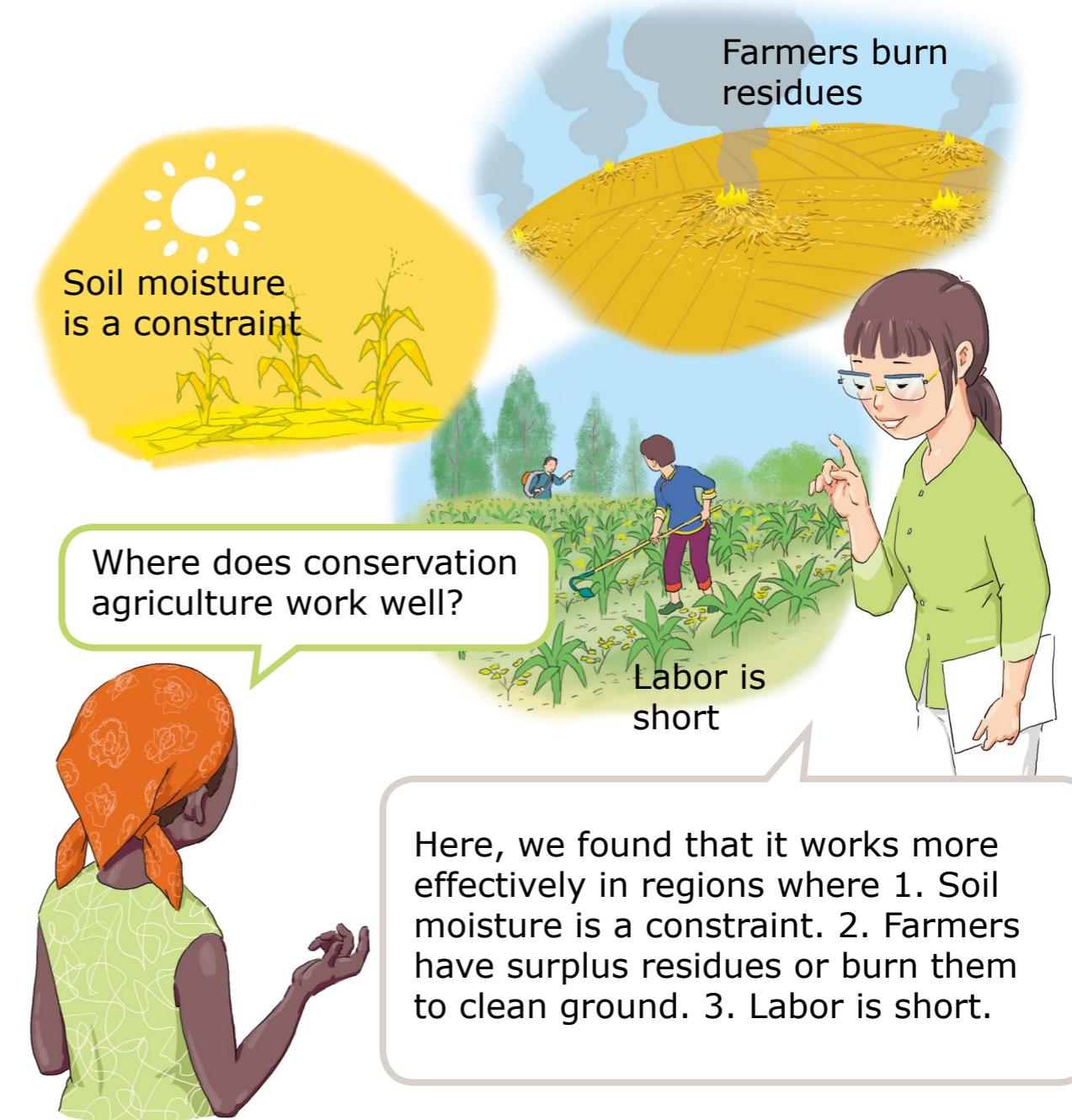


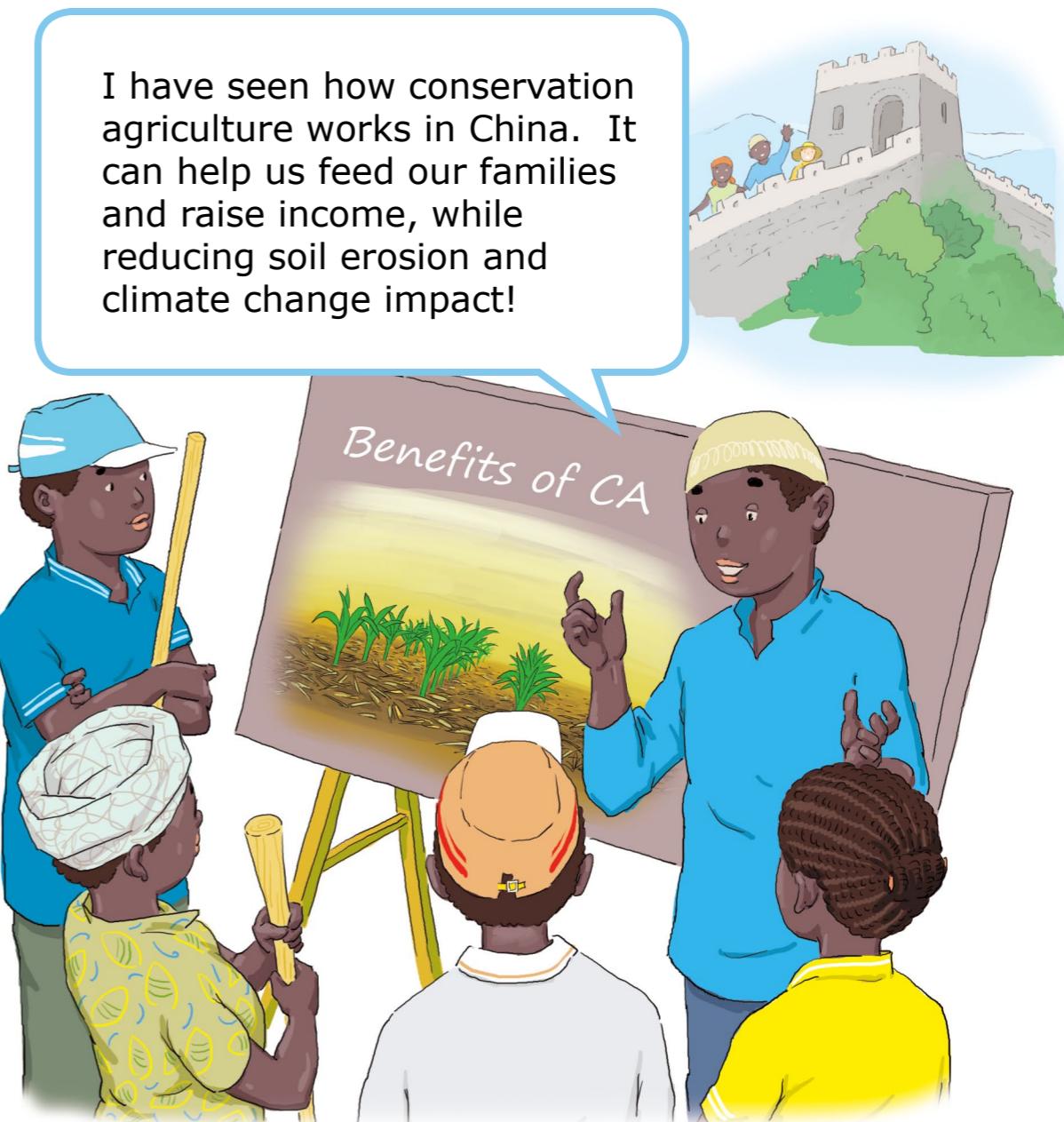
This tractor mounted chisel ripper opens shallow planting furrows.



This is a combine harvester with residue chopper. It spreads straw evenly on the fields as it harvests.





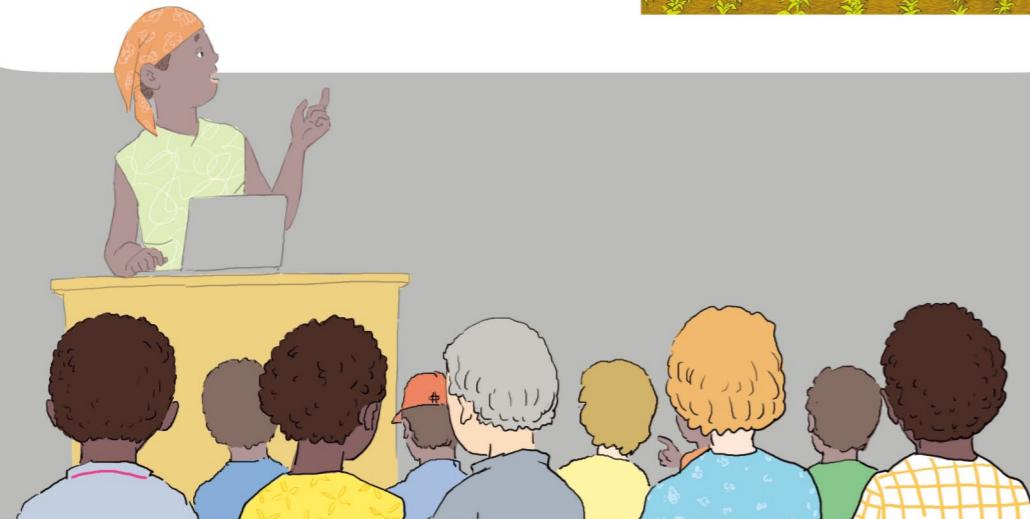


Dear colleagues,

Conservation agriculture can help address issues of productivity, land degradation and climate resilience.

Our government should support extension, farmer learning and agricultural mechanization.

Conservation agriculture
pays – I have seen it
in China.



Photos relating to conservation agriculture



Photo: LI Hongwen

China – No-till wheat seeder
in maize residue field



Photo: LI Hongwen

China – No-till maize seeder
in wheat residue field



Photo: LI Hongwen

China – Two row
no-till maize seeder



Photo: LI Hongwen

China – No-till direct seeder
driven by two-wheel tractor



Photo: LI Hongwen

China – No-till maize seeder
with herbicide sprayers



Photo: LI Hongwen

China – After rain, no logging in CA field



Photo: LI Yan

China – Jab planter



Photo: LI Yan

China – Li Seeder



Photo: LI Hongwen

China – Comparison of crop growth



Photo: LI Hongwen

China – No-till maize field after the first crop (left).
Second maize crop in the same field (right)



Photo: Peter Kuria

Kenya – Maize intercropping
with dolichos lablab



Photo: Peter Kuria

Kenya – Pigeon pea
after the maize harvest



Photo: LI Hongwen

China – No-till sowed wheat
in the maize residue field



Photo: XIE Mei

Zambia – Faidherbia trees
in maize field (GART)



Photo: Patrice Djamen

Burkina Faso – Millet
intercropping with cowpea

Dr. LI Hongwen is Professor of Agriculture and Changjiang Scholar at China Agricultural University. He is the Head of the Conservation Tillage Research Center at the Ministry of Agriculture, and Chairman of the Agricultural Mechanization Committee of the China Society of Agricultural Engineering. He has over 20 years of research experience in conservation agriculture. He has published over 180 papers, received 70 patents, and won three times second prize of the National Award for Technical Advancement for his work on conservation tillage. Email: lhwen@cau.edu.cn

Dr. XIE Mei is Senior Natural Resources Management Specialist at the Climate Change Group of the World Bank. She has over 20 years of development experience in sustainable land and water management, and worked in regions of South Asia, East Asia, Central Asia, Middle East and Africa. While at the World Bank Institute, she was program leader for climate-smart agriculture, and led to produce a series of learning products and global eCourses relating to sustainable land management. Email: mxie@worldbank.org

Dr. HE Jin is Associate Professor of Agricultural Engineering at China Agricultural University. His research focuses on agricultural machinery design, residue management, conservation tillage, and soil protection. He has published dozens of papers, and has won second prize for the National Award for Technical Advancement on Conservation Tillage in China. Email: hejin@cau.edu.cn

Ms. HUAN Yu is Consultant at the Climate Change Group of the World Bank. Her work focuses on development and implementation of capacity building and knowledge exchange activities related to climate-smart agriculture, sustainable land-water management, and carbon finance in agriculture, forestry, and other land use. Email: yhuan@worldbank.org

This wonderful booklet offers hands-on, practical advice for farmers and extension workers interested in using conservation agriculture techniques to boost crop yields, soil quality and water retention. These practices represent some of the many ways we can become more 'climate smart', which is essential if we are to sustainably produce more food on less land to feed our growing planet.

—Juergen Voegele, Senior Director, Agriculture
Global Practices, World Bank

Conservation Agriculture: a modern farming practice with ancient Chinese philosophy.

— Ke Bingsheng, President,
China Agricultural University

Smart use of land resources can turn agriculture around from being part of the problem to being part of the climate change solution.

— Saidi Mkomwa, Executive Secretary,
African Conservation Tillage Network

Sharing of experience between practitioners through South-South exchanges is an effective way to learn from mistakes of the past and scale up successes to meet climate change challenges.

— Neeraj Prasad, Manager,
Climate Change Knowledge, World Bank



The book is printed on recycled paper



定价：20.00 元