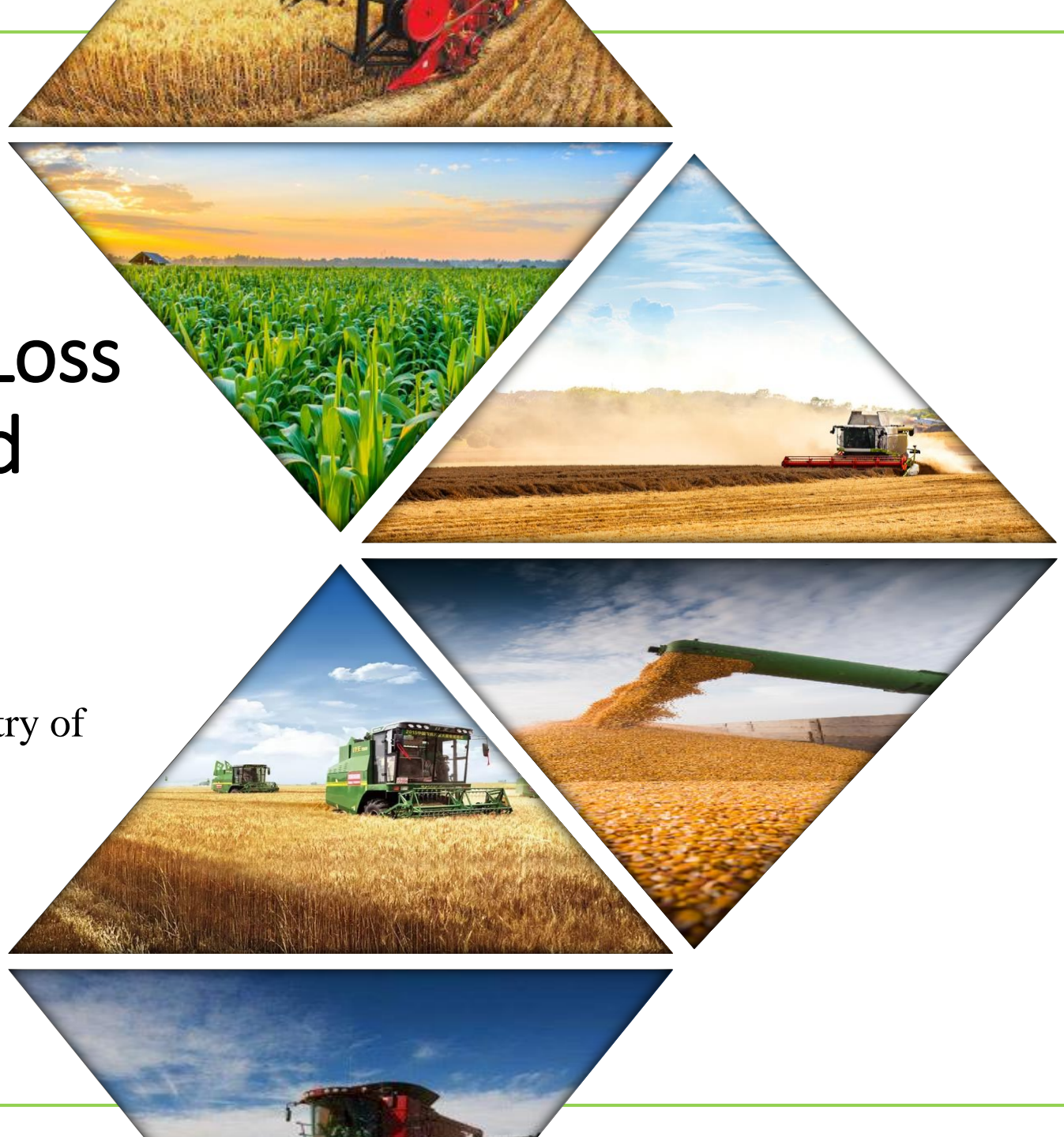


Detection Technology of Combine Harvester and Loss Reduction of Mechanized Harvesting in China

Feng Jian

China Agricultural Mechanization Center, Ministry of
Agriculture and Rural Affairs

October 11, 2022





Main national codes for combine harvester

- Current national standards
- Size division of combine harvester



Detection technology of combine harvester

- Main testing items of grain combine harvester and corn combine harvester
- How to detect the loss rate of combine harvester



Suggestions on reducing the loss of harvesting operation

- Machine loss reduction work in China
- Main measures to reduce food Loss

1

National Codes

Current national standards

Product technical standard

GB/T 8097 Equipment for harvesting-Combine harvesters-Test procedure

GB/T 20790 Technical requirements for head-feed combine harvester

JB/T 5117 Whole-feed combine harvester-Technical requirement

JB/T 6287 Reliability determination test methods for grain combine harvesters

GB/T 21962 Corn combine harvester

DG/T 014 Grain combine harvester

DG/T 015 Corn combine harvester



The main contents : Terms and definitions of combine harvesters, technical requirements, field performance test methods, production capacity test methods

Current national standards

Safety requirement

GB 10395.1 Agricultural and forestry machinery Safety Part 1:General requirements

GB 10396 Tractor, machinery for agriculture and forestry,powered lawn and garden equipment-Safety signs and hazard pictorials-General principles

DG/T 014 Grain combine harvester

DG/T 015 Corn combine harvester



The main contents :Combine harvester's safety protection, safety equipment, safety performance(braking,noise,etc) and safety information(safety signs)

Size division of combine harvester

		Types of machinery	Large	Medium	Small
Grain combine harvester	Whole-feed combine harvester rating throughput a (kg/s)	Wheeled	$a \geq 5.0$	$2.0 \leq a < 5.0$	$a < 2.0$
		Tracked	$a \geq 4.0$	$1.5 < a < 4.0$	$a \leq 1.5$
	head-feed combine harvester Number of working rows b (row)		$b \geq 5$	$2 < b \leq 4$	$b \leq 2$



Whole-feed combine harvester, Tracked
Rating throughput: 5kg/s



Whole-feed combine harvester, wheeled
Rating throughput: 10kg/s



head-feed combine harvester, Tracked
working rows: 2 rows

Size division of combine harvester

Corn combine harvester	Types of machinery	Large	Medium	Small
	maize head working width b (cm)	$b \geq 280$	$160 < b < 280$	$b \leq 160$



picking and peeling maize ear, self-propelled
Harvest 5 rows, head working width: 201cm



corn grain harvester, self-propelled
Harvest 5 rows, head working width: 290cm



picking maize ear, suspend
Harvest 2 rows, head working width: 120cm

2

Detection technology

Main testing items of combine harvester

For combine harvester, the working performance indicators concerned are total loss rate, impurity rate and broken rate.

Tab 1 working performance in China

standard requirements	Item	wheat	rice	maize	
				maize ear harvester	maize threshing harvester
	<i>total loss rate %</i>	≤ 1.2	≤ 2.8	≤ 4	≤ 5
	<i>impurity rate %</i>	≤ 2.0	≤ 2.0	≤ 1	≤ 5
	<i>broken rate %</i>	≤ 1.0	≤ 1.5	≤ 1.5	≤ 3
caution	<i>The above indicators are under the premise that the test conditions meet the standard requirements,including ratio between straw and grain,grain moisture content, lowest height of spicas,etc</i>				

- **Key operational indicator---Total loss**

In Chinese combine harvester detection method, total loss includes process loss and gathering loss.

***process loss**----during the harvest process, grain loss due to threshing, separating and cleaning.*

***gathering loss**----during the harvest process, grain loss due to falling of headers or other feeding devices.*

- Taking Whole-feed combine harvester as an example

Step 1

- *Test area: Length ≥ 25 m*

- *Test conditions: basic conditions of crops and fields, including soil moisture content, ratio between straw and grain, grain moisture content, lowest height of spicas, etc*

According to the test results, determine whether the test area and test conditions meet the standard requirements. (Satisfied continue, dissatisfied need to re-select)

- **Taking Whole-feed combine harvester as an example**

Step 2

➤ **Test process:** recording operating time, receiving all discharge from machine (including collecting grain and stem samples).

1 person: recording time through the test area with a stopwatch

2-4 persons: using a sample-cloth to receive all grains and stems from machine through the test area, and weigh the collected samples with a electronic scale

Combine harvester detection field process



- Taking Whole-feed combine harvester as an example

Step 3

- *Result calculation:* throughput Q , process loss rate S_t , gathering loss rate S_g

$$Q = \frac{W_v}{T}$$

Q — Throughput, unit:kg/s

W_v — Total Mass of Grains, Stem and Cleaning Effluents Receiving by test area, unit:kg

T — Time through the test area,unit:s

• Taking Whole-feed combine harvester as an example

Step 3

➤ **Result calculation:** process loss rate S_t , gathering loss rate S_g

$$S_t = \frac{W_w + W_f + W_q}{W} \times 100\%$$

$$W = W_c(1 - Z_z) + W_w + W_f + W_q$$

S_t — process loss rate;

W_w — the underthreshing loss of grain weight, unit:g;

W_f — the separation loss of grain weight, unit:g;

W_q — the cleaning loss of grain weight, unit:g;

W — The total mass of grains in the test area, unit:g;

W_c — The total mass of all discharges from machine outlets, unit:g.

• Taking Whole-feed combine harvester as an example

Step 3

➤ **Result calculation:** process loss rate S_t , gathering loss rate S_g

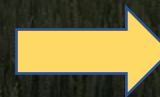
$$S_g = \frac{W_{gs} (B \times L)}{W} \times 100\%$$

S_g ——gathering loss rate;

W_{gs} ——actual loss per square meter of header,unit:g;

B——average actual working width, unit:m;

L——Test area: Length of the test area,unit:m



Total loss rate:

$$S = S_t + S_g$$

3

Suggestions



Machine loss reduction work in China



➤ Government attaches importance to food loss

Promoting the loss reduction of grain crop machinery constantly.

The national agricultural and rural system has widely organized and carried out large-scale training, publicity and competition activities for machine harvest reduction.



当前位置: 首页 > 机构 > 农业机械化管理局 > 工作动态

常抓不懈推进粮食作物机收减损

日期: 2021-11-09 作者: 来源: 农业机械化管理局 【字号: 大 中 小】 打印本页

当前我国水稻、小麦、玉米机收率分别达到94%、98%、79%，主粮作物收获已基本实现机械化，机收减损是降低农业生产环节损耗浪费、增加粮食产量的重要措施。近日，中办、国办印发《粮食节约行动方案》，明确要求要减少田间地头收获损耗。如果三大主粮作物机收损失率平均降低1个百分点，每年全国就可挽回120亿斤左右的粮食损失，推进机收减损意义重大。

今年以来，全国农业农村系统广泛组织开展了机收减损大培训、大宣传、大比武活动。“三夏”期间小麦机收减损约25亿斤，平均损失率控制在2%以内；“双抢”期间早稻机收减损近5亿斤，平均损失率控制在3%以内；各地秋粮机收减损工作正在有序开展。

当前和今后一段时期，各级农业农村部门要按照“一个品种一个品种、一个区域一个区域、一个季节一个季节、一个环节一个环节”抓实粮食生产的工作部署，牢固树立“减损就是增产”意识，将机收减损作为粮食生产机械化工作中的重中之重常抓不懈，要坚持问题导向和目标导向，立足当前、着眼长远，紧紧围绕收获机械、机手操作技能和技术状态这两个关键要素，紧盯主粮作物和“三夏”“双抢”“三秋”等重要农时，扎实做好农机管理服务措施，不断强化宣传动员、机手培训、技术指导、装备升级、质量管理、政策引导及服务保障，全方位提升粮食收获质量，进一步降低机收损失。

要广泛宣传动员，抓好机收减损工作，必须在全社会牢固树立“减损就是增产”意识。广泛动员地方政府部门和基层农业农村干部及时实现粮食工作重心转移，从只关注粒收到关注效率更关注质量，从重得引种、责任落实、监督检验等工作措施入手，尽可能消除主观认识不足和工作不到位的情况。常态化组织开展粮食收获减损技能比武活动，以赛促训、以赛促技，激发广大机手学赶超争先锋争先创优的荣誉感和使命感，推动机收作业提质增效、提质减损。广泛开展机收减损大宣传活动，营造广大农机手、全社会关注支持机收减损的浓厚氛围。



当前位置: 首页 > 新闻 > 全国信息联播

机收减损助力粮食颗粒归仓

日期: 2021-12-17 09:36 作者: 刘殿波 王永亮 来源: 河南日报 【字号: 大 中 小】 打印本页

12月10日，国家统计局河南调查总队发布河南全年粮食产量。2021年，河南粮食总产量为1308.84亿斤。作为全国农业大省、粮食生产大省，河南省粮食产量连续16年超过1000亿斤，连续5年超过1300亿斤，为扛稳粮食安全重任作出了河南贡献。

这份贡献里有河南农机化工作的一份功劳。今年以来，在河南省委、省政府的正确领导下，河南省农机化工作以习近平新时代中国特色社会主义思想为指导，深入学习贯彻党的十九届六中全会精神和河南省第十一次党代会精神，落实农机新发展理念、深化农机供给结构性改革、推进农机高质量发展，全力组织机收，多措并举强化粮食作物机收减损，有力地保障了全省粮食生产，为河南“三农”事业全面发展提供有力支撑保障。

科学谋划狠抓落实 精心组织机收减损比武



首页 > 新闻 > 国内

全国粮食机收减损技能大比武山东赛区开赛

2021-06-04 17:00 来源: 新华社 【字号: 大 中 小】 打印 分享



Machine loss reduction work in China



The video-competition activity for machine harvest reduction in Guangdong

广东省水稻机收减损工程 >> 农技乡村行 有我轻骑兵

机收比武 减损增效

2022年广东省水稻机收减损 激励机制试点暨技能大比武启动仪式

2022年6月26日 江门·台山

主办单位: 广东省农业农村厅
承办单位: 广东省农业技术推广中心 江门市农业农村局
协办单位: 台山市农业农村局 江门市农业技术服务中心 南方农村报

The poster features a background image of a vast, golden rice field under a clear blue sky. In the foreground, several combine harvesters are visible, some in the process of harvesting, creating dark tracks in the rice. The overall scene is bright and sunny, representing the agricultural context of the event.

➤ Strengthen the machine operator training

The technical level and professionalism of combine harvester drivers directly determine the quality of harvesting operations.

Organization to carry out professional agricultural machinery hand training action, improve the operator's operating ability and reduce the food loss by machine-harvesting.



➤ Publishing operation technical specifications

For guide the operators to reduce food loss when harvesting operations, publishing the technical guidance of mechanized harvesting and loss reduction of **rice, wheat and maize** successively.



当前位置：首页 > 机构 > 农业机械化管理司 > 全程全面机械化

小麦机械化收获减损技术指导意见

日期：2022-06-01 作者：来源：农机化总站 【字号：大 中 小】 打印本页

(2022年5月修订)

农业农村部农业机械化管理司 农业农村部农业机械化总站 农业农村部农作物生产全程机械化推进专家指导组

本技术指导意见适用于全喂入联合收割机的小麦收获作业。在一定区域内，小麦品种及种植模式应尽量规范一致，作物及田块条件适于机械化收获。机手应根据小麦田间状态提前检查调试好收获机械，确定适宜收割期，执行小麦机收作业质量标准 and 操作规程，提高作业效率、减少收获环节损失。

一、作业前准备

开始作业前要保持机具良好的工作状态，预防和减少作业故障，提高作业质量和效率。

(一) 机具检查

当前位置：首页 > 机构 > 农业机械化管理司 > 全程全面机械化

水稻机械化收获减损技术指导意见

日期：2022-06-01 作者：来源：农机化总站 【字号：大 中 小】 打印本页

(2022年5月修订)

农业农村部农业机械化管理司 农业农村部农业机械化总站 农业农村部农作物生产全程机械化推进专家指导组

本技术指导意见适用于联合收割机、分段式割晒机的水稻收获作业。在一定区域内，水稻品种及种植模式应尽量规范一致，作物生长及田块条件适于机械化收获。机手应提前检查调试好机具，确定适宜收获期，严格按照作业质量标准 and 操作规程，减少收获环节损失。

一、作业前准备

作业前要保持机具良好工作状态，预防和减少作业故障，提高作业质量和效率。

当前位置：首页 > 机构 > 农业机械化管理司 > 全程全面机械化

大豆玉米带状复合种植机械化收获减损技术指导意见

日期：2022-09-19 作者：来源：农业机械化总站 【字号：大 中 小】 打印本页

农业农村部农业机械化总站

农业农村部农作物生产全程机械化专家指导组

当前，即将进入大豆玉米复合种植大面积收获期。为加快大豆玉米带状复合种植全程机械化技术推广应用，针对部分地区机收经验不足、损失预期偏高等问题，聚焦“3+2”（3行大豆+2行玉米，下同）、“4+2”（4行大豆+2行玉米，下同）种植模式，制定了大豆玉米带状复合种植机械化收获减损技术指导意见，供各地参考。其他技术模式可参照应用。

一、适宜收获期确定

适期收获是机械化收获减损的关键，根据作物品种、成熟度、籽粒含水率及气候等条件，确定两种作物收获期，并适期收获，过早或过晚收获会对作物产量和品质造成不利影响。

(一) 大豆适宜收获期

Main measures to reduce food Loss



1. Choosing suitable harvest time

wheat & rice: between the end of waxen maturity and the initial stage of complete ripeness



2. Adjusting harvester parameters

During the operation, should choose the appropriate operating parameters, and according to the different natural conditions and crop conditions to adjust the machine in a timely manner, so that the combine harvester to maintain good working condition, reduce machine loss, improve the quality of operation.



3. Selecting operation route and operation speed

During the operation, the machine should be flexibly selected according to the actual situation of the field. It is convenient and fast to unload the grain and minimize the empty line of the machine. Try to keep driving straight when working. According to field conditions and crop conditions, choose the right operation speed.

Main measures to reduce food Loss

The Combine Harvester testing for reducing food losses is very important.

- *Formulate reasonable detection methods and detection indicators, ensuring that combine harvesters are tested for efficiency helps achieve food security.*
- *Using the test results, feedback to the combine harvester production enterprises, promote them to improve product quality, to achieve the purpose of reducing food losses gathering loss.*



Thank you

