



小杂粮
栽培技术丛书

XIAOZALIANG ZAIPESHU CONGSHU



小杂粮栽培技术 ——豆类

丁明◎主编

宁夏人民出版社

图书在版编目(CIP)数据

小杂粮栽培技术. 豆类/丁明主编. —银川: 宁夏人民出版社, 2009.4

ISBN 978-7-227-04159-7

I. 小… II. 丁… III. ①杂粮—栽培②豆类作物—栽培 IV. S51 S52

中国版本图书馆CIP数据核字(2009)第057257号

小杂粮栽培技术——豆类

责任编辑 景 岚 刘建英

封面设计 杨维扬

责任印制 来学军

宁夏人民出版社 出版发行

出 版 人 杨宏峰

地 址 银川市北京东路139号出版大厦(750001)

网 址 www.nxcbn.com

网上书店 www.hh-book.com

电子信箱 nxhhsz@yahoo.cn

邮购电话 0951-5044614

经 销 全国新华书店

印刷装订 宁夏书宏印刷有限公司

开 本 880mm×1230mm 1/32

印 张 3

字 数 70千

印 数 5000册

版 次 2009年4月第1版

印 次 2009年4月第1次印刷

书 号 ISBN 978-7-227-04159-7/S·241

定 价 16.00元

版权所有 翻印必究

编 委 会

学术顾问：柴 岩 冯佰利

主 编：丁 明

副 主 编：程炳文 吴素琴 李 华 常学文

徐润邑 安维太 宋 刚 常克勤

编写人员：(按姓氏笔画排序)

丁 明 刘 彬 李 华 李玉红 李春珍

宋 刚 吴素琴 安维太 别基亮 张庭柱

徐润邑 常学文 常克勤 黄菊霞 程炳文

内 容 提 要

本书是宁夏第一部关于小杂粮的综合性专著。全书共二十五章，系统介绍了糜子、谷子、甜荞、苦荞、莜麦、高粱、小扁豆、草豌豆、绿豆、小豆、芸豆、豌豆、蚕豆、胡麻、向日葵、苏子、红花、蓖麻、黄芥、芸芥、大麻等小杂粮、小油料的形态特征、分布、生产、区划、品种资源、栽培技术和综合利用等，搜集整理了宁夏种植并具有较大开发潜力的小宗植物，介绍了宁夏近年审定的小杂粮品种，编录了小杂粮的检验技术。本书较全面地反映了宁夏小杂粮产业的发展研究现状，可供从事小杂粮科研教学、农业生产、食品加工、贸易及行政管理等人员参考。

Overview

This book is the first publication in Ningxia to comprehensively focus on the minor grain crops. It consists of 25 chapters which broadly introduce the characteristics, distribution, production, layout of growing areas, breed variety, techniques to grow and all-round utilization of either the minor grain crops or the oil crops, mainly including broom-corn millet, foxtail millet, common buckwheat, bitter buckwheat, naked oat, sorghum, lentil, grass pea, mung bean, adzuki bean, French bean, pea, broad bean, oil-flax, sunflower, perilla, safflower, castor, India mustard, *eruca sativa*, hemp, and so on. It collects and classifies the minor plants typically grown in Ningxia which are believed having potential prospect in exploitation. Furthermore, the book briefs a variety of minor grain crops which have been officially identified by Ningxia authority over the last years, and subsequently records the examining methods for minor grain crops. On top of this, the book comparatively fully contributes a whole picture to the latest developing and research situation of minor grain crops in Ningxia. It is thus hoped that the book can be referenced by those who are engaged in teaching and research of minor grain crops, agricultural production, and food-process as well as helpful for businessmen and administrative officers.

由丁明同志担任主编,组织有关专家编写的《宁夏小杂粮》就要出版了,这是宁夏小杂粮产业发展中的一件大事,对此我甚感欣慰,倍感高兴。

小杂粮是宁夏的特色产业,种植历史悠久,主要分布在宁南山区 8 县,主要种植糜子、谷子、甜荞、苦荞、莜麦、高粱、小扁豆、草豌豆、绿豆、小豆、芸豆、豌豆、蚕豆等 21 个种,常年播种面积约 $16.7 \times 10^4 \text{ hm}^2$, 占宁夏粮食作物总面积的 20% 以上,总产量 $15.0 \times 10^4 \sim 20.0 \times 10^4 \text{ t}$, 占宁夏粮食总产量的 7% 左右,占山区粮食总产量的 17% 左右,山区农民人均纯收入的 30% 左右直接或间接来源于小杂粮,小杂粮产业对提高当地人民生活水平、促进农业生产和经济发展发挥了重要作用。

小杂粮是宁夏抗旱减灾优势作物。宁南山区自然灾害频繁,特别是干旱尤其严重。小杂粮抗旱能力强,适应性广,适播时间长,从莜麦开始,到豌豆、扁豆、蚕豆、谷子、糜子、荞麦,播种时间从 3 月中旬一直延续到 7 月中旬,历时将近 4 个月。播期长使小杂粮成为宁南山区旱地抗旱播种的首选作物,面积一直稳定在较高的水平上,干旱年份还会大幅度上升,小杂粮以其自身年际间面积的不稳定保证了宁南山区粮食产量的相对稳定,为促进经济发展和社会和谐作出了巨大贡献。

小杂粮是宁夏传统的出口农产品。宁夏小杂粮主产区水质清洁,光照充足,昼夜温差大,无霜期短,这种特殊的自然

条件为杂粮作物提供了良好的生长环境,生产的小杂粮以颗粒饱满,色味纯正,营养丰富,绿色无污染而著称。年出口量5000 t 以上,位居粮食出口量之首,在国外市场具有明显的区域优势、资源优势、生产优势和价格优势,是宁夏最具发展前景的作物之一。

随着人民生活水平的提高和膳食结构的改善,小杂粮作为医食同源的新型食品资源,将会越来越受到人们的青睐。宁夏独特的资源优势、优越的区位优势、上佳的品质优势、良好的品牌优势、强劲的产业优势必将带动小杂粮产业的快速发展,使其成为宁夏支柱产业。

《宁夏小杂粮》一书理论联系实际,全面系统地介绍了小杂粮的植物学特征、生长发育特性及宁夏生产概况、品种、分布、关键栽培技术以及加工、市场等,资料翔实,内容丰富。本书的出版,将丰富宁夏农业科学技术,提升宁夏小杂粮生产和科研水平,加快小杂粮产业化进程,扩大小杂粮外贸出口,促进宁夏小杂粮与国内、国际同行的交流与合作,有利于农业和农村经济快速发展。

宁夏回族自治区农牧厅厅长



2008 年 1 月

Preface I

The book “*Minor Grain Crops in Ningxia*”, edited by Mr. Ding Ming and compiled by many experts is due to be published. I am deeply gratified and enormously pleased because its publication is leading to a major event in the history of minor grain crops development in Ningxia.

Being a peculiar industry in Ningxia, minor grain crops has a long history of planting, distributed in the eight counties in the southern mountain areas of Ningxia where as many as 21 kinds are widely planted, including broom-corn millet, foxtail millet, common buckwheat, bitter buckwheat, naked oat, sorghum, lentil, grass pea, mung bean, adzuki bean, French bean, pea, broad bean, etc. The normal planting area is $16.7 \times 10^4 \text{ hm}^2$ which occupies more than 20% of the whole cereals planting area of Ningxia region. The total output is $15.0 \times 10^4 \sim 20.0 \times 10^4 \text{ t}$ accounting for 17% of the total grain output of the mountain areas and around 7% of the regional grain output. As a result, up to 30% of per capita net income of the local people is directly or indirectly gained by growing minor grain crops. That is to say minor grain crops play an important role in promoting people's living standard, agricultural production and economic development.

Minor grain crops is Ningxia dominant crop remarkable for its role of reducing damages caused by drought. This is because the natural calamity especially drought frequently happens in the southern mountain areas of Ningxia. However, the minor grain crops are having natural intensive strength to anti-drought, high ability of adaptation and longer sowing period. The sowing time for the minor grain crops (from the naked oats to peas, lentils, broad beans, foxtail millets, broom-corn millets, and finally buckwheat) is able to last for nearly 4 months from the mid-March to mid-July of a year. All of the advantages enable them to be the first selected relief crops to anti-drought in the southern mountain areas of Ningxia and the planting

area is steadily kept at a high level and even higher in a large scale in drought years. Moreover, the yearly uncertain planting area of the minor grain crops surely results in a relative stability of cereals output in the whole southern mountain areas of Ningxia and ultimately makes great contribution to the development of economy and social harmony.

Minor grain crops are traditional export products of Ningxia. The special natural conditions of clean water resource, sufficient sunshine, big temperature difference and short frost-free period in the primary producing area provide an effective growing environment for the minor grain crops. The minor grain crops there are well-known because of its full pellet, flavor and natural tastes, rich nutrition, and non-polluted organic features. The export quantity is more than 5000 tons which is the top of the whole exported cereals per year. In addition, it has the obvious regional, resources, producing and price advantages on the overseas market, and is one of the most prosperous agricultural products in Ningxia.

With the improvement of the people's living standard and change of dietary structure, the minor grain crops will be more popular as a new healthy food resource. The unique resource and regional advantages, high quality, excellent brand and vigor industry development will drive the minor grain crops industry developing rapidly and eventually push it to be a pillar industry in Ningxia.

"Minor Grain Corps in Ningxia" integrates theory with practice and reflects systematically about the botanic features, growing, production, variety, distribution, key cultivating technology, processing, and marketing etc. This book is based on rich resources and contents and its publication will definitely enrich the agricultural scientific technology, improve the scientific research level, speed up the industrialized process, enlarge the foreign export trade, and accelerate domestic and international communication and cooperation. It is of great beneficial to the rapid development of agriculture and rural economy of Ningxia.

Chief Director Mr. Zhao Yongbiao
Agricultural and Animal Husbandry Department
Ningxia Hui Autonomous Region
January, 2008

序

二

小杂粮是宁夏的传统优势作物,在宁夏特别是宁南山区农业和农村经济发展中具有十分重要的地位和作用。自治区政府把小杂粮列为优势特色产业,2005 年与西北农林科技大学签署了小杂粮科技合作协议,旨在通过品种引进、试验示范,加速小杂粮新品种的推广,将宁夏建成我国名优小杂粮生产及出口基地。2006 年成立了自治区小杂粮及油料产业培训专家组,从培训农民入手,逐步提升产业发展水平。我本人作为专家组首席专家,在实施培训过程中,深感培训资料的匮乏,专家授课材料凭个人经验自行搜集、整理,缺乏系统性和完整性。因此,为全面掌握宁夏小杂粮的基本情况,提高科技培训水平,普及小杂粮实用技术,加强与国内、国际合作及技术交流,促进小杂粮产业发展,编辑出版《宁夏小杂粮》就显得非常必要,且迫在眉睫。

本书在编写过程中,力求体现实用性、系统性、完整性和新颖性。除了详细介绍小杂粮植物学特征、生长发育特性外,还结合本地气候特点,总结了符合宁夏实际的栽培技术和综合利用方法,简单介绍了宁夏审定通过的小杂粮品种,提出了宁夏小杂粮区域布局发展规划,全面系统地反映了宁夏小杂粮品种、技术、市场等情况,编录了宁夏种植的所有小杂粮,不论面积大小都尽可能编入,兼顾了种植规模较大的胡麻、向日葵等油料作物;搜集、整理和收录了宁夏种植的并具有较大开发潜力的小宗植物;介绍了小杂粮的检验技术。相信本书的出版对促进宁夏小杂粮产业发展,宁南山区农业增效、

农民增收以及现代农业建设将发挥重要作用。

本书的编写与出版,得到了宁夏农牧厅主要领导及科技教育处的大力支持,西北农林科技大学柴岩和冯佰利教授给予悉心指导,在此表示真挚谢意。

A handwritten signature in black ink, consisting of stylized Chinese characters, likely '丁波' (Ding Bo).

2008 年 1 月

Preface II

Minor grain crops is the traditional advantage agricultural products and plays the vital role in development of agricultural and rural economy in Ningxia, especially in the southern mountain areas. It has been approved as the dominant industry by the regional government. In 2005, the provincial government signed scientific cooperative agreement with the Northwest Agricultural and Forestry Science and Technology University aiming to introduce, trial and speed up the extension of new crops in Ningxia where therefore was hoped to set up a national base for production and export of minor grain crops. In 2006, a provincial expert team was organized for carrying out training programme in terms of industry of minor grain crops and cooking oil resource. The outset of programme was to train the peasants in hope of promoting the level of industry gradually. As the chief expert of the team, what I deeply concerned was that we were dramatically lack of training materials because the materials the experts were using for lecture were mostly based on self-collected and edited copies which are obviously short of systematic and integrity. Hence, it is necessary and pressing for us to compile and publish a book “*Minor Grain Crops in Ningxia*”. We believe that this book will be helpful in understanding some basic knowledge of the crops in Ningxia, improving the scientific training level, popularizing the practical techniques, enhancing the domestic and international cooperation and promoting the development of the crops industry.

In the process of compiling the book, we make every effect to show the practicality, systematic ness, integrity, novelty and originality. In spite of the specific introduction to the botanic and growing characteristics of the minor grain crops, the book simultaneously summarizes the practical planting technology and comprehensive utilization of the minor grain crops in respect of Ningxia local climate condition. Moreover, it also briefs minor crop varieties, puts forward the scheme of its distri-

bution, and overall reflects the whole picture of the products, technology and market in Ningxia. In addition, it extensively lists the whole crops growing in Ningxia to the extent of different growing sizes, and at same time considerably covers those crops planted in a large area, such as oil-flax and sunflower. It also collects and outlines the plants varieties that are potentially having prosperous future, and introduces the examining technique. We believe that the publication of this book will play an important role on the improvement of Ningxia minor grain crops industry, agriculture efficiency promotion, farmer's income increase and building of modern agriculture in the southern mountain areas of Ningxia.

While compiling the book, we received great support from the leaders of Agricultural and Animal Husbandry Department of Ningxia and other officers from Scientific Education Office. We owe them a debt of gratitude. And thanks also go for support and instruction from Prof. Chai Yan and Prof. Feng Baili of Northwest Agricultural and Forestry Science Technology University.

Mr. Ding ming

January, 2008



1 目 录

第一章 小扁豆

- 第一节 概述 / 001
- 第二节 小扁豆特征特性 / 002
- 第三节 小扁豆分布 / 005
- 第四节 小扁豆栽培技术 / 006
- 第五节 小扁豆综合利用 / 009

第二章 草豌豆

- 第一节 概述 / 012
- 第二节 草豌豆特征特性 / 013
- 第三节 草豌豆分布 / 014
- 第四节 草豌豆栽培技术 / 015
- 第五节 草豌豆综合利用 / 018

第三章 绿豆

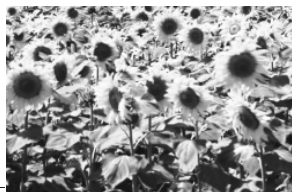
- 第一节 概述 / 020
- 第二节 绿豆特征特性 / 021
- 第三节 绿豆分布 / 024
- 第四节 绿豆栽培技术 / 025
- 第五节 绿豆综合利用 / 029

第四章 小豆

- 第一节 概述 / 032
- 第二节 小豆特征特性 / 034
- 第三节 小豆分布 / 038

目录 2

第四节	小豆栽培技术 / 039
第五节	小豆综合利用 / 043
第五章	芸豆
第一节	概述 / 048
第二节	芸豆特征特性 / 050
第三节	芸豆分布 / 054
第四节	芸豆栽培技术 / 055
第五节	芸豆综合利用 / 061
第六章	豌豆
第一节	概述 / 064
第二节	豌豆特征特性 / 065
第三节	豌豆分布 / 069
第四节	豌豆栽培技术 / 070
第五节	豌豆综合利用 / 074
第七章	蚕豆
第一节	概述 / 078
第二节	蚕豆特征特性 / 079
第三节	蚕豆分布 / 082
第四节	蚕豆栽培技术 / 083
第五节	蚕豆综合利用 / 087



第一章 小扁豆

第一节 概 述

小扁豆 (*Lens culinaris* Medic.), 英文名 Lentil, Split pea, 豆科 (*Leguminosae*) 兵豆属 [*Lens* (Tourn.) L.] 栽培种。小扁豆又名滨豆、鸡眼豆等。一年生草本植物, 根据籽粒大小和性状又分为两个亚种。大粒亚种 (*L. culinaris* subsp. *Macroperma*): 花较大, 白色有纹, 少数为浅蓝色; 荚果和籽粒均大而扁, 种皮浅绿色带斑点; 小叶大, 卵形。小粒亚种 (*L. Culnaris* subsp. *Microperma*): 花较小, 白色、紫色或浅粉红色; 荚果与籽粒小至中等; 籽粒形如凸透镜, 种皮浅黄、黑色, 花纹不一; 小叶小长条形或披针形。

小扁豆起源于亚洲西南部和地中海东部地区。史前在亚洲西部的温带地区就有栽培, 公元前 9000 ~ 公元前 8000 年, 近东地区及土耳其南部也有栽培, 青铜时期广泛分布在地中海、亚洲和欧洲, 后来传入美国、墨西哥、智利等地, 并从印度传入中国。

据《本草纲目》记载, 中国还有一种扁豆, “子有黑白赤斑四色, 一种荚硬不可食, 维豆子粗圆而色白者, 可入药”。即药用白扁豆, 形似白豌豆, 具有和中、下气, 补五脏, 久服头不白, 解毒、止泻痢, 除湿热等功效。

小扁豆南起云南,北到内蒙古,西至青藏高原等地均有种植。

小扁豆抗寒、抗旱能力强,耐瘠薄,生育期短,除了单播,还可与其他作物间作套种。小扁豆植株较小,根部多具有固氮能力的根瘤,有养地肥田之功效,在恢复地力和耕作制度调配中具有重要作用。籽粒的营养价值高于豌豆和蚕豆,除作为粮食外,还是多种副食品加工的主要原料和优质饲料,市场销售价每公斤3~4元。

第二节 小扁豆特征特性

一、植物学特征

(一) 根

小扁豆根属圆锥根系,主根明显,侧根繁茂,根部着生根瘤,具固氮能力,对水分和养分的吸收能力较强。根系入土较浅,主根长约15 cm,侧根多,并有旺盛根瘤的浅根系。主根细长,入土35 cm左右为深根系。根长和侧根数量介于二者之间的为中间类型,宁夏栽培品种以浅根为主。小扁豆根瘤菌可与豌豆族根瘤菌共生,形状不规则,且有顶端分生组织。

(二) 茎

小扁豆茎草质,浅绿色,有的苗期紫色,圆形、中空,成熟前组织柔软,成熟后基部木质化,多分枝。株高因品种而异,也与水肥条件有关,条件好的生长旺盛,植株较高,一般大粒种30~70 cm,小粒种20~40 cm。节间中部较长,两头较短。宁夏小扁豆以株型直立为主,生长过旺,或光照不足时易倒伏。分枝数随生态环境和密度而异,环境恶劣、密度过高时减少,一般3~5个。茎秆开花期蛋白质含量达14%,比禾谷类高2.5~3.0倍,比薯类