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# **Essentials Of Plant Breeding**

**This book presents a detailed account of information on modern approaches in plant breeding. Contemporary plant breeding is regarded as a discipline whose**

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**origins lie in the science of genetics. It is considered a very intricate subject, involving the use of several integrative novel sciences and technologies which developed into business, science and art. Extraordinary growth in contemporary plant**

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**breeding has been witnessed, enriching the conventional breeding practices with accurate, effective, economical and swift breeding tools and approaches as a result of novel advancements in genomics as well as plant genetics and coupling plant**

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"omics"

**accomplishments  
accompanied with  
progresses in  
computer science  
and informatics, as  
well as laboratory  
robotics. The aim of  
this book is to  
describe some of the  
current  
developments of 21st  
century plant**

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**breeding, elucidating  
new approaches,  
achievements, views,  
research efforts and  
perspectives in  
breeding of some  
crop species. Latest  
advances and  
comprehensive  
information on  
selected topics have  
been provided in this  
all-inclusive book**

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**which aims to improve the knowledge of the readers regarding contemporary plant breeding.**

**Experience shows that biotic stresses occur with different levels of intensity in nearly all agricultural areas around the world.**

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**The occurrence of insects, weeds and diseases caused by fungi, bacteria or viruses may not be relevant in a specific year but they usually harm yield in most years. Global warming has shifted the paradigm of biotic stresses in most growing areas,**

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**especially in the  
tropical countries,  
sparking intense  
discussions in  
scientific forums.**

**This book was  
written with the idea  
of collecting in a  
single publication the  
most recent advances  
and discoveries  
concerning breeding  
for biotic stresses,**



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**covering all major classes of biotic challenges to agriculture and food production. Accordingly, it presents the state-of-the-art in plant stresses caused by all microorganisms, weeds and insects and how to breed for them.**

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**Complementing  
Plant Breeding for  
Abiotic Stress  
Tolerance, this book  
was written for  
scientists and  
students interested in  
learning how to  
breed for biotic  
stress scenarios,  
allowing them to  
develop a greater  
understanding of the**

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**basic mechanisms of resistance to biotic stresses and develop resistant cultivars. The field of plant physiology includes the study of all chemical and physical processes of plants, from the molecular-level interactions of photosynthesis and**

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**the diffusion of water, minerals, and nutrients within the plant, to the larger-scale processes of plant growth, dormancy and reproduction. This new book covers a broad array of topics within the field.**

**Plant Physiology focuses on the study**

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**of the internal activities of plants, including research into the molecular interactions of photosynthesis and the internal diffusion of water, minerals, and nutrients. Also included are investigations into the processes of plant development,**

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**seasonality,  
dormancy, and  
reproductive control.  
The chapters focus  
on various aspects of  
plant physiology,  
including  
phytochemistry;  
interactions within a  
plant between cells,  
issues, and organs;  
ways in which plants  
regulate their**

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**internal functions;  
and how plants  
respond to  
conditions and  
variations within the  
environment. Given  
the environmental  
crises brought about  
by pollution and  
climate change, this  
is a particularly vital  
area of study, since  
stress from water**

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**loss, changes in air chemistry, or crowding by other plants can lead to changes in the way a plant function.**

**Readers of this book will gain the information they need to stay current with the latest research being done in this essential field**



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of study.

**This book discusses theoretical approaches to the taxonomy of biological systems and theory and mathematical approaches to the problem of plant diversity, cultivation, and the environment. Particular attention**

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**is given to theoretical and practical problems of soil and the environmental sustainability of phytocoenosis, with the goal to enhance the productivity of agricultural crops: cereals, legumes, vegetables, and fruit. Providing valuable information on the**

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**distribution of  
chemical elements in  
the soil–plant system  
and on the migration  
of chemical elements  
in the food chain,  
this book looks at the  
composition of the  
soil and the  
distribution of  
elements in the  
soil–plant system  
that are manifested**

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**as adaptations of  
plant organism to  
environmental  
conditions. With  
chapters written by  
acknowledged  
scientists in the field  
of genetics, plant  
selection, ecology,  
and agro-economy,  
the book attempts, in  
many cases, to find  
consensus between**

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**the need to address ways to decrease the excess load on the environment and the need to provide adequately for the human population in agro-developed countries. This book also presents precision farming techniques, including the introduction of**

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**differentiated  
agrochemicals and  
considering  
variability of soil  
fertility and crop  
conditions. An  
important element  
for the conservation  
and adaptation of  
plant organism to  
environmental  
conditions is the use  
of physiologically**

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**active compounds.**

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**Challenges and**

**Opportunities**

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**Breeding and**

**Genetics**

**Breeding for**

*Page 23/207*

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**Quantitative Traits  
in Plants**

As ancient as agriculture itself, plant breeding is one of civilization\'s oldest activities. Today, world food production is more dependent than



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ever on the  
successful  
cultivation of  
only a handful  
of major crops,  
while continuing  
advances in  
agriculture rely  
on successfully  
breeding new  
varieties that  
are well-

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adapted to their human-influenced ecological circumstances. Plant breeding involves elements of both natural and cultural selection-a process which

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operates on  
individual plants  
and on plant  
populations.

This book offers  
the most recent  
detailed  
knowledge of  
plant  
reproduction  
and their  
environmental

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interaction,  
which can help  
guide new  
breeding  
programs and  
help insure  
continuing  
progress in  
providing more  
food for growing  
populations  
produced with

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better care of  
the  
environment.  
Alternate  
approaches for  
the exploitation  
of heterosis and  
population  
improvement  
have been  
elaborated with  
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integrates  
theory and  
practice to  
provide an  
insightful  
examination of  
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principles and  
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describes the  
multidisciplinary  
strategies

used to produce  
new varieties of



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crops and plants, particularly in response to the increasing demands to of growing populations.

Illustrated chapters cover a wide range of topics, including

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plant  
reproductive  
systems,  
germplasm for  
breeding,  
molecular  
breeding, the  
common  
objectives of  
plant breeders,  
marketing and  
societal issues,

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and more. Now  
in its third  
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essential  
textbook  
contains  
extensively  
revised content  
that reflects  
recent advances  
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practices.

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Substantial updates have been made to its molecular genetics and breeding sections, including discussions of new breeding techniques such as zinc finger

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nuclease,  
oligonucleotide  
directed  
mutagenesis,  
RNA-dependent  
DNA  
methylation,  
reverse  
breeding,  
genome editing,  
and others. A  
new table

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enables efficient comparison of an expanded list of molecular markers, including Allozyme, RFLPs, RAPD, SSR, ISSR, DAMD, AFLP, SNPs and ESTs. Also, new and

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updated

“Industry  
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sections provide  
examples of the  
practical  
application of  
plant breeding  
methods to real-  
world problems.  
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edition:

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Organizes topics to reflect the stages of an actual breeding project

Incorporates the most recent technologies in the field, such as CRISPR genome edition and grafting on



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researchers and professionals an invaluable resource and remains the ideal textbook for advanced undergraduates and graduates in plant science, particularly those studying

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research on the  
ecological  
aspects of crops  
growing under  
stress

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conditions due to atmospheric changes and pollution and the impact on both plant and human health. The book provides research that will help to find ways to

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overcome

adverse abiotic  
environmental  
factors and  
unfavorable  
anthropogenic  
pressures on  
crop plants,  
which also  
eventually  
impact human  
health. Divided

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into six parts,  
leading authors  
from many  
institutes  
provide and  
share new  
knowledge  
gained from  
studies on  
ecological and  
genetic controls  
of plant

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resistance to various adverse environmental factors.

Geneticists and breeders are creating new cultivars and hybrids of crops, which greatly expand the range of



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source material.

The book includes a range of material on the biology, genetics, and breeding of crops, taking into account ecological and climatic conditions, with

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emphasis on the impact to humans. The main agricultural crops are studied: cereals, fodder crops, and horticultural plants. The chapters include

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the interaction of plant-soil-environment, ways of using plants as anticancer drugs, and other important problems and trends in agricultural and nature management.

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The role of different genetic and agronomical approaches to improving plant productivity and seasonal and profile dynamics of elements of soil acidity are considered.

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With the increasing demand and consumption of vegetables and fruits (by themselves or as additions to other foods), new agricultural methods are needed to

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overcome the deficit, and these new methods pose new concerns. The book includes: Plant breeding under adverse conditions of acid soils New studies in

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horticultural  
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peculiarities of  
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regions and  
cytogenetic  
anomalies of the  
local human  
population  
Phenogenetic  
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cultivated plants  
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and plant  
diversity

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and qualitative characters of selection samples The research found here will be valuable to agricultural engineers and others and is applicable at both regional

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objective of the  
book is to  
provide concise  
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information on  
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treatment of  
the subject,  
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principles of  
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to run business  
that raise and  
sell plants for  
substantive  
profit. This is  
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only for  
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business, and  
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of Plants  
explores the  
mysterious  
phenomenon of  
'apomixis', the**

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**ability of  
certain plants  
to 'self-clone',  
and its  
potential as a  
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tool for  
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enhancing food  
security, that  
may soon be a  
reality. Through  
historical**

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**shape how  
knowledge is  
produced, as  
well as what  
remains  
'unknown', and  
constrain the  
development of  
an 'Apomixis  
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a part of paper  
III (Unit 2 and  
3) some of its  
parts have been  
recently  
introduced in  
course of the**

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Botany). In this  
book, an  
attempt has  
been made to  
present the gist  
of the subject in  
a simple**

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**language and  
with suitable  
diagrams and it  
is hoped that  
this would be of  
some help to  
the students.**

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/compiled from  
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acknowledge all  
the authors  
whose contents**

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**have been  
helpful in this  
book or other  
ways. At last,  
but with the  
deepest  
gratitude, I am  
thankful to the  
almighty God  
and the deep,  
unfailing,  
supportive  
affection of my**



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**husband “Sri  
Abhai Kumar  
Srivastava” so  
that I was able  
to compile this  
work.**

**This book  
presents the  
history of, and  
current  
approaches to,  
farmer-breeder  
collaboration in**

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**plant breeding,  
situating this  
work in the  
context of  
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food systems, as  
well as national  
and  
international  
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regimes. Plant  
breeding is  
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practitioners  
and researchers  
involved in  
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programmes  
across a  
diversity of  
crops and agro-  
ecologies  
around the  
world. Case  
studies include  
collaborative  
sorghum and  
pearl millet  
breeding for**

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environments in  
West Africa,  
participatory  
rice breeding  
for intensive  
rice farming in  
the Mekong  
Delta, and  
evolutionary  
participatory  
quinoa  
breeding for**

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agriculture in  
North America.  
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the challenges,  
the volume also  
highlights the  
positive  
impacts, such  
as yield  
increases,  
farmers'  
empowerment**

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innovation and  
development  
processes,  
contributions to  
maintenance of  
crop genetic  
diversity and  
adaptation to  
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This collection  
offers a range  
of perspectives**

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**on enabling  
conditions for  
farmer-breeder  
collaboration in  
plant breeding  
in relation to  
biodiversity  
agreements  
such as the  
Plant Treaty,  
trade  
agreements and  
related**



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(IPR) regimes,  
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including  
practitioners  
with experience  
in plant  
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**management of  
crop genetic  
resources and  
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development, as  
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of international  
cooperation and  
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this volume is a**

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**Transgenic  
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*Owing to its  
considerable winter  
hardiness, rye is a  
cereal that played  
a major role in the  
feeding of  
European  
populations*

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*throughout the Middle Ages. Recent data shows that rye is grown on about 5.4 million hectares, with a world production of approximately 13 million tons. While still an important bread food in many countries, rye produced for bread*

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*making has decreased or stagnated, whereas production is increasing for other market segments. Particularly, rye for feeding, ethanol processing, and biogas is promoted in Europe. The first comprehensive monograph on rye, Rye: Genetics,*

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*Breeding, and Cultivation gathers all the relevant and historic information from botany and genetics to utilization and sustainability of rye. The book covers taxonomy, morphology, and other botany-related aspects of rye. It describes its*

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*physiology, cytology, and genetics, including use for genetic improvement of other cereals. The author addresses various types of breeding such as population, hybrid, and molecular breeding. He also discusses rye cropping, including*



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*seeding techniques, fungal and viral diseases, and predators. The book examines the various uses for rye beyond bread making. This includes feeding, biomass and biogas production, ethanol production, and other important*

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*and present.*

*Medicinal and aromatic plants (MAPs) have accompanied mankind from its very early beginnings. Their utilization has co-evolved with homo sapiens itself bringing about a profound increase in our scientific*

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*knowledge of these species enabling them to be used in many facets of our life (e.g. pharmaceutical products, feed- and food additives, cosmetics, etc.). Remarkably, despite the new renaissance of MAPs usage, ca. 80 % of the world's*

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*population is relying on natural substances of plant origin, with most of these botanicals sourced from the wild state. This first volume and ultimately the series, provides readers with a wealth of information on medicinal and*

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*aromatic plants.*

*Recent advances in plant genomics and molecular biology have revolutionized our understanding of plant genetics, providing new opportunities for more efficient and controllable plant breeding.*

*Successful techniques require*

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**by their  
photosynthetic  
activity.**

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agriculture  
reduces the  
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stable yields  
and desired  
quality  
characteristics  
are the sub  
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an introductory  
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**(Kuckuck =  
Engl. cuckoo).  
During the last  
6 years (the  
fifth German  
edition  
appeared in  
1985) again  
numerous  
results of basic  
research have  
found practical**

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**application,  
making  
extensive  
additions neces  
sary. Further, it  
seemed timely  
to change to the  
international  
language of  
science: English.  
For help in  
translation we**

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Silke Kluth and  
Kathy Seaman.  
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agricultural  
sciences - like  
all others - have  
become more  
specialized, we  
were happy to  
welcome D.  
Baringer (Sect.**

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5.4), W.

**Hondelmann  
(Sects. 4.4, 4.5,  
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(Sect. 4.2), and  
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(Sects. 2.3.1.4  
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science,  
particularly  
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that optimizes  
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such as  
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breeding uses  
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area of  
transgenic  
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has increased  
every year,  
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continues to  
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origin,  
Ethiopia has  
long been  
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an important

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area of  
diversity for  
several major  
and various  
minor crops.  
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how plant

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diversity in  
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importance in  
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desirable char  
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can help to  
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successfully selectively  
bred for thousands of  
years, culminating in  
incredible yields,  
quality, resistance and  
so on that we see in our  
modern day crops and  
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recent years the  
techniques used have  
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