

Handbook of Maize Production

Hazem Shawky Fouda



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Canada

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ABOUT THE AUTHOR



Hazem Shawky Fouda has a PhD. In Agriculture Sciences, obtained his PhD. from the Faculty of Agriculture, Alexandria University, 2008, MSc. In Agriculture Sciences from the Faculty of Agriculture, Alexandria University in 2004, Post-Grade Diploma in Cotton, 2001, BSc. in Agriculture Sciences, from the Faculty of Agriculture, Alexandria University, 1997, He worked in Cotton Arbitration & Testing General Organization (CATGO) since 1999 till 2018. Was working in the International Cotton Training Center (ICTC) – Cotton Arbitration & Testing General Organization (CATGO) from 2000 till 2015, as a Lecturer & Classer's Trainer for Egyptian and foreigner classers, technicians, ginners, spinners & traders in all cotton aspects starting from picking seed cotton till preparing bales for export including other cotton aspects and training them practically on classing cotton. Besides that he was an editor and active member in the Research & Translation Committee, participating in issuing weekly, monthly and annually issues about the international & local cotton market including price trends and direction, recent developments & researches concerning cotton production, protection, harvesting, ginning, fiber testing, spinning & weaving since its foundation in 2000 till 2014 and since 2015 till 2018 he worked as an inspector, from 2018 till present works as a consultant.

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LIST OF ABBREVIATIONS

AB	Accreditation Body
AESA	Agro-Ecosystem Analysis
AN	Ammonium Nitrate
BT	Bacillus Thuringiensis
CA	Conservation Agriculture
CB	Certificate Body
DM	Dry Matter
EGP	Eastern Gangetic Plains
ESA	Eastern and Southern Africa
FAW	Fall Armyworm
FTL	Financial Limit Level
FYM	Farm Yard Manure
GAP	Good Agricultural Practices
GVB	Green Vegetable Bugs
HSF	High Soil Fertility
IAP	Coordinated Agronomic Practice
ICAR	Indian Council of Agricultural Research
ICM	Integrated Crop Management
IFRI	International Food Research Policy Institute
IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
IPM	Integrated Pest Management
IWM	Incorporated Weed Management
LAI	Leaf Area Index
LSF	Low Soil Fertility
MAP	Mono Ammonium Phosphate
MSV	Maize Streak Virus
NUE	Nitrogen Use Productivity
RP	Ridge Planting

SO	Scheme Owner
VR	Variable Rate
WCA	Western and Central Africa

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PREFACE

This book takes the readers through several different stages and concepts of maize production, its history, land preparation practices, climate and soil requirement for its production, maize seed production, growth and development of maize. This book sheds light on weed management in maize, agronomic practices of maize, integrated pest management in maize, different technologies implemented, and the challenges in its production.

The first chapter stresses on the basic overview of the history and origin of maize, taxonomy, maize in the light of the new world. This chapter will also emphasize the natural history of the maize, and its concept in the old world. The African connection and the future of maize.

The second chapter takes the readers through the concepts of land preparation practices for the production of maize, the different methods involved. This chapter will provide highlights on the animal versus tractor power, animal drawn disk harrow, beans grown on raised beds, conventional tillage, flat planting as well as the land preparation.

Then, the third chapter explains the climate and soil requirement of maize farming, agroclimatology of the crop. It also explains the climatic requirements, weather stress in maize cultivation, and soil as the foundation of agriculture. This chapter also sheds light on the sustainable soil management and the requirements of soil for growing corns.

The fourth chapter introduces the readers to the aspect of maize seed production, producing quality seeds, creating of the seed-growers cooperatives. This chapter also explains the concept of quality seed use doubles, maize hybrid seed production, and significant considerations for hybrid seed production.

The fifth chapter throws light on the growth as well as the development of maize, different kinds of maize plant. This chapter contains different approaches to the corn growth and development, germination and emergence, vegetative growth and the reproductive development.

The sixth chapter takes the readers through concept of weed management in maize, characteristics of weed. The readers are then told about the critical period of crop-weed competition, weed management programs in maize such as social control, flame weeding etc. It then talks about the impact of pre-rise herbicides on weed control in maize.

The seventh chapter explains the agronomic practices of maize, the concepts and guiding principles of good agriculture. This chapter also emphasizes on the GAP approach and concepts, and the maize agronomic principles

The eighth chapter of this book sheds lights on the integrated pest management in maize and the diseases pest management approach. This chapter also mentions the management practices for insect pests, pest management, different types of guidelines for management, as well as the safety parameters in pesticides usage.

The ninth chapter of this books gives insight to the reader on the advanced maize production technologies, the improved technologies for higher maize production, nutrient management. It also illustrates the insect and pest management, new technologies available in recent years, and the data management technologies.

The tenth chapter of this book sheds light on the challenges, the problems, issues as well as the opportunities in maize production. It talks about the fertilization and liming, problem descriptions like the climatic factors, management factors etc. and it also defines maize in the context of the developing world.

This book has been designed to suit the knowledge and pursuit of the researcher and scholars and to empower them with various concepts of the production of maize and its different dimensions like the history, requirements, challenges, its development and the management practices. I hope that the readers find the book explanatory and insightful and that this book is referred by the scholars across various fields.

History and Origin of Maize

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This chapter deals with the history and origin of maize and its historical argument as well as the modern argument. It sheds light on the natural history of maize, its significance. It also talks about the ethnobotany of maize and describes maize in the light of the quintessential maize plant.

It also defines maize in the context of a new world along with explaining its historical backdrops as well as it illustrates maize in the old world which constitutes several countries such as China and Southeast Asia. It gives insight to the reader on the concept of old-world dispersals. The social, financial and political effects.

It goes on putting emphasis on the African connection, the future of maize that elucidates how the maize is prepared into a bewildering cluster of consumer products.

1.1. INTRODUCTION

Corn, (*Zea mays*), additionally called Indian corn or maize, oat plant of the grass family (*Poaceae*) and its edible grain. The domesticated yield started in the Americas and is possibly the most broadly circulated of the world's food crops.

Corn is utilized as animals feed, as human food, as biofuel, and as raw material in industry. In the United States the vivid variegated strains known as Indian corn are customarily utilized in fall harvest enhancements.

Corn was first domesticated by local people groups in Mexico around 10,000 years prior. Local Americans encouraged European pilgrims to develop the native grains, and, since its presentation into Europe by Christopher Columbus and different pioneers, corn has spread to all spaces of the world suitable to its cultivation.

It is grown from 58° N latitude in Canada and Russia to 40° S latitude in South America, with a corn crop maturing somewhere in the world nearly every month of the year. It is the most important crop in the United States and is a staple food in many places.

The corn plant is a tall yearly grass with a bold, erect, strong stem. The huge narrow leaves have wavy edges and are dispersed alternatively on inverse sides of the stem. Staminate (male) blossoms are borne on the tassel ending the primary pivot of the stem.



Figure 1.1. History and origin of maize

Source: Image by Wikimedia commons

The pistillate (female) inflorescences, which develop to turn into the eatable ears, are spikes with a thickened pivot, bearing matched spikelets in longitudinal lines; each line of combined spikelets regularly delivers two columns of grain. Assortments of yellow and white corn are the most well known as food, however there are assortments with red, blue, pink, and black kernels, regularly banded, spotted, or striped.

Every ear is encased by adjusted leaves called shucks or husks. Numerous industrial varieties of corn are hereditarily altered for protection from the herbicide glyphosate or to create proteins from *Bacillus thuringiensis* (Bt.) to kill explicit insect pests. Also, a few strains have been hereditarily designed for more prominent drought resistance.

Business characterizations, in light of kernel texture, incorporate dent corn, flint corn, flour corn, sweet corn, and popcorn. Mark corn is portrayed by a downturn in the crown of the piece brought about by inconsistent drying of the hard and delicate starch making up the kernel.

Flint corn, containing minimal delicate starch, has no downturn. Flour corn, made generally out of delicate starch, has delicate, coarse, effectively ground kernels. Sweet corn has wrinkled clear seeds; the plant sugar isn't changed over to starch as in other sorts.

Popcorn, a limit kind of flint corn portrayed by little hard bits, is without delicate starch, and heating makes the dampness in the cells extend, making the kernels to detonate. Upgrades in corn have come about because of hybridization, in view of crossbreeding of predominant ingrained strains.

Despite the fact that it is a significant food in numerous pieces of the world, corn is substandard compared to different cereals in dietary benefit. Its protein is of low quality, and it is inadequate in niacin. Diets in which it prevails regularly bring about pellagra (niacin-inadequacy infection).

Its gluten (elastic protein) is of nearly low quality, and it isn't utilized to deliver raised bread. It is generally utilized, in any case, in Latin American cooking to make masa, a sort of mixture utilized in such staple food varieties as tortillas and tamales.

Given that corn flour is without gluten, it can't be utilized alone to make rising breads. In the United States corn is bubbled or broiled on the cob, creamed, changed over into hominy (hulled portions) or feast, and cooked in corn puddings, mush, polenta, frying pan cakes, cornbread, and scrapple. It is additionally utilized for popcorn, desserts, and different produced cereal arrangements.

Corn is also used to produce ethanol (ethyl alcohol), a first-generation liquid biofuel. In the United States corn ethanol is typically blended with gasoline to produce "gasohol," an automotive fuel that is 10 percent ethanol.

In spite of the fact that corn-based biofuels were at first promoted as harmless to the ecosystem options in contrast to petrol, their production diverts arable land and feedstock from the human evolved way of life, starting a "food versus fuel" banter.

Cellulosic ethanol, which is produced using non - edible plant parts like rural waste, has a smaller impact on the food chain than corn ethanol, however the change innovation is by and large less proficient than that of original biofuels.

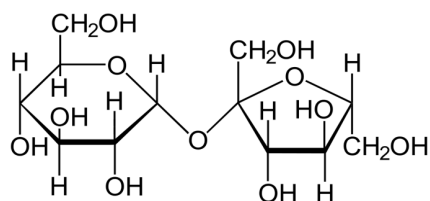


Figure 1.2. Structure of sucrose

Source: Image by Wikimedia commons

Numerous pieces of the corn plant are utilized in industry. Corn-starch can be separated into corn syrup, a typical sugar that is by and large more affordable than sucrose; high-fructose corn syrup is utilized broadly in handled food varieties like sodas and confections. Stalks are made into paper and wallboard; husks are utilized as filling material; cobs are utilized straightforwardly for fuel, to make charcoal, and in the planning of industrial solvents.

Corn grain is processed by wet milling, in which the grain is soaked in a dilute solution of sulphur acid; by dry milling, in which the corn is exposed to a water spray or steam; and by fermentation, in which starches are changed to sugars and yeast is employed to convert the sugars into alcohol. Corn husks likewise have a long history of utilization in the folk arts for items, for example, woven ornaments and corn-husk dolls.

1.1.1. Taxonomy

Maize is an individual from the grass family Poaceae (Gramineae), a classification it shares to numerous other significant rural yields, including wheat, rice, oats, sorghum, grain, and sugarcane. In view of fossil proof, it is assessed that these significant grass genealogies emerged from a typical predecessor inside the last 55 - 70 million years, close to the near end of the rule of dinosaurs. Maize is additionally coordinated in the genus *Zea*, a gathering of yearly and perennial grasses local to Mexico and Central America.

The genus *Zea* includes the wild taxa, known collectively as teosinte (*Zea* spp.), and domesticated corn, or maize (*Zea mays* L. ssp. *mays*). For a long time, the connections inside genus *Zea* were the subject of much contention. The central difficulty in the taxonomy of maize and the identification of its closest relatives was the absence of a cob like pistillate inflorescence—or “ear”—in any other known plant.