

Maize research in India - historical prospective and future challenges

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ABSTRACT

All India Coordinated Maize Improvement Project (AICMIP) was established in 1957, and with the inception of AICMIP, maize improvement in India has gone through many phases. The initial emphasis was on development of double crosses followed by a shift from the double crosses to open pollinated varieties in 1967. Thereafter, the shift from composites to three-way crosses and from three-way crosses to double-crosses and then combinations of composites, three-way and double crosses was continued till 1996. During that period >50 composites and around 15 double, top and three-way crosses were released. In 1996, the first single cross hybrid 'Parus' was released, but due to some limitations in hybrid seed production it did not get the acceptance. Even after 1996 the emphasis on composites was continued but at the same time the several single cross hybrids were also released. The improvement gained through double, double top, three-way crosses and composite varieties were not significant as compared to present day single cross hybrids. With the cultivation of less productive OPVs and multi parent crosses, area, production and productivity remained stagnant during 1967-1987 in this country. However, the strategy to switch over to single cross hybrids in 2006-07 has paid rich dividends. There has been tremendous increase in acreage, production and productivity in recent years. Single cross hybrids being most productive have shown better adaptability to new set of cropping systems and management practices. This has resulted in sudden increase in the constant annual growth rate (CAGR) of maize production (12.89%) during 2007-2011; this is mainly because of the significant increase in the maize CAGR of productivity. In spite of increased production and productivity of maize in recent years there is continued increase in maize demand both normal maize and specialty corn from poultry and food processing industries respectively. To cope up with these challenges there is need to supply sufficient quantity of quality hybrid seed and application of novel tools and techniques to further enhance the maize productivity.

Key words: Composite, Double cross hybrid, Inbred, Single cross hybrid, Specialty corn

Maize (*Zea mays* L.) is an important cereal food crop of the world with highest production and productivity as compared to rice and wheat. It is the most versatile crop which is being grown in more than 166 countries across the globe including tropical, sub tropical and temperate regions from sea level to 3000 m amsl. Maize is the third most important cereal after rice and wheat for human food by contributing almost 9 % to India's food basket and 5 % to World's dietary energy supply. Its production has increased more than 12 times from a mere 1.73 million tons 1950-51 to 21.73 million tons in 2010-11 (ASG, 2011) and presently it occupies 8.55 million hectare area with the mean yield of 2.54 tons/hectare (Fig.1). This achievement is remarkable despite ~75% maize area is under rainfed and low input condition, which often faces vagaries of monsoon.

In India, it is being estimated that maize demand will continue to increase in view of increasing demand in poultry and livestock sectors in the country and growing non-

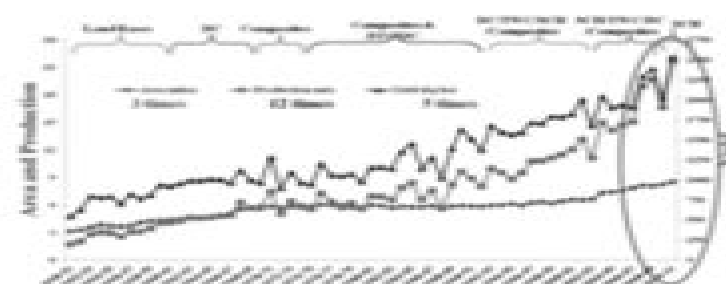


Fig. 1. Breeding strategies vis-à-vis productivity in maize

vegetarian population and changing food habits. To meet the growing demand, enhancement of maize yield in coming years across all the growing locations in India is the big challenge in the era of climate change. Meeting such challenge will only be possible through science based technological interventions like single cross hybrid technology and application of novel molecular tools and techniques in maize improvement.

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Dorosh, Paul A., ed.,Minten, Bart, ed.

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Maize Research In India S.L. Jat, 2021-06-22 This book Maize Research in India Retrospect Prospect focuses on 60 years of maize research in India s through first All India Coordinated Research Project AICRP of the country The book chapters compiled from different part of the country having contemporary and historical importance of maize research for development in the country Theses state wise chapters offering a comprehensive overview and provides a detailed information about trend of the major growing areas maize based industries cropping systems agricultural practices AICRP achievements constraints in maize production package of practices yield gaps climatic patterns and key R4D challenges and their probable solutions Overall it demonstrates the options for future progress and thrust of maize with special reference to nutritional and industrial quality improvement hybrid seed production cultivation of specialty corn value addition biotic and abiotic stress management etc The book also has a chapter on the recent worldwide R4D in maize molecular breeding and frontier technologies in maize improvement like genomic selection transgenic phonemics doubled haploid DH technology etc for making plausible future strategy of maize R4D Trajectory of 75 years of Indian Agriculture after Independence P. K. Ghosh, Anup Das, Raka Saxena, Kaushik Banerjee, Gouranga Kar, D. Vijay, 2023-08-28 This edited book focus on highlighting the evolution of Indian agriculture over the past 75 years of independence covering every sector viz crop science horticulture management of biotic abiotic stress post harvest quality management livestock fisheries mechanization marketing and human resource development The book has 30 chapters from most experienced researchers and academicians who are actively engaged in research work on the subject area of the book The book is in line with the strategy for new India 75 brought out by NITI Ayog It highlights India s success stories in innovation technology enterprise and efficient management together to achieve overall growth while making available food required nutrition and others ecological services It also asses the India s preparedness in terms of commitment toward sustainable development goal SDG The book is a relevant reading material for both students and researchers and policy makers **Transforming Agriculture in South Asia** Ashok K. Mishra, Anjani Kumar, Pramod K. Joshi, 2020-12-30 Debates about public expenditure in the agricultural sector have reopened in many developing and emerging economies because of high budget deficits and changes in public opinion As a result agricultural policy in many of these countries is beginning to take a more market oriented approach to agrarian problems most notably through the introduction of contract farming This book explores the policy issues around contract farming and its transformative potential and addresses the lack of empirical research on this topic by focusing on South Asia principally India Bangladesh and Nepal The book first addresses the effects of contract farming vertical coordination on productivity food security indicators yield consumption expenditures prices employment and input usage Then it draws lessons from the South Asian case studies on the impact of institutional changes like contract farming on income and food security of smallholder households The core of the book includes case study chapters on several commodities that are produced under contract

farming including vegetables and fisheries in Bangladesh low value crops in Nepal and coffee in India Other chapters also explore contracts storage input usage and technical efficiency in these cases This book serves as an essential guide to academics researchers students legislative liaisons and think tank groups interested in agrarian issues agricultural economics and agricultural policy in emerging economies and particularly in South Asia Harnessing Crop Biofortification for Sustainable Agriculture Siddharth Tiwari,Baljeet Singh,2024-08-31 This edited volume provides insights into the current state of food and nutritional security highlights the significance of micronutrients for human health offers a historical perspective on biofortification and covers current strategies and challenges This book explores the role of multidisciplinary approaches to cope up with the challenges of major nutrient deficiency Hidden hunger aka micronutrient deficiencies a prevalent global issue refers to the chronic deficiency of essential micronutrients despite sufficient caloric intake With over 2 billion affected individuals particularly women and children in low income countries it impairs physical and cognitive development increases disease susceptibility and diminishes productivity Despite economic progress undernourishment remains prevalent in the developing countries including India Among all nutrients the deficiencies of iron zinc iodine and vitamin A are highly prevalent Crop biofortification seems a sustainable solution to reduce the global burden of hidden hunger Previous reports examined the genetic diversity related to micronutrients in germplasm of staple crops and their wild relatives A number of biofortified crops have been developed by utilizing genetic diversity and biotechnological approaches This book explores crop specific biofortification initiatives and diverse approaches encompassing both traditional and genomics driven enhancements It also enlightens the efficacy of biofortification bioavailability and future thrust This book serves as a valuable resource for researchers academics extension workers policymakers students and all those involved in agriculture nutrition and health It focuses on promoting diets that are rich in nutrition benefiting everyone along the value chain *Contract farming, productivity and fertilizer usage: Empirical evidence from specialty crop production* Mishra, Ashok K.,Kumar, Anjani,Joshi, Pramod Kumar,D'Souza, Alwin,Tripathi, Gaurav,2018-11-14 This study investigates the impact of contract farming CF in baby corn production on yield irrigation costs fertilizer costs and usage of chemical fertilizer We find that adoption of CF by baby corn smallholders after controlling for characteristics of both control and treatment groups leads to higher yields and lower spending on fertilizers and irrigation Additionally CF in baby corn farming leads to a reduction in the use of chemical fertilizers Urea and DAP Thus CF intervention benefits the livelihood of smallholders reduces environmental degradation and reduces stress on groundwater without compromising yield Flavors for Nutraceutical and Functional Foods M. Selvamuthukumaran,Yashwant Pathak,2018-08-06 Flavors are an integral part of nutraceutical formulations Flavors offer significant advantage to Nutraceuticals when it comes to palatability and get an edge over other products in an extremely competitive nutraceutical market Flavors for Nutraceuticals and Functional Foods addresses different natural ingredients botanicals used in various functional foods and nutraceutical products The techniques

of incorporating flavors in Nutraceutical products can be classified as conventional and using recently developed modern techniques such as nanotechnology are also covered in different chapters These techniques are mainly used for masking the taste of nutraceutical and functional food products The book discusses the basics of flavors and the significance of the flavor industry in relation to Nutraceuticals This book covers various processes involved in incorporating flavor and improving product acceptability It provides an overview on the potential applications of the main terpene based flavors as part of nutraceuticals formulations This book will serve as a reference to academicians and industry people who are involved in Nutraceutical formulations and marketing

Myanmar's agrifood system: Historical development, recent shocks, future opportunities Boughton, Duncan, Belton, Ben, Lambrecht, Isabel B., Masias, Ian, Minten, Bart, 2024-10-16 Myanmar has endured multiple crises in recent years including COVID 19 global price instability the 2021 coup and widespread conflict that have disrupted and even reversed a decade of economic development Household welfare has declined severely with more than 3 million people displaced and many more affected by high food price inflation and worsening diets Yet Myanmar's agrifood production and exports have proved surprisingly resilient Myanmar's Agrifood System Historical Development Recent Shocks Future Opportunities provides critical analyses and insights into the agrifood system's evolution current state and future potential This work fills an important knowledge gap for one of Southeast Asia's major agricultural economies one largely closed to empirical research for many years It is the culmination of a decade of rigorous empirical research on Myanmar's agrifood system including through the recent crises Written by IFPRI researchers and colleagues from Michigan State University the book's insights can serve as a to guide immediate humanitarian assistance and inform future growth strategies once a sustainable resolution to the current crisis is found that ensures lasting peace and good governance

Histories of Maize in Mesoamerica John Staller, Robert Tykot, Bruce Benz, 2016-06-16 Abridged and updated version of the basic work on the development of maize including 20 chapters of interest to Mesoamerican specialists updated with recent findings and interpretations

Achieving sustainable cultivation of maize Volume 1 Dr Dave Watson, 2017-06-09 Reviews key challenges and advances in maize breeding methods Discusses the development of varieties with enhanced nutritional and other properties such as improved protein content and abiotic stress resistance Summarises key steps being taken to support smallholders growing maize in developing countries

History of Soybeans and Soyfoods in South Asia / Indian Subcontinent (1656-2010) William Shurtleff, Akiko Aoyagi, 2010-12 Covers Afghanistan Bangladesh Bhutan India Nepal Pakistan Sikkim and Sri Lanka

Plant Breeding: Past, Present and Future John E. Bradshaw, 2016-03-08 This book aims to help plant breeders by reviewing past achievements currently successful practices and emerging methods and techniques Theoretical considerations are also presented to strike the right balance between being as simple as possible but as complex as necessary The United Nations predicts that the global human population will continue rising to 9.0 billion by 2050 World food production will need to increase between 70-100 per cent in just 40 years

First generation bio fuels are also using crops and cropland to produce energy rather than food. In addition, land area used for agriculture may remain static or even decrease as a result of degradation and climate change despite more land being theoretically available unless crops can be bred which tolerate associated abiotic stresses. Lastly, it is unlikely that steps can be taken to mitigate all of the climate change predicted to occur by 2050 and beyond and hence adaptation of farming systems and crop production will be required to reduce predicted negative effects on yields that will occur without crop adaptation. Substantial progress will therefore be required in bridging the yield gap between what is currently achieved per unit of land and what should be possible in future with the best farming methods and best storage and transportation of food given the availability of suitably adapted cultivars including adaptation to climate change. My book is divided into four parts. Part I is an historical introduction. Part II deals with the origin of genetic variation by mutation and recombination of DNA. Part III explains how the mating system of a crop species determines the genetic structure of its landraces. Part IV considers the three complementary options for future progress: use of sexual reproduction in further conventional breeding, base broadening and introgression, mutation breeding and genetically modified crops.

The History and Future of Technology
Robert U. Ayres, 2021-07-27. Eminent physicist and economist Robert Ayres examines the history of technology as a change agent in society, focusing on societal roots rather than technology as an autonomous self-perpetuating phenomenon. With rare exceptions, technology is developed in response to societal needs that have evolutionary roots and causes. In our genus *Homo*, language evolved in response to a need for our ancestors to communicate both in the moment and to posterity. A band of hunters had no chance in competition with predators that were larger and faster without this type of organization, which eventually gave birth to writing and music. The steam engine did not leap fully formed from the brain of James Watt. It evolved from a need to pump water out of coal mines, driven by a need to burn coal instead of firewood in turn due to deforestation. Later, the steam engine made machines and mechanization possible. Even quite simple machines increased human productivity by a factor of hundreds if not thousands. That was the Industrial Revolution. If we count electricity and the automobile as a second industrial revolution and the digital computer as the beginning of a third, the world is now on the cusp of a fourth revolution led by microbiology. These industrial revolutions have benefited many in the short term but devastated the Earth's ecosystems. Can technology save the human race from the catastrophic consequences of its past success? That is the question this book will try to answer.

The Future Rice Strategy for India
Samarendu Mohanty, P. G. Chengappa, Mruthunjaya Hedge, J.K. Ladha, Sampri Baruah, Elumalai Kannan, A. V. Manjunatha, 2017-06-07. The Future Rice Strategy for India presents forward-looking insights toward achieving sustainable development of the rice sector, ensuring future food and nutritional security. As a staple food for many in India, including the economically disadvantaged, there are many concerns that affect the development of the rice sector. Facing issues from environmental demands to economic stagnation, access to food, food inflation, and the Food Security Act, demand, supply, distribution of rice, achieving sustainability in

production and exports is an important and urgent challenge Using case studies to illustrate existing and potential issues challenges and solutions The Future Rice Strategy for India presents key strategic options while considering the implicit consequences In addition the findings enrich the strategy and policy formulation considerations for the role of rice in the country This multidisciplinary approach features the expertise of rice scientists covering different aspects of rice sector from breeding to consumer preferences and markets and trade Uses analysis based on agro ecological zones AEZ patterns providing understanding of future growth patterns based on rice ecologies Includes case studies with proposed solutions taking into consideration pros and cons of each allowing readers facing similar concerns and issues to identify an appropriate solution more efficiently and effectively Advancing gender equality through agricultural and environmental research: Past, present, and future Pyburn, Rhiannon, ed., van Eerdewijk, Anouka, ed., 2021-11-02

Over the past decade interest in gender equality and women s empowerment has grown rapidly creating a unique opportunity to institutionalize gender research within agricultural research for development This book edited by researchers from the CGIAR Gender Platform reviews and reflects on the growing body of evidence from gender research It marks a shift a way from a traditional focus on how gender analysis can contribute to improved productivity flipping the question to ask How does agricultural and environmental research and development contribute to gender equality and women s empowerment Chapters synthesize the wide range of CGIAR and other research in this area covering breeding research and seed systems value chain participation nutrition sensitive agriculture natural resources climate adaptation and mitigation the feminization of agriculture women s role in agricultural research and emerging gender transformative approaches **Literary History: Towards a Global**

Perspective Anders Pettersson, Gunilla Lindberg-Wada, Margareta Petersson, Stefan Helgesson, 2011-12-22 Literary History Towards a Global Perspective is a research project funded by the Swedish Research Council Vetenskapsr det Initiated in 1996 and launched in 1999 it aims at finding suitable methods and approaches for studying and analysing literature globally emphasizing the comparative and intercultural aspect Even though we nowadays have fast and easy access to any kind of information on literature and literary history we encounter more than ever the difficulty of finding a credible overall perspective on world literary history Until today literary cultures and traditions have usually been studied separately each field using its own principles and methods Even the conceptual basis itself varies from section to section and the genre concepts employed are not mutually compatible As a consequence it is very difficult if not impossible for the interested layperson as well as for the professional student to gain a clear and fair perspective both on the literary traditions of other peoples and on one s own traditions The project can be considered as a contribution to gradually removing this problem and helping to gain a better understanding of literature and literary history by means of a concerted empirical research and deeper conceptual reflection The contributions to the four volumes are written in English by specialists from a large number of disciplines primarily from the fields of comparative literature Oriental studies and African studies in Sweden All of the

literary texts discussed in the articles are in the original language Each one of the four volumes is devoted to a special research topic

Asian Regional Maize Workshop, 10. Maize for Asia - Emerging Trends and; Technologies. Proceedings of The Asian Regional Maize Workshop; Makassar, Indonesia; 20-23 October, 2008 , Combating stem and leaf rust of wheat: Historical perspective, impacts, and lessons learned H.J. Dubin, John P. Brennan, Ethiopia's agrifood system: Past trends, present challenges, and future scenarios Dorosh, Paul A., ed.,Minten, Bart, ed.,2020-09-14 Ethiopia has experienced impressive agricultural growth and poverty reduction stemming in part from substantial public investments in agriculture Yet the agriculture sector now faces increasing land and water constraints along with other challenges to growth Ethiopia s Agrifood System Past Trends Present Challenges and Future Scenarios presents a forward looking analysis of Ethiopia s agrifood system in the context of a rapidly changing economy Growth in the agriculture sector remains essential to continued poverty reduction in Ethiopia and will depend on sustained investment in the agrifood system especially private sector investment Many of the policies for a successful agricultural and rural development strategy for Ethiopia are relevant for other African countries as well Ethiopia s Agrifood System should be a valuable resource for policymakers development specialists and others concerned with economic development in Africa south of the Sahara *History of Soy Nutritional Research (1946-1989)* William Shurtleff; Akiko Aoyagi,2021-02-07 The world s most comprehensive well documented and well illustrated book on this subject With extensive subject and geographic index 20 photographs and illustrations many color Free of charge in digital PDF format **Story Of Kalanamak Rice: Past Preent And Future** Dr. Ram Chet Chaudhary,2023-01-21 The Story of Kalanamak Rice Past Present and Future described the story of heritage rice Kalanamak started as blessings of Lord Buddha some 3000 years ago How its cultivation went up and down in the history But thankfully farmers maintained it by growing it annually Then the book describes the work of Dr R C Chaudhary that made Kalanamak from Near Extinction to Distinction Now Kalanamak has support of Central and State governments and so many organizations are coming up to take credit as the see unstoppable support of the farmers consumers and traders

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