



STUDYING ABOUT FUTURE PROSPECTS AND IMPORTANCE OF MAIZE PRODUCTION IN INDIAN SCENARIO

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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 'Paras' 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.

Keywords: -Maize, World, Production, India, Technology

I. INTRODUCTION

Maize 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 rain fed 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-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.

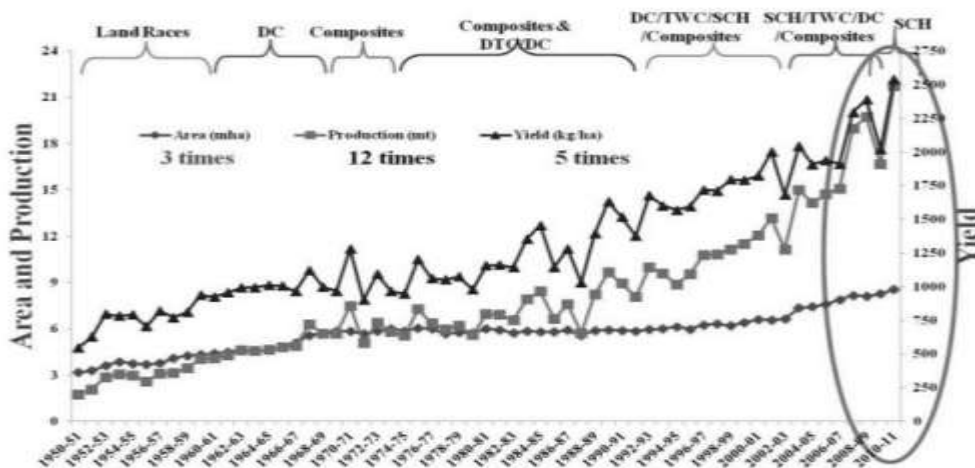
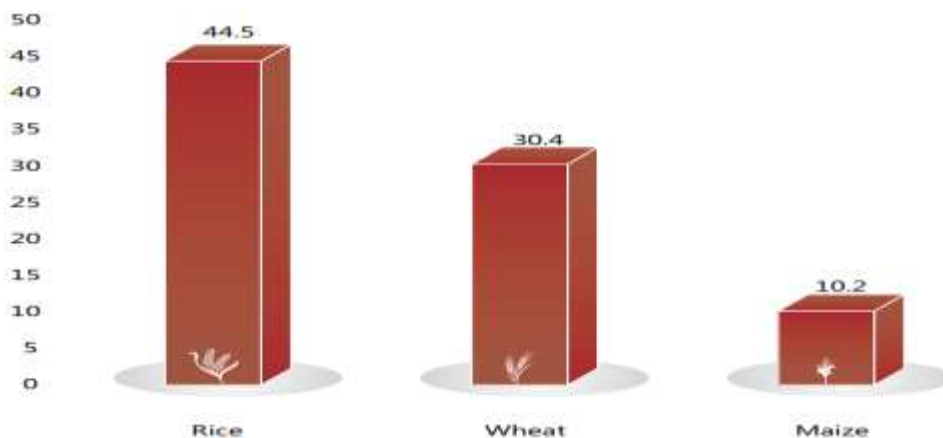


Fig. 1. Breeding strategies vis-a-vis productivity in maize

II. IMPORTANCE OF MAIZE PRODUCTION IN INDIAN

The US and China are the first and second largest producers and consumers of maize. The ever increasing use of maize in cattle and feed industry is what puts it apart from other cereal crops globally. The increased use of maize for ethanol production for fuel in US and many European countries adds further value to the crop. Within India unlike various other high value crops, the direct involvement of small and marginal farmers is very intense in the cultivation of maize. Considering the value of output and degree of involvement of maize growers, importance of Maize in Indian Agribusiness ecosystem is immense.

Exhibit: Maize acreage vis-à-vis acreage of Paddy and Wheat in India in Mn ha



Source: Grain: World Market and Trade, Nov 2017, USDA

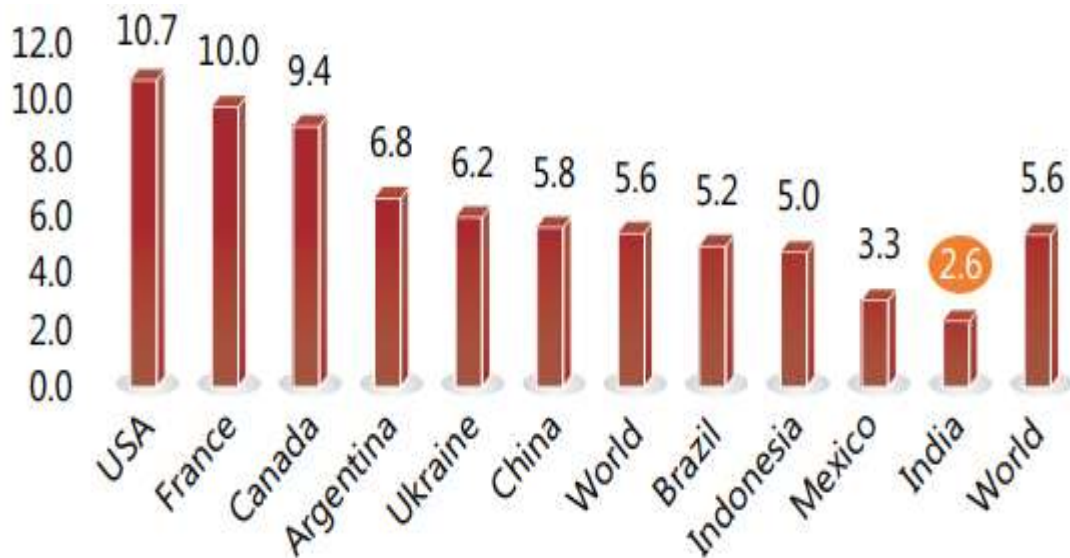
(a) Importance of Maize in employment generation and value creation:

Any positive development in the sector results in benefiting a huge mass of people involved in the agricultural sector. Rough estimates put the figure of farmers engaged in maize cultivation to 15 Millions in India alone. Further, it has been estimated that assuming, the human labour requirement of on an average 75 person-days per hectare, the crop is also generating employment of more than 650 million person-days at the farm and downstream the agricultural and industrial sectors in India. It contributes about 2 per cent to the total value of output from all the agricultural crops.

(b) Scope of improvement in Yield potential:

Despite, the dependency of such a significant population in terms of employment generation and diversity in the usage of maize, Indian Maize is performing comparatively low in terms of yield as compared to world average. The depicted graph seeks to captures the yield comparison of most of the major maize producing countries.

Exhibit: Comparative analysis of average yield (T / ha) of key Maize producing countries



Source: Agricultural Statistics at a Glance 2016, DoA ,C& FW

The difference in yield between India and world yield for maize is huge and works out to roughly 130%. The difference in yield with the leaders in maize production is even much larger, for example, with US it is more than 400% and with China it is nearly 225%. Interestingly, Argentina and Ukraine with less than half of area under maize than India are able to produce significantly more than India.

The large gap in yield of maize production in India and rest of the countries is quite striking. What is clearly evident is the huge amount of effort required in improving the yield and total production of maize in India. It is imperative for all the stakeholders involved in the maize sector to join hands to leap frog it to a stage where the production is at least able to meet the demand of the domestic consumption.

(c) Potential of Maize in improving farmers' income:

NITI Aayog has identified 7 sources of growth, which could help in doubling farmers' income by 2022: 1) Increase in productivity of crops, 2) Increase in production of livestock, 3) Improvement in efficiency of input use, 4) Increase in crop intensity, 5) Diversification towards high value crops, 6) Improved price realization by farmers, 7) Shift of cultivators to non –farm jobs. On all these 7 identified growth parameters, Maize has visible potential to qualify. Technology adoption has direct correlation with these growth sources, leading to increase in farmers' income.

(d) Nutritional importance of Maize:

Maize can be consumed as food, feed, and fodder and is a source of more than 3,500 Content %age dry matter basis Starch 71-72 Protein 9-10 Fat 4-45 Fibre 9-10 Sugar 2-3 Minerals 1.4 Food

Feed Fuel Industrial Use Maize 7 Mn MT 14 Mn MT 1.2 Mn MT 1.8 Mn MT Paddy 97 Mn MT 0 0 0 Wheat 94 Mn MT 4.8 Mn MT 0 0 Other coarse cereals 16 Mn MT 1 Mn MT 0 1 Mn MT
Source : Grain and Feed Annual 2017, GAIN Report; (0~ very low amount) products including specialized maize like quality protein maize (QPM), baby corn, sweet corn etc. Due to recent research advancements, the quality protein maize, single cross and 3-way cross hybrids have given a fillip to the nutritional quality of this cereal. The nutritional value of maize has been shown in the table alongside.

(e) Adaptability of Maize to varied climatic conditions:

Maize is the only food cereal crop that can be grown in different seasons and requires moderate climate for growth. In the country, more than three-fourths of the area to maize production is contributed by eight states, viz Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Tamil Nadu. Over the past two decades, the crop has witnessed a growing prominence in these states, though with a varying degree, particularly as a feed crop. Maize being a C4 plants it has a competitive edge over C3 plants. C4 plants use 3-fold less water, allowing them to grow in conditions of drought, high temperature, and carbon dioxide limitation. It has been recognised that C4 plant species (including maize) have a higher optimal temperature for undertaking photosynthesis than C3 plants due to operation of a CO₂-concentrating system that inhibits Rubisco oxygenase activity.

III. FUTURE PROSPECTS OF SPECIALTY CORNS

Quality protein maize (QPM)

In India 84% of the maize produced is directly used either as feed or food. With respect to nutritional value, quality protein maize has better say than the normal maize. In addition, the productivity of QPM is at par with normal maize and the biological value of QPM maize is double than the normal maize and higher than wheat and rice and matches with milk for true protein digestibility. The prices of meat, egg, milk and their products have gone higher.

This cannot be afforded by poor peoples of the country. Therefore, high biological value of QPM will reduce food/ feed cost and its requirement and this will provide solution to malnutrition in human being and benefit poultry, livestock, pig, fish etc.

Future Challenge - seed production technology

The importance of effective seed production technology can hardly be over-emphasized. The failure of double cross hybrids during the initial phase of the coordinated project may be attributed mainly due to the lack of seed production. The lessons from this debacle prompted the policy makers in devising holistic initiatives to tackle the issues of seed production in a big way when two-parent crosses assumed significance in breaking the yield barrier in maize. A network of

initiatives spanning from grassroots to end-users has been developed under which the public-bred high yielding single cross hybrids are being promoted/popularized on farmers' fields. MoUs have been signed between State Agricultural Universities (SAUs) and various private organizations for popularization of hybrids like 'HM 4', 'HQPM 1', 'Vivek QPM 9', 'HM 8', 'HM 9', 'DHM 117', 'Vivek 33', 'HM 5' etc. Public institutions like KVKs have been roped in for production and timely supply of hybrid seed to farmers. Such approaches have begun to give results, among the quality protein maize, HQPM1 and in normal maize DHM117 and PMH3 are being popularized in many parts of the country.

Application of novel tools and techniques for maize improvement

With the advent of new generation sequencing technology, it has become possible to unravel the sequence of gene(s) of economic importance and also explore novel alleles present in the germplasm. Bringing such novel alleles into well-established cultivars has become possible through transgenics and conventional breeding. Such novel approaches will not only enhanced the per se performance of parents involved in hybrids development but also hybrids as well. Several examples are already available in maize and other crops. One such classical example is introgression of yield QTLs into Mo17 and B73 inbred lines, which has enhanced the overall performance of the new hybrids (Stuber et al., 1992). Another practical example is cultivation of transgenic maize single cross hybrids in USA, which has achieved the productivity level of 10 t/ha.

Future export opportunity

The increased production of maize has helped India to become one of the top exporters of maize in the South East Asian region. India being near to South East Asian countries it is supplying maize to neighbouring countries as India also enjoys the comparative advantage over the American competitors because of low cost of transportation. The higher prices of U.S., Brazil and Argentina maize as well as their longer transport time gives Indian maize an edge in the South East Asian region.

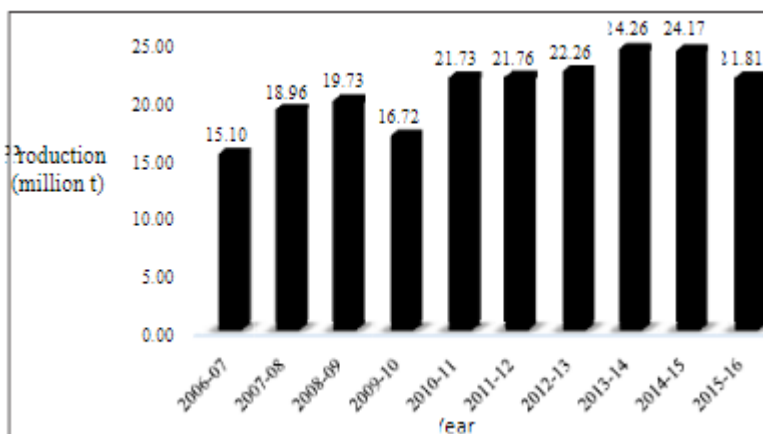
IV. STATUS OF MAIZE IN WORLD

Global maize production reaches up to 1147.7 million MT from an area of 193.7 million ha with productivity 5.75 tonne/ha (FAO, 2020). US and China are the two largest producer and consumer countries of the world with 30 per cent and 23 per cent contribution to the global maize production respectively. Whereas, in terms of export Argentina and Brazil are leading the place.

V. MAIZE SCENARIO OF INDIA

In India, production of maize is 21.81 million tons from 8.69 m ha with a productivity of 2509 kg/ha. Projected demand for maize production by 2050 in India is around 121 million

tonnes. Raju et al. (2010) reported a growth rate of 3% per annum in maize area in the early years of the 21st century. But enhancement of production is not much satisfactory during recent times which can fulfill the future demand (Fig. 2). Author predicted that the area would grow further to meet future food, feed, and other demands, especially in view of the booming livestock and poultry producing sectors in the country. On the other side, the demand for maize as a food is constantly declining in India. Therefore, the projected consumption demand of livestock based products will drive the demand for maize. As different estimates showed that with 4 to 8 per cent of per capita income growth, the demand for livestock based products is expected to grow by 6 -10 per cent annually which may lead to a continuous demand of maize as an essential ingredient of feed industry.



VI. CONCLUSION

Maize is a potential future cereal crop. It not only increases the farmer's income but also is a source of raw material for various agricultural products. Changing climate which is negatively affecting the yield of numerous crops, in that case maize can perform better as it is a C4 plant. In India farmers growing more wheat and paddy in non-traditional areas leading to depletion of ground water table and soil declination whereas, maize can be a solution to similar situations as it saves 90 per cent of water and 70 per cent of the power. This crop needs further impetus and support from all stakeholders for better economic growth.

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