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FOREWORD - FICCI

Dr. A. Didar Singh
Secretary General,
FICCI

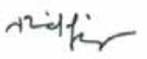
Maize is the third most important crop in India after rice and wheat and is an important staple food in many countries of the world. Its importance lies in the fact that it is not only used for human food and animal feed but at the same time it has wide individual applications.

Animal feed is the largest end use segment for maize in Asia with around 70% of total volumes used by the feed industry. The demand for maize is expected to go up due to a growing population and increasing inclination towards higher protein consumption in the form of meat and eggs. Maize, as poultry feed, is more acceptable than rice and wheat both in terms of price and nutrition. However, less than 20% of corn produced is used for direct consumption. With economic development, as cereal consumption shifts towards more protein rich food, the share of direct maize consumption is likely to decline. However, it is encouraging to know value added corn usage is becoming popular as snacks and breakfast cereals and is a fast growing market given the increasing health consciousness of consumers.

With a large area under cultivation and low productivity, maize has a strong potential for production growth in coming years. In the current scenario, the need is to focus not only on production and productivity but also on building a competitive maize supply chain.

The study on maize outlines the outlook for Maize, which is the second most important cereal crop after rice in South East Asia. With demand for maize expected to double by 2050, the report highlights the macroeconomic scenario in Asia as well as the growth of the agribusiness and food processing industries with a specific focus on opportunities for the use of maize as food, feed, fodder and in value added industry. The report also brings to the fore various state initiatives being taken up for upscaling maize supply to meet domestic and export demand which will help developing India as an export hub for maize in South East Asia.

FICCI has always thrived in providing thought leadership. It is our strong belief that this report would be helpful in focusing India's potential in the maize sector and immensely useful to various stakeholders in the maize industry in identifying the critical constraints and challenges confronting the industry and is instrumental in designing the possible interventions by the market players and the Government.



Dr. A. Didar Singh

FOREWORD - NCDEX

Mr. Samir Shah
MD & CEO,
NCDEX

Rising demand from food, feed and industrial sectors, evolving new production technologies, improving pre and post-harvest processes, are making maize an exciting opportunity today.

Today India is one of the top maize exporters to South East Asia thanks to its strategic location vis-à-vis its American competitors, though not as much to those from China.

The Theme of the Seminar 'India – the preferred destination for maize in South East Asia' finds resonance with every single member of the fraternity, which will need to come together to realise their vision.

We can sharpen our advantage is by improving productivity, and by assuring fair and remunerative prices to producers to make maize cultivation more attractive.

Commodity exchanges play a key role in enabling all in the value chain fetch a fair price. By offering an online centralised market place for price discovery and disseminating these transparent prices, commodity exchanges have given pricing power to the producer and have also aided institutional development of support infrastructure and allied services, e.g., grading, warehousing, supply chain integration and farm credit facilitation.

Going a step forward, NCDEX has launched exchange traded forwards that provide the missing links in organized commodity value chain. They enable traders execute their customised bilateral deals on national online platform of the exchange, under its regulatory purview. This has enlarged the market to national from just local, reduced overhead costs for participants and has instilled confidence with regard to minimizing counter-party default risks by assuring compensation guarantee to the extent of margin collected.

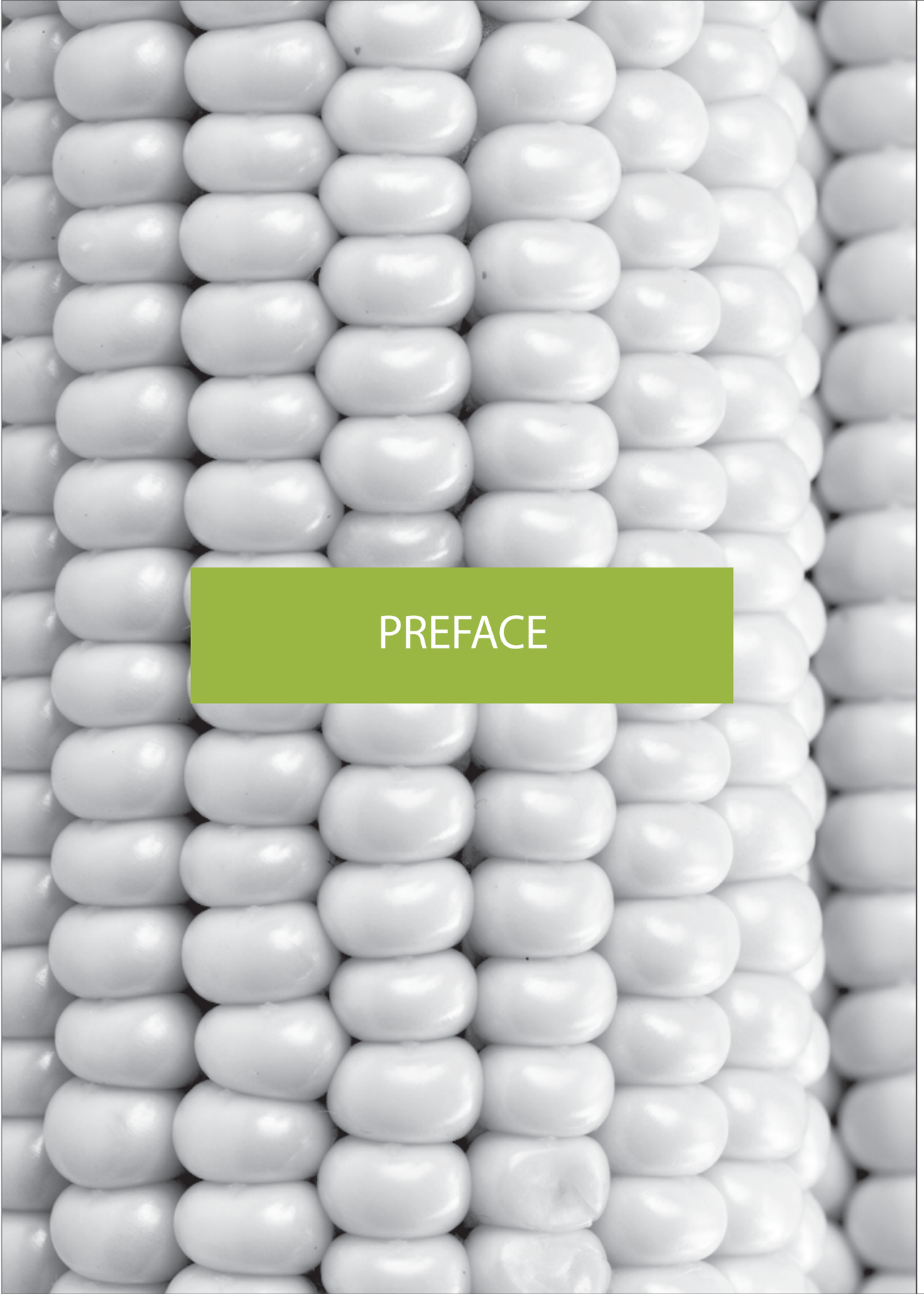
Forward transactions in maize has generated a volume of more than 4000 tonnes worth Rs 184 lakh since their inception till date.

In the third edition of India Maize Summit'15 our endeavour is to extend NCDEX platform towards bringing all maize stakeholders on a common ground and cohesively work out a developmental roadmap.

This knowledge report has been prepared with a view to provide key insights, recent trends and emerging challenges to the maize industry and should provide a context for discussions during the Summit.

I hope the Summit is immensely useful to all members of the maize fraternity and discussions benefit all the participants and enable India to achieve leadership position not only in South East Asian region but across global markets as well.

Samir Shah



PREFACE

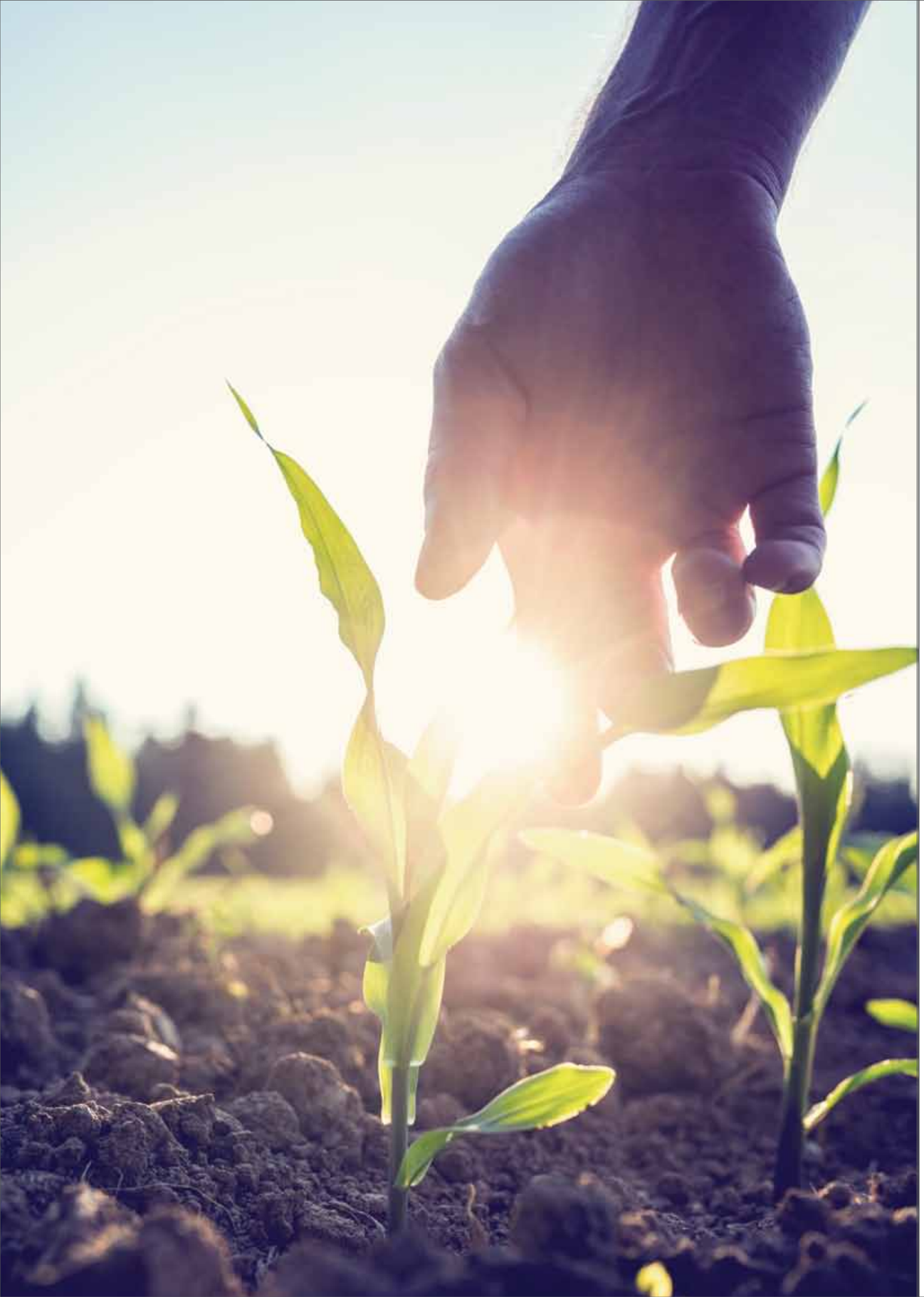
INDIA MAIZE SUMMIT'15

Maize production in India has increased at ~4.2% CAGR from ~19.7 million tonnes 2008-09 to ~24.3 million tonnes in 2013-14. However, its share in global production is only 2.5% and in recent past, exports from India have been limited (only ~3% of global exports in 2013-14) due to relatively lower quality and higher price.

Going ahead, there lies immense long term potential to increase India's importance in global maize landscape. Right from yield & quality enhancement to realization improvement to loss reduction, there lie opportunities galore. However, realizing it would require a focused, planned and collective effort from each stakeholder throughout the value chain right from production to marketing to storage.

The report summarizes the outlook for Maize and the demand potential of Indian Maize from South East Asia. It highlights the macroeconomic scenario with specific focus on trade policies, price competitiveness and quality competitiveness of Indian Maize as well as the growth opportunities of maize to be used as food, feed, fodder and fuel. State specific initiatives, production technologies and post harvest management have been discussed in the report. All these factors will ensure economy of scale to meet domestic as well as export demand which will shape India as an export hub for maize in South East Asia.

This summit intends to provide a platform to ideate the way forward to place Indian maize on the global map. The objective is to identify key development areas and invite collaborative solutions & ideas from a diverse set of minds. In order to achieve its objective, FICCI and NCDEX have brought together stakeholders across the value chain including technology providers, producers, infrastructure providers and policy makers.

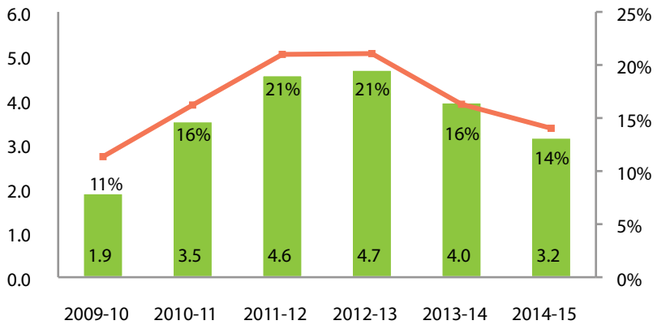


MAIZE - OUTLOOK AND RIDING THE DEMAND WAVE

MEDIUM TO LONG TERM VIEW ON DEMAND OF INDIAN MAIZE FROM SOUTH EAST ASIA

Maize is cultivated on nearly 178 million Ha globally in about 160 countries and contributes ~50% (1,170 million MT) to the global grain production. In India, maize constitutes ~9% of the total volume of cereals produced and is the third most important food grain after rice (~42%) and wheat (~38%). Advance estimates for total production in India stands at 9.3 million MT in trade year 2015, growing at ~6% in the past 5 years.

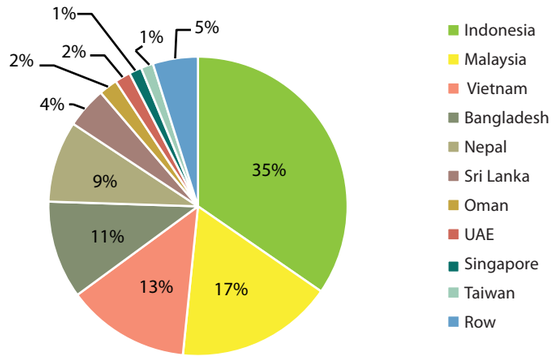
India's Maize exports (Million MT)



Source : Ministry of Commerce & Industry

About 14% of the total production in India in 2014-15 was exported which is a clear dip from the 2011-12 and 2012-13 levels. In the past two years, due to changes in MSP, price of Indian maize is ~20% higher compared to global prices. Key corn producing nations in North and South America have experienced an over supply, enabling them to offer lower prices. As a result, Indian exports since Oct'14 are estimated to be 0.6 Mn MT and overall exports in marketing year 2014-15 are expected to be restricted to 2 Mn MT.

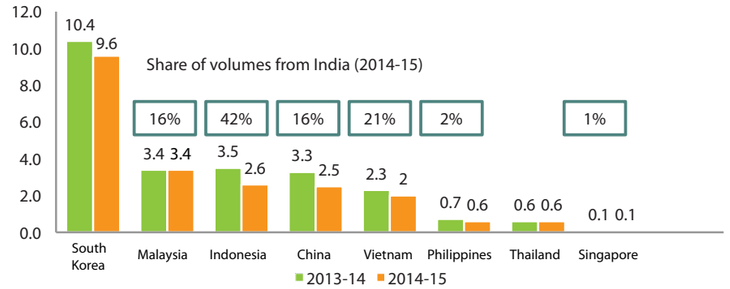
Indian Maize importers by volume (2014-15)



Source : Ministry of Commerce & Industry

While India has been exporting to Indonesia and Malaysia for long, export volumes to other importing nations like South Korea and Thailand have traditionally been negligible as these countries import from North and South American corn growing nations more cost effectively.

Top Importers of Maize in SE Asia (Million MT)



Source : FAO

Maize imports in Indonesia, which is the highest importer of Indian corn, have fallen in the last year due to better production in 2015 (estimated to be ~8% higher from 2014-15) and larger carryover stock from the previous year.

Higher price of Indian corn (USD 220 / MT compared to global prices at USD 175/ MT) coupled with lower quality (low grain weight) has impacted exports of corn from India. Policies around price correction and initiatives to improve quality can be key drivers of corn exports from India in the coming years.

Demand Potential from feed and food industry

Animal feed is the largest end use segment for maize in Asia with ~70% of total volumes used by feed industry. It is estimated that the demand for maize will be fueled by population growth and increasing inclination towards higher protein consumption in the form of meat and eggs.

Maize, as poultry feed, is more acceptable than rice and wheat both in terms of price and nutrition. The nutritional value of maize is higher (3,365 Kcal/kg) compared to rice (3,320 Kcal/kg), rice bran (2,620 Kcal/kg), peanut (2,915 Kcal/kg) and oilcake (2,350Kcal/kg). Recent trends show that consumption of meat in Southeast Asia is expected to grow at ~20% between 2015 and 2020. This indicates a clear potential for demand from the South East Asian region going ahead.

Apart from feed and industrial applications, food processing industry is a crucial end use segment for maize as it is being used for making food additives and sweeteners. With processed food industry slated to grow at 10%+ rate in the next five years in most countries of the region, maize demand is expected to rise.

Country	Processed Food Industry Growth (2015 – 2020)
India	18 – 20%
Indonesia	12 – 14%
Bangladesh	20 – 22%
Malaysia	10 – 12%
Vietnam	22 – 25%

Source : Industry reports

MACROECONOMIC AND AGRICULTURAL TRENDS

Trade Policies and Regulations

Reduction in price of corn globally compared to domestic price of INR 1310/ quintal (USD 220/ MT excluding freight) is likely to have impacted exports. Regulations in domestic pricing may be required to make Indian corn competitive unless global supply contracts leading to an increase in prices globally.

Indicative Median Prices (USD/ton)

Exporter	Oct-14	Apr-15 (YTD)	Growth %
Argentina	163	202	20%
Brazil	163	175	4%
Black Sea	173	173	0%
USA	177	187	6%
France	182	169	-7%
India	233	215	-8%

Source : Ministry of Commerce and Industry, International Grains Council, A & M Analysis

Historical price comparison of corn sourced from USA, Argentina and India indicates that the Indian corn has been more competitive since 2010-11 except for recent years wherein Indian corn was selling at a premium. This has been one of the reasons for the dip in exports of Indian maize. However, for 2014-15 the Indian government has increased the MSP for most crops, except maize, the impact of which on price competitiveness of Indian maize remains to be seen.

Quality Competitiveness of Indian Maize

Indian maize tends to fall short on key quality indicators such as grain weight and starch content. Average grain count for Indian maize stands at ~450 grains / 100 grams whereas grain count for American maize is generally in the range of 295 – 300 grains/ 100 grams making it more suitable for feed industry. Starch content of American maize is reportedly close to 73% compared to 63 – 67% in Indian maize. Initiatives to improve quality may be needed for driving demand and this may be addressed through use of better seeds and agronomic practices.

INDUSTRIAL DEMAND FOR MAIZE IN INDIA AND SE ASIA

Feed industry which is the largest consumer of maize is expected to witness a growth of 8-10% backed by the rapidly rising meat and poultry consumption in the region. In 2014 for example, Indonesia witnessed addition of 3 new feed mills with an aggregate processing capacity of 720,000 MT/ per annum to support the rising demand. Similarly China, which has a per capita meat consumption of ~20kgs is witnessing a growth in demand from the animal feed market which is likely to witness a 15%+ growth in the next 5 years.

Maize Usage by Industry in SE Asian countries (2013 -14)

Country/ Region	Food Industry & Consumption	Feed Industry	Seeds, & other Uses	Industrial Applications
Bangladesh	5 - 7%	88 - 90%	5 - 7%	Negligible
China	6 – 7%	68 – 70%	20 – 25%	1 – 3%
Indonesia	35 - 40%	25 – 30%	30 – 35%	0.1 - 0.5%
Malaysia	6 – 10%	86 – 88%	4 – 6%	0.4 – 0.5%
Vietnam	16 – 18%	78 – 80%	4 – 5%	Negligible
India	17 - 20%	60 – 62%	6 – 7%	12 - 14%
Asia	6 - 8%	65 - 70%	2 - 5%	~20%

Source : Research Reports

Ethanol outlook in SE Asia

As per the OECD agricultural outlook report, biofuel volumes for southeast Asia are expected to grow from 4.9 billion liters in 2013 to 7.5 billion liters by 2021 at an annual growth rate of 5.5% backed by favorable policies in SE Asian countries (focus on increasing share of biofuels in the overall energy mix). However, corn usage for biofuels is negligible in the region to avoid food supply disruption and hence may not impact demand for maize unless policy changes are brought in. Beverages is relatively newer but growing market for Rice, Sorghum and Corn based alcohols.

DEMAND FROM INDIAN FEED INDUSTRY

Maize has diversified industrial applications with its primary usage being in feed. Poultry industry is heavily dependent on maize as it forms 50-60% of the input required for broiler feed and 25-35% of the input required for layer feed.

Broilers consume 3.6-4 kgs of feed over a period of 32 - 35 days (5 weeks) to attain weight of ~2.2 kg. Layers have a life span of ~72 weeks of which they lay eggs for 52 weeks with an annual feed consumption of 42 - 47 kgs, producing over 300 eggs. Percentage of maize consumed in feed varies by manufacturer. Integrators and large manufacturers generally use a higher proportion of maize as compared to small and unorganized players.

The industry standard for energy requirement is 3,200 Kcal/ kg in case of broiler feed and 2,300 Kcal/ kg in case of layer feed. Maize provides approximately 3,400 kcal/ kg and is most preferred due to availability and higher energy content. Jowar is the closest substitute but its availability is constrained while wheat contains high non-starch polysaccharides which are indigestible by broilers and have to be depolymerized with an enzyme for release of energy.

Hence, demand for maize in this segment will only grow in tandem with industry growth which is being driven by various factors like higher demand for meat and poultry with increasing income and strong growth in food services. Better quality maize can be developed for this industry with higher energy content in order to ensure there is no substitution.

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Demand Drivers for Feed Industry in India

Industry Growth

India has low per capita broiler meat and eggs consumption of 3 kg per capita per annum when compared with countries like USA and China that have a consumption of 44 kg and 17 kg per annum clearly indicating a scope for growth.

Per capita consumption of eggs in India is estimated at 55 eggs per annum as against 180 eggs recommended by National Institute of Nutrition indicating growth headroom.

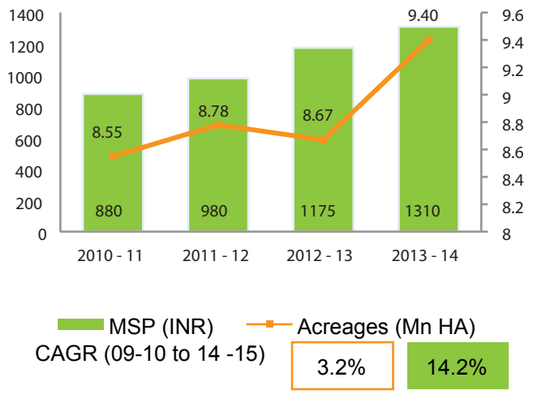
Unlike bovine and pork meat, chicken meat does not have religious sentiments and can be freely consumed in India. A number of players in the food services segment, especially QSRs, are offering chicken products leading to a huge spurt in demand.

STATE INITIATIVES – SCALING UP SUPPLY TO MEET DOMESTIC AND EXPORT DEMAND

SUPPORTING MAIZE THROUGH DIRECT PURCHASE UNDER THE MSP

Impact of Minimum Support Price (MSP) scheme on maize acreages

Acreages and MSP between TY11 and TY15



Source : Ministry of Commerce & Industry

Minimum support price for maize has increased at ~14.2% CAGR from INR 880/ quintal in 2010-11 to INR 1310/quintal in 2013-14 – one of the fastest among crops. During this period, acreages have increased from 8.55 million Ha (2010-11) to 9.40 million Ha (2013-14) at ~ 3.2% CAGR. Moreover, rising global prices till 2013-14 have also assisted in maintaining acreages. However, due to muted global prices, MSP in 2014-15 have been kept flat at previous year levels. Growth in MSP has played a key role in boosting acreages by maintaining higher profits for maize cultivation. However, given the land constraints for other crops, a mid-term outlook on the maize MSP relative to other crops becomes a critical discussion point.

Government's role in quality maize procurement and associated costs

Government's role in maize procurement (through FCI) becomes pronounced during the low price durations. In 2013-14, when global prices started plummeting due to supply glut, Government's maize procurement increased to ~12 Lakh MT from previous year procurement of only ~2,200 MT. It remains high even in 2014-15. However, maize usage in public distribution system remains limited, resulting in re-entry of some quantity of maize into the end use industry (at a lower cost than MSP).

Also, due to lack of availability of quality storage infrastructure (by both FCI and state warehousing corporation), maintenance of quality for end use consumption becomes a challenge. Consequently, Government bears the cost of subsidizing maize – directly via MSP and notionally through quality depletion. The key discussion issues are the sustainability of the cost to the exchequer, FCI's storage infrastructure for peak volumes, quality maintenance and relatively higher cost to the end use industry.

Impact of MSP based purchase on Export

Currently, the global prices are ~USD 170-180/ MT (U.S. No 2 – FOB) vs. USD 220+/ MT for the Indian corn. The difference has largely has been driven by high minimum support price (~USD 214/ MT) in India. This has resulted in India having a low share (<2%) in global trade currently. Thus, the key issue is that given the changing global dynamics and India's increasing intent to meaningfully participate in global trade, what could be the possible approaches towards MSP?

Price Comparison between US and Indian Corn

Year	US Corn	MSP	MSP
	USD/Ton	USD/Ton*	INR/ Ton
2010 – 11	290 – 295	193	8,800
2011 – 12	295 – 300	211	9,800
2012 – 13	260 – 265	220	11,750
2013 - 14	190 – 195	223	13,100
2014 – 15	170 – 175	215	13,100

*USD exchange rate has been taken as follows – 2010 – 11 : INR 45.65
2011 -12 : INR 46.45, 2012 – 13 : 53.42, 2013 – 14 : INR 58.5, 2014 – 15 : INR 61.00

Source : FAO, Ministry of Commerce & Industry

PUNJAB GOVERNMENT INITIATIVES FOR MAIZE

Importance of public private partnership in improving the overall maize eco-system

Currently, large part of the value chain of maize – production to delivery, ranks lower in quality compared to large global producers. 35-37% of the maize acreages continue to use low quality OPV seeds (primarily supplied by the government). There remains a gap in high quality knowledge transfer to farmers to enhance the quality of produce. There is a shortage of farm level infrastructure (maize driers) and quality storage facilities, resulting in quality degradation (such as ~15-20% higher moisture content).

Public private partnership could potentially be a route which could assist in improving various segment of the value chain – improved seeds, technical knowhow, storage infrastructure, etc. Punjab government (along with central government) has recently approved a public private partnership between Punjab Agriculture University and certain private players to provide subsidies on seeds & pesticides and technical assistance to the farmer.

Going ahead, the discussion point remains the importance of PPP, the roles which such partnerships can possibly play and the extent of impact it can generate.

Evolving policy frameworks for crop planning – Learnings from maize cultivation Punjab

Paddy-wheat has been the traditional crop cycle for a large part of Punjab. However, extensive usage of water in paddy has led to an increase in water development from 145% in 2004 to 190% in 2014, resulting in severe water crisis.

Consequently, Punjab Government has been trying to incentivize maize cropping to replace paddy in the kharif season in order to contain the depletion in water level.

In the process, government has introduced a host of initiatives such as increase in MSP (in conjunction with central government), seed & pesticide subsidy (INR 500/ acre for seeds and 50% subsidy on pesticides), installation of large scale driers at two locations (cost of INR 16 Cr.), farmer awareness fairs, extension programs through KVK & universities and creation of efficient marketing infrastructure.

However, some part of maize cultivation has come as a third crop (from March to June) which do not serve the purpose of the initiative.

Thus, the areas of focus would be – sustainability of the maize acreage through promotion, scalability of the model to crop planning in nationally/ other states and implementation roadmap.

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VALUE CHAIN DEVELOPMENT – INITIATIVES IN MAHARASHTRA

Framework, coverage and key future considerations for value chain development

Value chain development is a key improvement lever for the Indian food and agriculture industry. Lack of quality farm inputs and inefficient farming techniques result in inferior produce. Moreover, post-harvest losses amount to thousands of crores (quality and quantity losses).

This is largely due to lack of technical knowhow, limited advanced resources and inefficient farm to consumer infrastructure (cold chain, dry & cold storage, post-harvest farm level processing).

World Economic Forum and Government of Maharashtra launched a Public-Private Partnership – Integrated Agriculture Development (PPP-IAD) in November 2011 to develop integrated value chains for specific crops.

In 2014-15, the program intends to focus on 15 crops (including maize). The project assists in implementation of approved value chain projects from private participants, which involve building capacities, providing technology (including mechanization) & training to the farmers and developing farmer associations.

The Maharashtra PPP-IAD partnership is now in its third year of implementation. In its first cycle, 10 projects reached over 140,000 farmers on almost 150,000 hectares.

In its current third cycle for 2014-15, the partnership now covers 30 value chain projects, representing more than $50 million in total value.

The 2014-15 projects target nearly 500,000 farmers, covering over 300,000 hectares, and is on target to meet its goal of impacting one million farmers by 2015.

The key consideration areas are –

- The scalability of value chain initiatives,
- Value impact both at end user level and farm level,
- Continued participation (not project based) of private players and
- Key challenges in implementation

COLLECTIVE EFFORTS IN MAIZE CULTIVATION IN ANDHRA PRADESH

In India, marketing by small farmers is localized through a chain of middlemen restricting farmers to fetch the best prices. Moreover, farmers generally do not have direct linkage to commodity exchanges.

Increasing market knowhow through exchange and establishing aggregated direct linkage can assist in better price realization for the producers. Andhra Pradesh government supports bringing together of farmers to form producer organizations which can collectively achieve better prices for their crops.

This ensures that producers are able to realize optimal value from their produce and progress further due to fragmentation of land holdings and lack of organization. Through better organization, these producers can

1. Utilize scale to procure inputs at a lower price

2. Gain more selling power for their produce

3. Get access to timely and adequate finance, build capacity and provide linkages to markets

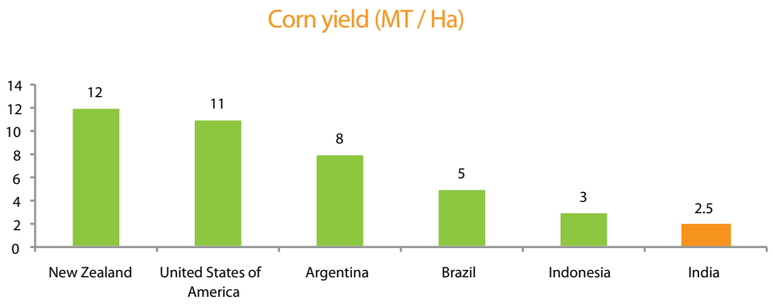
These initiatives can be credited for better yields and price discovery in the state and can be adopted in other maize growing regions.

As a result, the key points for discussion are the potential of scalability and sustainability of this model for a national level adoption.

PRODUCER'S VIEW - PREPAREDNESS AND FARM PRACTICES

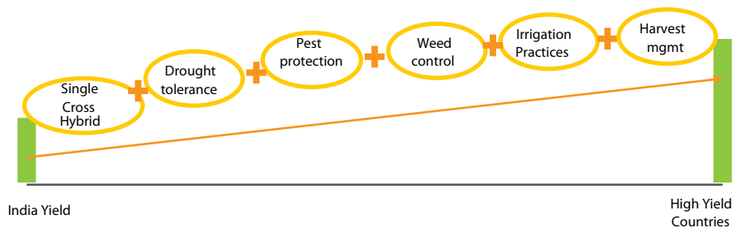
CORN PRODUCTIVITY

India is currently among the top five exporters of corn worldwide. However, current yield levels in corn are much lower compared to other corn growing nations like USA and Argentina. As corn varieties have shifted from composites to double cross hybrids to single cross hybrids in some areas over the years, there has been a marked improvement in yields, with single cross hybrids yielding up to 6 MT/ Ha in select areas.



Source : FAO, Research reports

High yielding seed varieties combined with other seed technologies like drought tolerance coupled with farm practices like disease control, weed control and irrigation can lead to significant yield improvement. Mechanized harvesting and post harvest management can also provide additional yield benefits.



A multi pronged effort through breeding, agronomics and biotic and abiotic stress resistance (through biotechnology traits or otherwise) can lead to sustainable yield benefits. However, access to finance support, information and technological knowhow are areas where cultivators require support from governments and private organizations working with producers.

While overall productivity is low, there are specific pockets in Orissa, Bihar, Telangana etc which have been able to improve returns by increasing productivity and implementing best practices of cultivation suited for that climate, soil and rainfall situation. It is important to study these cases to understand the inputs required, most effective farming practices, harvesting and storage techniques and avenues for commanding better prices . Governments and Kisan organizations can play a key role in helping farmers fulfill these objectives.

Productivity Improvement Initiatives and Best Practices

Inputs

- Seed selection, seed rate, seed treatment
- Fertilizer usage
- Weed control
- Insect and disease control

Farming Practices

- Land preparation and tilling – level of mechanization
- Sowing- techniques and mechanization
- Irrigation and drainage
- Intercropping

Harvest and Storage

- Harvesting technology and mechanization – minimizing losses
- Drying and storage technologies and pest management

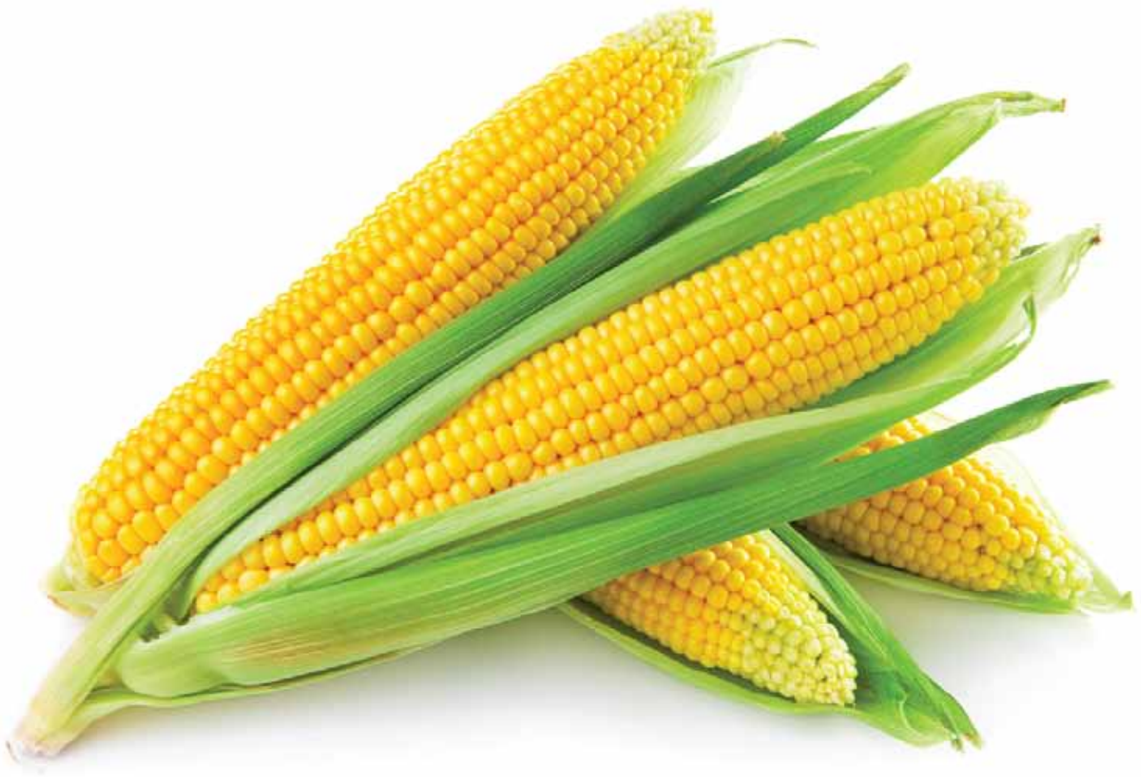
Access to Markets and Pricing

- Support in forming farmer organization for better access to markets and key customers
- Technology support to provide access to price information and ensure better price discovery
- MSP support

Support Required (including role of Kisan Organizations)

- Access and support for inputs (seeds, fertilizers, etc)
- Support for mechanization – machine leasing, subsidies
- Access to credit
- Access to crop insurance
- Assistance in obtaining new seed varieties with higher yield/ biotic and abiotic stress resistance, etc
- Technology enabled knowhow support
- Unified market platform offering better market access to corn producers

Increase in productivity and profitability



PROCESSING VALUE ADDED MAIZE - VIEW FROM CONSUMING INDUSTRY

FUTURE OUTLOOK FOR MAIZE IN POULTRY SEGMENT

Current role of maize in poultry

Maize is preferred in poultry feed because of its easy availability. India has grown to be the fifth largest producer of eggs and poultry meat. Maize constitutes about 60% of poultry feed and therefore is a critical raw material. Maize has greater calorific value, is rich in amino acids and has less toxins compared to grains like millet and broken rice. Wheat is comparable in effectiveness but is costlier (by ~20%) than maize.

Key issues and substitutes

Maize provides energy of approximately 3,400 kcal/ kg and is most preferred when compared with other substitutes due to availability, higher energy and price economics. Jowar is the closest substitute but its availability is constrained. Apart from Jowar, layers of Bajra and Rice are also popular North and South India, respectively. However, Bajra usage is restricted primarily due to lower energy and Xanthophyll content and Rice usage limited by price economics. Wheat contains high non-starch polysaccharides, which are indigestible by broilers and have to be depolymerized with an enzyme for release of energy. Hence maize remains an important constituent of feed. Annual demand growth rate of 8-10% is projected for the broiler and 4-5% for the egg industry in next five years.

Need for nutritionally enhanced maize

Development of variants which provide higher energy can lead to efficient breeding and hence profitability benefits for poultry farmers in this segment by reducing the cost of energy per Kcal. This can increase use of maize as an energy source.

OUTLOOK FOR MAIZE IN STARCH AND SWEETENERS SEGMENT

Growth in end use segments

The demand for starch is strong and is growing at 10-12% every year due to rising consumption in the food and pharmaceutical industry. The domestic starch makers together consume about 2.6 million MT of maize every year. Maize starch, an excellent source of carbohydrate, is a highly versatile industrial raw material and finds extensive applications in the textile, food, pharmaceutical and paper industries.

While textile and paper industries are expected to witness 6-7% growth (volume), pharmaceutical and food segments are expected to grow at ~12-15% (volume) in the next five years driving the demand for maize.

Encouraging alternate applications

India manufactures only 40 products from maize and starch derivatives whereas over 800 products are produced in the international markets indicating huge potential for expanding the application base for maize. Use of maize starch for alternate applications like biodegradable plastics, car parts, edible oil and sweeteners are already picking up.

Usage of maize starch bags is rising on the back of it being bio-degradable and hence environment friendly. It can also handle more weight and have longer shelf life. Starch based sweeteners are increasingly replacing sugar in food and beverage applications. Their usage in aerated drinks is, however is not economically viable in India.

Benefits and issues with use of maize for starch currently

Maize has 60-65% starch content and hence cannot be easily substituted by other commodities. Tapioca is occasionally used as a substitute for maize, however, low starch content (20-30%) and restricted availability prevent its widespread use. Other substitutes like potato and rice are not as popular yet and are not likely to impact maize demand adversely.

Initiatives needed to aid usage growth in existing industries.

Growth of high starch content (70-75%) varieties (e.g. dent corn) can be effective in ensuring industry stickiness towards maize. Varieties with higher grain size can also be encouraged to ensure higher profitability of the starch sector.

FOOD INDUSTRY PERSPECTIVE ON DIRECT CONSUMPTION OF MAIZE

Less than 20% of corn produced is used for direct consumption. With economic development, cereal consumption shifts towards more protein rich options and even among cereals, rice and wheat are more preferred. Hence, the share of direct maize consumption is likely to be on a decline.

Value added corn usage however is becoming popular as snacks and breakfast cereals and is a fast growing market given the increasing health consciousness of consumers. However, the quality of corn procured and the nutritional value remains a key concern area.

In order to support this growth, initiatives will have to be taken to encourage growing of better quality corn as well as specialty corn and industry participants need to work with farmers to educate them with the knowhow and economic benefits.

Direct farmer linkages with corporates can help in building a better procurement pathway for end user companies.

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OUTLOOK FOR BIOFUELS AND ROLE OF MAIZE

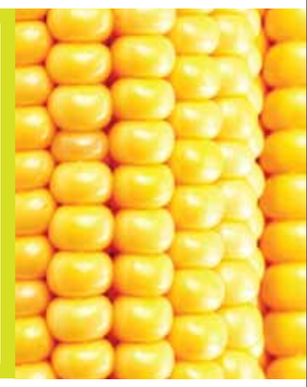
Ethanol makers are facing a drop in earnings as cheap crude pushed down the prices they fetch from refiners to blend the corn-based fuel additive into gasoline. Falling profit margins for the ethanol industry may cause some companies to scale back production. However, it is still expected that ethanol demand may remain steady globally or even rise if cheap fuel spurs motorists to drive more, tempering the hit to ethanol earnings.

In India, however, other sources like biomass, sorghum and sugarcane are used to generate biofuel while maize is not encouraged to be used owing to its use in other important areas. Only non food crops are allowed to be raised in wastelands not suitable for agriculture to avoid any conflicts with food security.

As ethanol demand picks up, there may be a need to shift towards corn which can be stored over a longer period compared to sugarcane and thus large scale processing plants that enable scale economies are easier to develop leading to cost effectiveness.

Growth of alternate uses of ethanol besides biofuel may also have an impact on the demand and maize may be considered for production

IMPROVING QUALITY & PRODUCTION: TECHNOLOGY & OTHER INPUTS

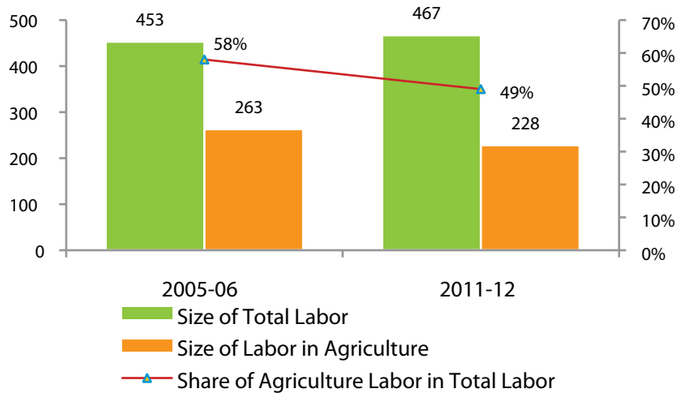


NEED FOR MECHANIZATION IN MAIZE AND FUTURE OUTLOOK

Evolving labour situation and need for mechanization

Share of agriculture labour in the overall labour force has reduced from ~58% in 2006 to ~48% in 2012 . Migration to more remunerative professions (industries, other services in metros/Tier I cities) has been the key reason for the reduction. Moreover, development in migrant labour states (UP, Bihar, etc) has led to low availability of seasonal labour (especially for harvesting).

Employment in Agriculture (million)



Source : Ministry of Agriculture

Although, at an India level average labour costs have increased by 13-15% in the past 4-5 years, yet seasonal labour rates in certain states have increased by 20-25% in the same period. Moreover, the average age of the current farmer is 40+ years and the next generation is gravitating towards other professions. Going ahead, the labour availability is expected to reduce, resulting in increasing production costs across crop cycle. Key discussion point is the need for mechanization across the crop production cycle.

Trends in Daily Wages (INR) in Key States

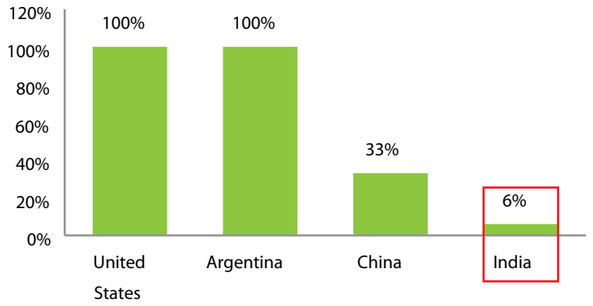
States	FY08	FY12	CAGR %
West Bengal	75	161	21%
Andhra Pradesh	71	150	21%
Karnataka	74	125	14%
Punjab	98	153	12%
Tamil Nadu	80	119	10%
Bihar	81	120	10%

Source : Government Sources

Role of mechanization in enhancing productivity and reducing farm losses

~100% of the acreages in large corn producing nations (United States and Argentina) sow and harvest maize mechanically. China has increased its mechanization in harvest from ~16% in 2010 to ~33% in 2013. With increase in mechanization (harvesting), large maize producing nations have experienced increase in yield. In India, the mechanical sowing & harvesting penetration has only been 5-7%. Farm losses (due to poor harvesting practice or lack of timely labour) can potentially be controlled through mechanization. Increase in thrust on promotion and adoption of mechanical harvesting could potentially assist in improving productivity and control farm losses.

Level of Mechanization (2013)



Source : Research reports

View on mechanization penetration in various phases of the crop life (2015-20)

With increasing development in cities, ageing farmer (currently 40+ in age) and reducing interest of the next generation in farming, the labour problem is expected to intensify going ahead. Currently, the average land holding is ~3 acres per household signifying limited of financial ability to afford a mechanical harvester. Going ahead, India is expected to witness gradual consolidation (through cooperatives and large farmer- small farmer model). The discussion area should concentrate around the potential of mechanization despite the adoption being low till now.

Possible supply side support to aid increase in adoption

Given the small landholdings and limited financial ability, supply side support could potentially provide a fillip to adoption of mechanization. Various emerging models such as leasing by large farmers, Krishi Vigyaan Kendra, Agri-institutes and processors, have been adopted in wheat and sugarcane. Similarly, these could be adopted in a wider scale to promote mechanization in maize. Moreover, initiatives by the state governments in form of knowledge transfer, subsidies, etc., could encourage adoption. There lies a need from the supply side to reach a critical mass in adoption, which could accelerate thereafter.

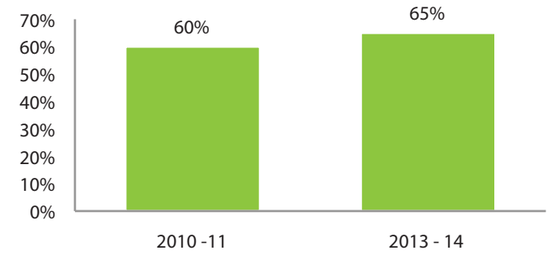
SEED TECHNOLOGY AS A PRODUCTIVITY DRIVER

View on adoption of hybrid maize and single cross maize

Penetration of hybrid corn has gradually reached ~65% (increase of only 4-5% in the past 3 years) leading to increase in productivity. Moreover, evolving hybrid varieties (like single cross hybrid) has led to further improvement in yields.

Continuous promotion of hybrid maize could potentially enhance the productivity levels getting the nation closer to self-sustainability targets. The key discussion points are initiatives to promote hybrid adoption and development of better hybrid seeds.

Penetration of Hybrid Seeds and SCH Seeds



Source : Research Reports

Need for evolving breeding programs (molecular breeding, etc.)

Breeding is an integral part of research & development. Evolving breeding programs can not only provide better products but also at a faster pace. Various technological advancements (marker assisted technology, molecular breeding, etc) have been made globally in discovering native traits through efficient breeding programs. Practices such as disciplined maintenance of historical breeding records and germplasm tags could significantly reduce the time to market for new product lines. Given its agro-climactic diversity, this becomes even more relevant in a country like India.

Future outlook on genetically modified maize (2015-25)

Globally, ~32% of maize hectares cultivate genetically modified crop – primarily in USA, Argentina, Canada, South Africa, Uruguay, Egypt and South America. While, Philippines has witnessed ~80-90% adoption of GM Maize in 3-4 years, Vietnam has granted license to four GM Maize varieties in Sept '14. Yield improvements have ranged from 10% to 30% across countries. In India, a host of products are in the pipeline (ranging from BRL 1 trials stage to final approval stage). Key discussion points are the role of GM in developing effective & sustainable solutions (for insect control, abiotic stresses (esp. drought) and early stage weed losses) and its social & environmental impact.

Awareness creation among producers on new seed technologies and benefits

With the introduction of new technology and product lines, awareness creation becomes an imperative. Although, "word of mouth" publicity governs adoption rate for a good product/ technology, yet the necessity for demonstrations plots, farmer field days and promotional activities cannot be undermined. Moreover, it assists in faster conversion of relatively more cautious and non-progressive farmers, thereby steepening the adoption curve steeper.

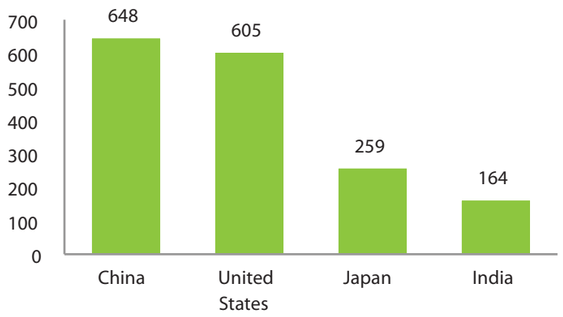
ROLE OF FARM INPUTS IN YIELD ENHANCEMENT

Need for improved inputs usage & management, better farm level infrastructure and knowledge transfer to the farmer for higher productivity

Currently, India's fertilizer usage is one of the lowest among the large agriculture countries. As of 2012, fertilizer consumption in India was ~164 kgs/ ha/ annum fertilizer vs. 647 Kgs/ Ha/ year of China and 605 Kgs/ Ha/ year of USA. Moreover, usage in maize (~60 Kgs/Hectare) is lower than national average (164 Kgs/Hectare) . Use of specialized fertilizer is very limited. Also, with soil testing, relevant fertilizer usage can potentially be increased thereby improving soil conditions. Key discussion areas include possible ways to improve fertilizer consumption (quantity and quality), improving availability of quality fertilizers and key challenges.

Weed losses in maize due to inability to use glyphosate, remain high. Moreover, the cost of weeding with the prevalent manual weeding process (4-5 man-days per de-weeding process) remains very high. Also, losses due to pest infestations are high due inefficient usage of pesticides.

Fertilizer Usage in 2012 (Kgs/Hectare)



Source : World Bank

Although maize requires less water as compared to paddy and sugarcane, but still the requisite irrigation infrastructure is grossly sub-optimal. Only ~30-35% of Indian maize acreage is irrigated with an improvement of 12-15% in the past decade. With drought cycles become shorter and increasing rainfall variations, development of irrigation infrastructure is an imperative to assure consistent improvement in productivity.

With the improvement in technology and infrastructure, there is a strong need for knowledge transfer to the farmer. Educating the farmer regarding the relevant chemical usage, integrated pest management, soil maintenance and other production techniques, is very essential to achieve the productivity improvement goal. Apart from production technology, knowledge transfer about information systems (such as commodity exchanges, futures contracts, etc.) is required to assist farmers attain optimal realizations on their harvest and expand the market place.

Therefore, the key discussion areas are ways to encourage better inputs availability & usage and delivering better farm level infrastructure.

POST HARVEST MANAGEMENT: INFRASTRUCTURE & LOGISTICS

KEY INFRASTRUCTURE CHALLENGES AND EMERGING SOLUTIONS

With the introduction of new technology and product lines, awareness creation becomes an imperative. Although, "word of mouth" publicity governs adoption rate for a good product/ technology, yet the necessity for demonstrations plots, farmer field days and promotional activities cannot be undermined. Moreover, it assists in faster conversion of relatively more cautious and non-progressive farmers, thereby steepening the adoption curve steeper.

Post-harvest

After the harvesting process, maize requires drying for 10-15 days to reduce the moisture levels to 13%-14%. The higher the moisture level the lower the price of the produce. In India, currently a large part of maize production is sun dried, where the drying is not uniform. Also, farmers in certain states also sell spring maize (March-June) with high moisture just after harvesting so as to use the field for the Kharif crop.

As a result, due to improper drying practice, the grain quality reduces. Currently certain steps are being taken to improve drying practices. E.g. Punjab government has installed large scale dryers at 2 locations and plans to expand it to 5-6 more locations to improve the quality of produce. Enhancing post-harvest practices could potentially lead to higher acceptability in the global market.

Storage

As per Food & Agriculture Organization (FAO), ~6% of the produce is lost due to improper storage.

In India, large part of the maize produce is currently being procured by the Food Corporation of India (FCI) where the storage conditions are sub-optimal. In 2012-13, average grain storage requirement was estimated to be 117.8 million MT. Although the Government warehouses had a capacity of ~101 MT, they were able to store an average of ~71 million MT.

Of this, the covered and plinth (CAP) storage was ~5.9 million MT. Therefore implying that there was a quality storage deficit of ~42.6 million MT (including private storage). This could have been due to unavailability of quality storage infrastructure, regional capacity mismatch and improper fumigation during storage.

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Moreover, most storage infrastructure at farm level is not rodent and fungal attack proof resulting in minor losses. Consequently, there lies significant improvement potential in storage infrastructure. However, with advent of organized private players (currently serving ~5% of storage demand) quality of infrastructure is gradually improving in certain pockets. Moreover, emerging services such as warehouse management (done by warehousing firms like Origo Commodities) are assisting in proper management of stored grains in FCI warehouses.

Moreover, value added services such as procurement and trade financing would assist small traders and perhaps farmers to improve the marketability of the goods.

Logistics (Transport)

Bulk of grain in India is transported in open trucks. As a result, lack of protection from weather conditions, result in natural losses. Moreover, through the transportation pilferage is another concern which results in losses for the buyer.

Given the infrastructural issues along the value chain, the key issues to discuss would be:

- Methods to enhance infrastructure and reduce losses at each juncture – post-harvest, storage and transport
- Engagement models between private and public stakeholders to assist improvement
- Scalability of emerging solutions
- Need for improved logistics in being export ready and impact on quality

INTERNATIONAL PERSPECTIVE AND BEST PRACTICE

In the developed maize producing nations, use of advanced infrastructure is prevalent across the value chain. Drying is primarily done in large scale dryers, leading to uniform moisture loss. Moreover, the moisture content is monitored to avoid cracking in the kernel and hence maintaining the grain quality. Also, due to high average land holding, large scale dryers become financially viable for the farmer. Moreover, the harvesting process is also completely mechanized, which reduces losses due to post harvest farm activities (threshing, separating, etc.). Storage is largely done in the large silos/bins which are monitored & treated regularly to prevent losses from pest attacks. The transportation is primarily through closed locked and tracked vehicles. This reduces both the natural losses and pilferage.

The key discussion areas are:

- Adoption of best practices and requisite enablers (regulatory, commercial, R&D, etc.)
- Stakeholder roles & participation – both private and public
- Implementation roadmap for improvement across each segment of the value chain
- Key challenges

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FICCI

Established in 1927, FICCI is the largest and oldest apex business organization in India. Its history is closely interwoven with India's struggle for independence and its subsequent emergence as one of the most rapidly growing economies globally. FICCI plays a leading role in policy debates that are at the forefront of social, economic and political change. Through its 400 professionals, FICCI is active in 53 sectors of the economy. FICCI's stand on policy issues is sought out by think tanks, governments and academia. Its publications are widely read for their in-depth research and policy prescriptions. FICCI has joint business councils with 75 countries around the world.

A non-government, not-for-profit organization, FICCI is the voice of India's business and industry. FICCI has direct membership from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of around 2,50,000 companies from regional chambers of commerce.

FICCI works closely with the government on policy issues, enhancing efficiency, competitiveness and expanding business opportunities for industry through a range of specialized services and global linkages. It also provides a platform for sector specific consensus building and networking. Partnerships with countries across the world carry forward our initiatives in inclusive development, which encompass health, education, livelihood, governance, skill development, etc. FICCI serves as the first port of call for Indian industry and the international business community.

NCDEX

National Commodity & Derivatives Exchange Limited (NCDEX) is a professionally managed on-line multi commodity exchange. The shareholders of NCDEX comprises of large national level institutions, large public sector bank and companies. NCDEX is the only commodity exchange in the country promoted by national level institutions. This unique parentage enables it to offer a bouquet of benefits and services.

Established on April 23, 2003 NCDEX commenced operations on December 15, 2003. The Exchange facilitates trading in an array of over 47 commodities both agricultural and non-agricultural. With around 830 members and a client base of over 500,000, trading is conducted over 20,000 terminals across nearly 700 centres across India. It also facilitates delivery of commodities through a network of over 775 accredited warehouses with a holding capacity of around 1.3 million tonnes.

NCDEX is committed to provide a world-class commodity exchange platform for market participants to trade in a wide spectrum of commodity derivatives driven by best global practices, professionalism and transparency. Regulated by Forward Markets Commission, NCDEX is subjected to various laws of the land like the Forward Contracts (Regulation) Act, Companies Act, Stamp Act, Contract Act and various other legislations.

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