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MAPPING MAIZE VALUE CHAIN - AN ANALYSIS OF BEGUSARAI AND KHAGARIA DISTRICTS OF BIHAR

Udhav Prasad Singh[1], Harshika Choudhary[1], P.S. Badal[2], O.P.Singh[2] and Rakesh Singh[2]
[1]Research Scholars and [2]Professor, Department of Agricultural Economics, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi.-221005, E-mail:chaudharyharshika@gmail.com, Corresponding author: Harshika Choudhary

Abstract: *Maize is the most versatile crop and is grown in more than 166 countries across the globe, including tropical, subtropical and temperate regions, from sea level to 3000 m above sea level. Maize is an excellent crop in terms of biomass production and in terms of quality, it is considered to be better than many other non-leguminous cultivated fodders. Unlike sorghum, which contains components such as HCN and oxalate, causing adverse effect on animal health, maize offers a good quality fodder along with good quantity of biomass. In the peri-urban region, particularly around highly populated cities, baby corn has emerged as a good source of income for the farmers within 2 months after its sowing, along with a good quality of green fodder during otherwise lean season. The present study has been conducted in the districts of Begusarai and Khagaria which are medium maize growing regions in Bihar faces regular flood, drought and disease and insect pest infestation. Farmers in the selected study area used to grow high yielding as well as local varieties of maize. Maize value chain mapping has been done considering all the collaborators in the process.*

Keywords: *Input use, maize value chain, market-linkage.*

Introduction: Maize is an excellent crop in terms of biomass production. Since ages, maize straw is being used as animal fodder and in terms of quality, it is considered to be better than many other non legume cultivated fodders. Unlike sorghum, which contains components such as HCN and oxalate, causing adverse effect on animal health, maize offers a good quality fodder along with good quantity of biomass. In the peri-urban region, particularly around highly populated cities, baby corn has emerged as a good source of income for the farmers within 2 months after its sowing, along with a good quality of green fodder during otherwise lean season [1]. The past few years have seen dramatic changes in the production and productivity of maize in India. The adoption of single cross hybrids has revolutionized the maize production. Consequently, its production has registered an annual growth rate of 6.4 per cent (2007-2010), the highest among food crops and surpassing the 4 per cent growth rate for agriculture in general and 4.7 per cent for maize in particular as the target set by the Planning Commission, Government of India. 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. Since the demand for maize is increasing consistently, it has become important to understand the existing maize situation in the country and plan the future based on the past and present situations.

According to the maize production data for the year 2011-12, the states with more than 1 per cent of maize area in the country can be categorized as:-

High Maize Productivity States: Andhra Pradesh (highest yield of 4.55 t/ha) and Tamil Nadu (Maize grain yield: >4 t/ha) constituting about 13.0 per cent of total maize area in the country.

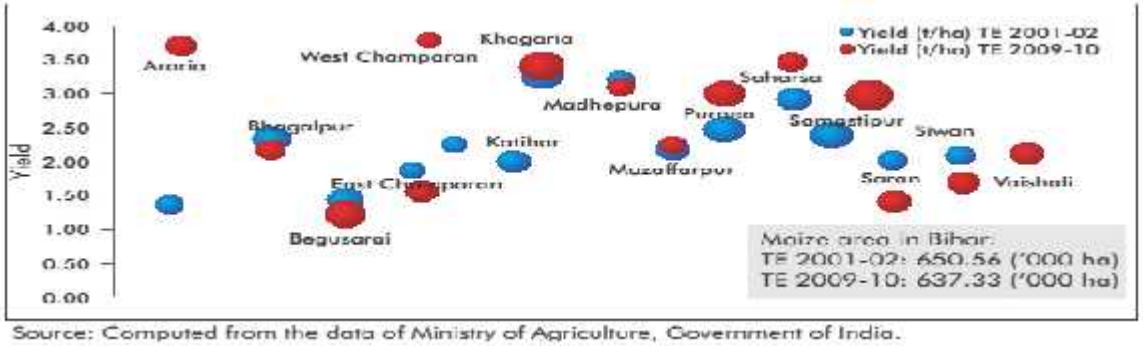
Medium Maize Productivity States: Bihar, Himachal Pradesh, Karnataka, Maharashtra, Odisha, (Maize grain yield: 2-4 t/ha) Punjab and

West Bengal constituting about 40.2 per cent of total maize area in the country.

Low Maize Productivity States: Chhattisgarh, Gujarat, Jammu & Kashmir, Jharkhand, Madhya Pradesh (Maize grain yield : <2 t/ha) Pradesh, Rajasthan and Uttar Pradesh representing 43.8 per cent of total maize area in the country.

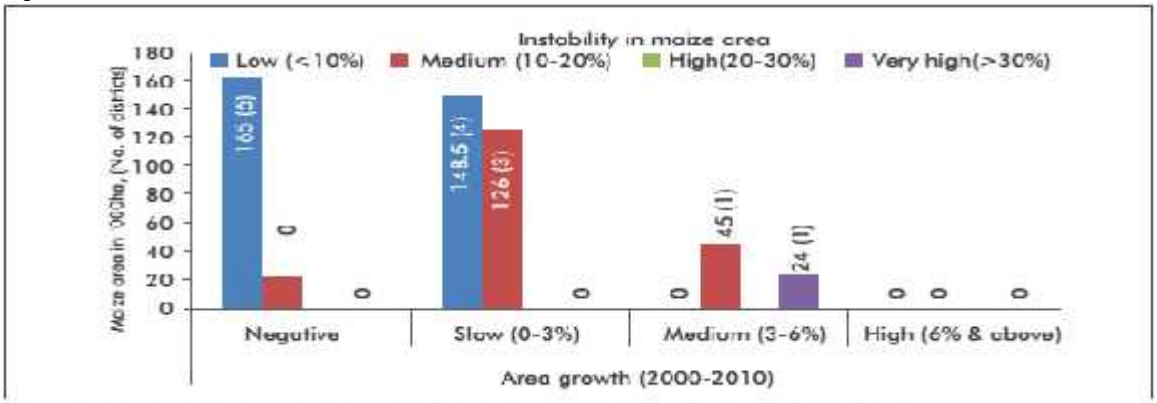
Moreover, there has been wide variability in maize area and productivity within the states. On one hand significant maize area within northern states has negative growth with low instability, on the other hand major chunk of maize area in southern states have very high growth but medium to high instability. Bihar is one of the traditional maize-growing states in India; however, over the years the importance of crop has shifted from rainy (Kharif) season to winter (Rabi) season or summer season [2]. In fact, it is the only state where area under Rabi maize (>400 thousand ha) is larger than that under Kharif maize (>230 thousand ha). It also boasts of having the largest maize area under Rabi season among all the maize-growing states. Maize is grown in the state for food as well as feed purposes. In the year 2011-12, maize was grown on 675 thousand ha (9.6% of total cropped area) producing 2.48 mt of grain. There is a significant yield difference between the two seasons- in Kharif, the average grain yield estimated was 2.4 t/ha, while during Rabi/summer, farmers were able to harvest 4.5 t/ha; thereby more than 77 per cent of maize grain was produced in Rabi/summer season. The shift to Rabi maize by farmers of the state shows obvious comparative advantage over Kharif maize due to low infestation of insect, pest and diseases as well as slow growth of weeds [3]. The crop is spread in almost all the districts, though 15 districts together contributed about 80 per cent of the total maize production in the state, which mainly fall in the agro-climatic zones I and II. These districts are flood-prone areas during rainy season historically and fall north of the Ganges, having several seasonal river tributaries. Begusarai, Khagaria, Samastipur, Katihar and Madhepura are the leading maize-growing districts with more than 45 thousand ha area in each district and producing more than 100 thousand tonnes of maize grain every year. In some of the districts, marginal increase in the maize area was observed in the recent past. This may be due to the institutional changes brought in the recent years in terms of favourable procurement environment for rice and wheat by the government agencies at Minimum Support Price (MSP), and support given to the farmers for growing hybrid paddy under the National Food Security Mission. In some districts like Katihar and Khagaria, area under this crop has significantly increased while in Muzaffarpur district it declined during the previous decade. Among the major maize-growing districts, 6 districts (Bhagalpur, Begusarai, East Champaran, Madhepura, Saran and Siwan) showed a declining trend in the yield, whereas 8 districts (Araria, West Champaran, Katihar, Khagaria, Purnia, Saharsa, Samastipur and Vaishali) depicted an increasing trend. There was not much change in the maize yield in most of the districts, except that in Araria and West Champaran in the state (Figure 1). The growth and instability analysis of maize area and yield was carried out for the major districts in Bihar. Around 11 per cent of maize area spread in two districts had grown by more than 3 per cent annually with medium to very high instability. On the other hand, about one-third of the maize area spread in 6 districts had a negative growth with low to medium instability. About 70 per cent of the area and 75 per cent of the districts had negative and slow growth in the yield with medium to very high instability. There were only five districts among the major maize-growing districts in Bihar showing a productivity of more than 2 t/ha.

Figure 1: Changes in area and yield of maize in major districts of Bihar



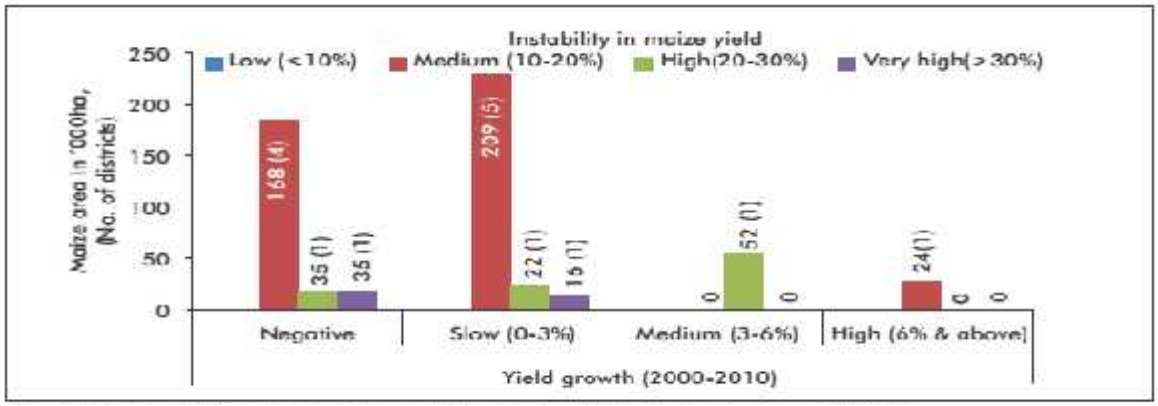
Source: Computed from the data of Ministry of Agriculture, Government of India.

Figure 2: Distribution of maize-growing districts according to growth and instability of maize area in Bihar during the period 2000-2010



Source: Computed from the data of Ministry of Agriculture, Government of India.

Figure 3: Distribution of maize-growing districts according to growth and instability of maize yield in Bihar during the period 2000-2010



Source: Computed from the data of Ministry of Agriculture, Government of India.

Materials and Methods

A comprehensive survey was carried out using well structured schedule to collect the required information for the study. The data pertaining to general information about the family structure, occupational structure, education, holding size, land use pattern, cropping pattern, consumption pattern etc. have been collected. The details about the inputs used along with cultural practices in the cultivation of various crops with their output and prices of inputs and outputs also were collected for estimation of costs and returns in crop production in the study area.

Data Sources: The study was based on primary as well as secondary data. Primary data has been collected from farmers in order to assess the mapping of Maize Value Chain, few market functionaries were also interviewed. Secondary data has been collected from different sources like publication of Agricultural Ministry, Govt. of Bihar, FAOSTAT, District Statistical Office, Directorate, Statistics and Evaluation, Govt. of Bihar (Patna), and Directorate of Economics and Statistics, Govt. of India. An appropriate sampling is essential for obtaining required information. Since the study was to be carried out in Bihar, the districts Begusarai and Khagaria were selected purposively as these districts have maximum cropped area in the maize production. Districts Begusarai and Khagaria comprise of 18 and 7 community blocks respectively. Two blocks from Begusarai district and two blocks from Khagaria district were selected randomly. These were Sahebpur Kamal and Khudawanpur from Begusarai and Beldaur and Choutham from Khagaria district. The list of all the villages in the selected blocks was obtained from the respective block head quarters. A sample of two villages form each block was taken randomly making a total of 8 villages in the study.

Results and Discussion

Cropping System and Net Return of Different Cropping Systems under the Study: Table 1 shows the different cropping systems taken by the farmers in the study area. In most of the cases nearly 40 farmers used to grow maize throughout the year. Maize-Pigeon pea-maize cropping system is grown by 37 farmers, Maize-Gram–Maize is grown by 29 farmers, Castor-Pigeon

Pea-maize is followed by 25 farmers, Maize-castor-maize is followed by 20 farmers and paddy-Maize-Maize is followed by 9 farmers. Maize equivalent yield of the different cropping system has been worked out to find out the yield of the maize cultivation of the different cropping system. Efficiency of Paddy-wheat maize cropping system has the highest land use efficiency among all the other cropping patterns. Net return of different cropping system has been calculated and tabled in 1. Cost benefit ratio of the cropping system maize-pegion pea-maize is highest among all the other cropping systems i.e 1.75.

Table 1. Effect of cropping System on Crop Yield, land use efficiency and Net Return

	Cropping System	MEY			LUE	Net Return			B:C Ratio
		Kharif (q/ha)	Rabi (q/ha)	Summer (q/ha)		Kharif (q/ha)	Rabi (q/ha)	Summer (q/ha)	
1.	Maize-Maize-Maize (40)	32	35	31	81	12400	28000	26000	1.71
2.	Maize-P.Pea-Maize (37)	33	28	35	78	13500	29650	22500	1.75
3.	Maize-Gram-Maize (29)	29	36	32	80	12800	28750	24657	1.69
4.	Castor-P.Pea-Maize (25)	18	27	31	75	9450	32950	23045	1.65
5.	Maize-castor-sunflower (20)	30	19	35	79	10500	19750	21985	1.70
6.	Paddy-wheat-Maize (9)	33	30	32	82	8985	17650	23450	1.64

Note: MEY=Maize equivalent yield, LUE= Land use Efficiency

The first step in mapping the market is to delineate the value chain. The flow of seed to farmers and grain or tubers to the market occurs along chains. These can be referred to as value chains because as the product moves from chain actor to chain actor e.g. from producer to intermediary to consumer it gains value. A value chain can be defined as *the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final customers, and final disposal after use.*. The chain actors who actually transact a particular product as it moves through the value chain include input (e.g. seed suppliers), farmers, traders, processors, transporters, wholesalers, retailers and final consumers.

In table 2, the most common hybrids and open pollinated varieties have been listed below which are mostly used by the farmers in the study area.

Table 2. Most common hybrids and OPVs of maize cultivated in the study area

S.No.	Hybrid	Open Pollinated Varieties
1.	Super-900M	Devki
2.	Pinacle-708	Lakshmi
3.	Super-900M Gold	Sawan
4.	NHM-909 (Raja)	Hemant
5.	NHM-234 (Kamdhenu)	
6.	SeedTech-2324	
7.	Shaktiman-1 to 4 (QPM	
8.	RHM-1	
9.	RHM-2	
10.	RHM-3	

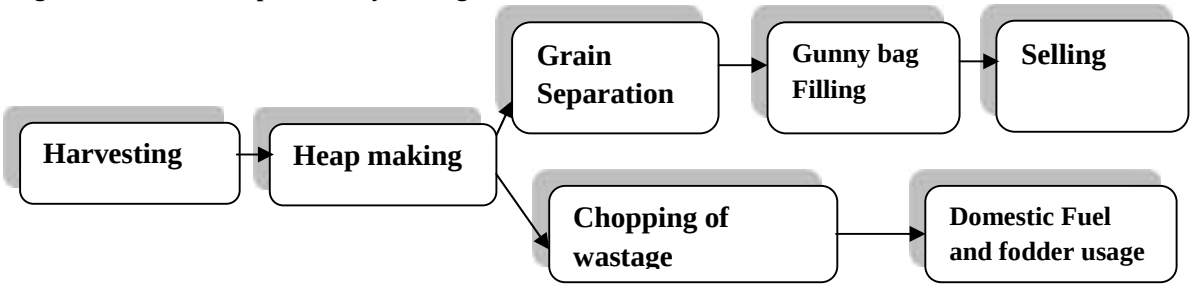
Mostly affluent farmers who have non-farm occupation were involved in the use of HYV. Due to the water logging situation in the study area farmers prefer to grow maize as the primary activity in the agricultural crop production.

Market Arrival Dynamics of Maize: The sowing and harvesting pattern of maize is unique as it progresses in waves across the country. The crop duration also ranges from 90 to 150 days. The first sowing starts in districts Begusarai and Khagaria towards the beginning of June in the irrigated areas. With the onset of monsoon in June, sowing starts in adjacent rain-fed areas. In other parts of the state, sowing starts towards the middle of July and completes by August. Accordingly, the arrivals of maize-grain in the markets show a seasonal variation. The early-sown crop in the region comes to harvest by late September, and arrivals pick up in October. During this period, North-East monsoon starts, which many times intervene in the grain storage, marketing and transportation. In Begusarai, the arrivals start from mid-September and gather momentum by November-end while in the district Khagaria arrival starts in November. The quantity of market arrivals is more in the months of October and November from the region; while in December and January from Khudabanpur and Chhorahi markets, which later decreases. The lowest arrivals were seen in the month of July in both the markets. Thus, the arrivals in the region

are in full from October to January-February. The peak arrivals of the Kharif-crop are in the months of November, December and January, from other regions of the state which are adjoining districts of Begusarai and Khagaria. In the meantime, the sowing of Rabi-maize starts in the state, after harvest of paddy in mid-October and extends till mid-December. The arrivals from the state start by March-end or early April and continue till May-end. Bihar-arrivals start towards the end of April and continue till end of June, depending on the duration of winter. The short-duration (mostly 90-100 days) spring crop sowing in Bihar and adjoining states takes place in mid-February to March and arrivals start in June, but do not last more than a month. Rabi arrivals peak during the months of April, May and June, mostly from other parts of Bihar. It has been observed that poultry farms and feed millers hold stocks for a period ranging from 15 days to 60 days, depending on their mill capacities, financial strength, and receivables cycle. Usually, they purchase and stock maize during the peak arrival season at low prices. This stock is maintained to tide over the peak price months, and buying for regular requirement continues in parallel. Starch manufacturers store it for longer durations, sometimes as long as three months. To some extent, the role of traditional stockists has been taken over by the trading companies, which normally enter into forward trade agreement with the consumers (say, a poultry farm), purchase and store grains during the peak arrival season [5].

Maize Output Value-chains: It was observed that maize crop was gradually becoming a commercial crop in most of the states and the countries around the world as the marketed surplus ratio (ratio of selling quantity to total produce) of maize grain has increased over the years in almost all the states. The farmers in the area were growing maize largely for selling purpose. The marketed surplus for the farmers in Bihar has also gradually increased from about 40-50 per cent in the early 1990s to 70-90 per cent and farmers continue to retain 30 per cent of maize produced for domestic utilisation. The maize output value-chain starts from farmers' fields after harvest of the crop. In the largest maize belt of Begusarai and Khagaria, farmers were found to store maize harvested in October-November till May, in anticipation of higher prices. And this storage is not in any warehouse, but in the usual 'heap of cobs covered with crop residue' fashion. Just one or two days before sale, the cobs are threshed using mechanical threshers to separate the grain. The grain is allowed to dry in open for a day, brought in tractor trolly or packed in 50-kg gunny bags and offered for sale in grain mandi or sometime directly collected from the farmers' fields.

Figure 4. Post-harvest operations by maize growers



Key Participants in Maize Value Chain Begusarai and Khagaria Districts: A value chain may be defined as an integrated process wherein a number of various business entities (i.e., suppliers, manufacturers, distributors, and retailers) work together in an effort to: (i) acquire raw materials, (ii) convert these raw materials into specified final products, and (3) deliver these final products to the end users, after adding some values to it. It is necessary here to understand that even after APMC (Agricultural Produce Marketing Committee) reforms have been introduced in most of the states, maize grain has to be brought to the APMC regulated market, from where the forward movement of grain starts. As on 30 June 2011, there were 7,246 regulated markets and 21,238 Rural Periodic Markets in India spread across 26 states [4]. In Bihar, APMC (Regulation) Act has been repealed from 1st September 2006 and therefore complete trading is done outside the ambit of APMC rules.

The key players in the value chain are Farmers, contract farmers, village aggregators/ traders, commission agents/ brokers, feed industry. The typical maize supply chain in the majority of maize-growing regions is:

Farmers → Local trader (Aggregator) → Trader → Processor (Feed industry/ Starch industry) → Consumer (Poultry industry/Food or textile industry.

Figure 5: Supply Chain for Maize in the Study Area

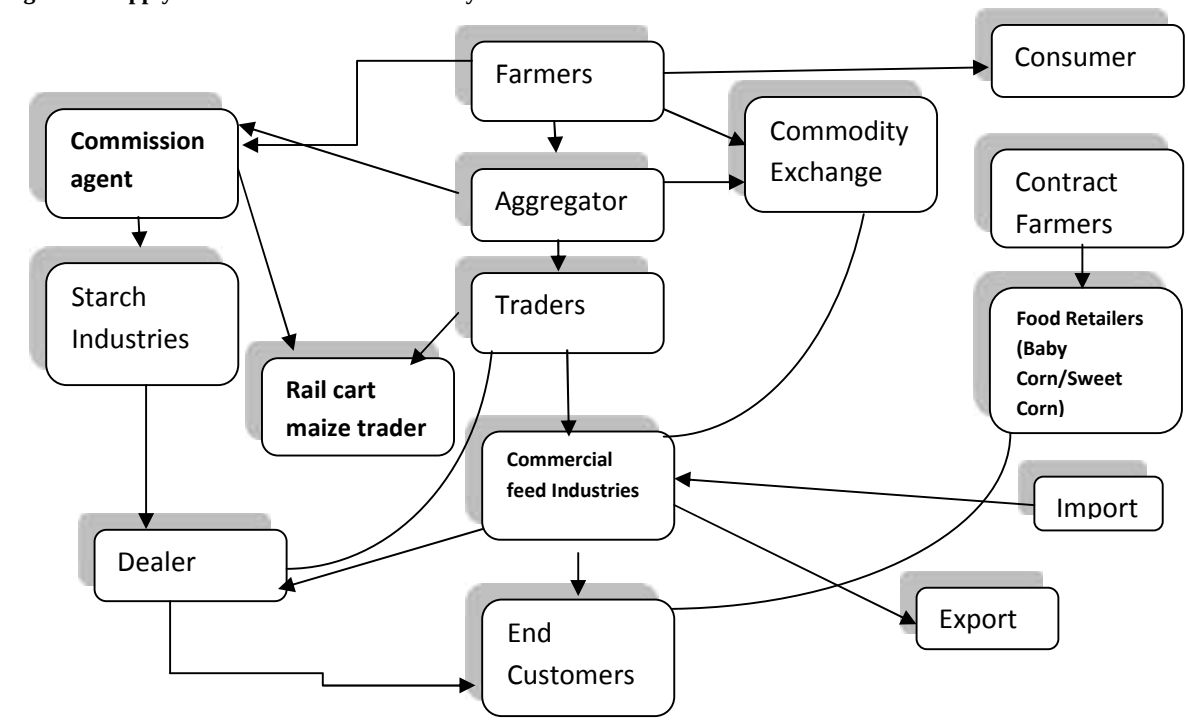
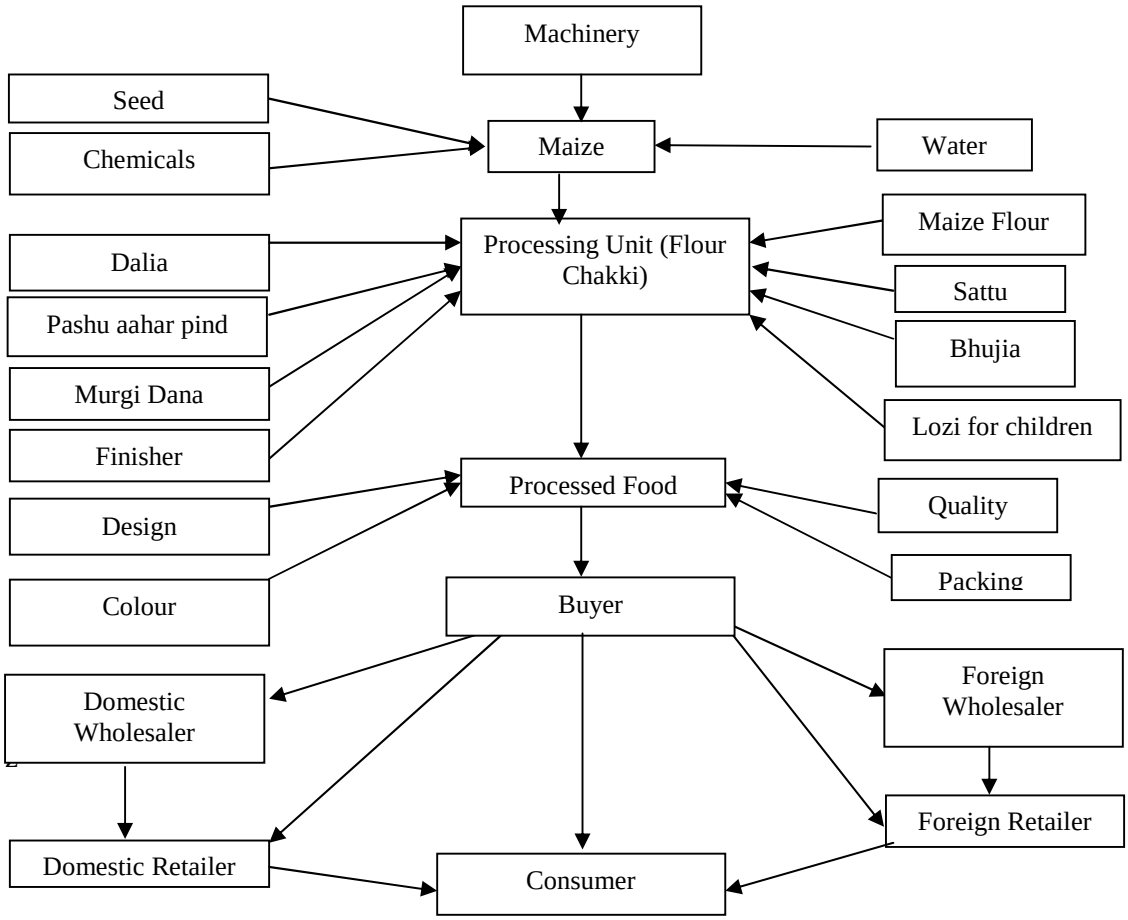


Figure 6. Maize Value Chain under Water Scarcity and Increased Temperature



Conclusion

Smallholder inclusion presents of number of challenges such as how small-scale farmers can be linked to markets and be integrated into the farm-to-consumer value chains in a way that makes it possible to benefit more from the economies of scale and to capture more value for their products. Moreover, the process of productivity growth through farm (and off-farm) investments and adoption of modern farming techniques have to be facilitated.

A. Small Holder Agriculture Viability: Food and Agribusiness (F&A) companies in the value chains will have to source more from smallholders in the decades to come. This implies a transition process in which small-scale producers are stimulated to become economically self-sustaining and small-scale farming is turned into a scalable and competitive business, producing food for local and international food markets in an environmentally sustainable way. A value chain approach to smallholder inclusion is crucial for breaking the barrier of low-farm-income trap.

B. Collaboration across Different Collaborators: Small farms often lack access to affordable financial services, knowledge and education, market information, land, water and fertilizers. They must therefore unite in strong producer organizations or-even better-in cooperatives. By working together, they are able to overcome the drawbacks of their small size and fragmented production structure. There are various ways to increase food production, such as improving yield per hectare, cropping intensification, increasing arable land, reducing post-harvest losses, storage and transport losses, improving irrigation technology and reversing land degradation. However, achieving these gains in practice will require an exceptional level of collaboration among stakeholders in the agricultural value chain, including governments, companies, multilateral institutions and civil society organizations.

C. Rural Advisory Services–Trigger Change: However, it is not just physical resources that co-operatives can pool. The most powerful resource that farmers are able to share–once organized into co-operatives–is knowledge. Rural public and private advisory services work directly with co-operatives and farmer organizations around the world, to provide them with the information and services they need to produce more food for their families, and build booming local businesses. This support can range from linking farmers to the latest innovations in scientific research, to improving the efficiency of water use, to providing training on how to successfully market their produce. But this crucial stream of information does not flow in just one direction. Farmers themselves also have important knowledge and innovations that are specific to their particular circumstances. Systems like this need to be scaled-up, to offer smallholder farmers the chance to work themselves out of hunger and poverty. We need a standardized way to share information that takes into account the diversity of rural life, and offers best-fit approaches for plural situations, rather than scaling-up a "one-size-fits-all" approach.

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