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A Study on Maize Production in Samastipur (Bihar): An Empirical Analysis

Amalendu Kumar¹ and K.M. Singh²

Abstract

Maize is an important cereal crop in the world. It has several important uses for industrial purposes, human food and animal feed. It is grown under variety of agro-ecological conditions and possesses highest yield potential above 80 quintal per hectare among the food grain crop. The demand of maize is growing globally due to multiple uses and need to increase production continuously. This crop has tremendous potential for increase in productivity, profitability and sustainability in agriculture. But the drawback is that it is cultivated mostly under stress condition. In this backdrop the present study has plan to access the maize production and utilization system in Samastipur district of Bihar with objectives of maize production system prevails in the area, opportunities for utilization of maize and constraints thereon is the main focus of the paper. The study is based on primary data collected through 120 different categories of house hold from six villages falls under two blocks in Samastipur district. The main findings emerged from the analysis that in study area farmers were growing maize extensively in *rabi* season only. In kharif season flood and water logging condition is the main problem from August to January almost every year. Due to high risk involve in kharif and summer season farmers were found growing maize generally local variety with less input use. The farmers were reported that adoption of hybrid maize during risk situation avoids and uses open pollinated varieties (OPVs). Due to lacks of good quality maize seed varieties particularly for stress situation of flood, and droughts, bad marketing facilities, storage facilities etc. are the factors which limits the increase in productivity and production of maize in the areas. The hybrid variety of maize during the rabi season was extensively grown for commercial purpose not for consumption of human is the main drawback of utilization. The study also finds that due to high risk involve in kharif and summer season farmer were kept their cultivated land fallow. The paper suggests that more research and development is required for increase production and productivity particularly in abiotic stress conditions in the study area with development of suitable hybrid varieties of maize for human consumptions. This is important for food and nutritional security to the economically poor families in the study area.

Key work: Abiotic stress, agro-ecological, hybrid maize, open pollinated varieties (OPV).

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A Study on Maize Production in Samastipur (Bihar): An Empirical Analysis

Maize (*Zea mays*) is the most widely distributed crop of the world. It is cultivated in-tropic, sub-tropic and temperate regions with an annual production of 960 million metric ton (2013-14). In India, it is grown throughout the year (Kharif, rabi and summer) and is third most important cereal crop after rice and wheat. It ranks sixth in global production with 2.4 per cent of world production. The maize production has grown significantly over the past decade and increase from 14 million metric ton to 23 million metric ton. During the same period other cereal crops registered a negative growth in production. In India, traditional maize – growing states U.P, M.P, Jharkhand, Chhattisgarh and Bihar accounting about half of the total production share at national level (Joshi et. al. 2005). It is the fact that maize is less water demanding, supporting crop diversification and income generating for farmers. Farmers reported that drought and water logging are the most important abiotic stress in India (Joshi et. al. 2005). The water requirement of maize is at least sixty per cent less than that of rice in irrigated system (Tuong and Bouman, 2003). In the Eastern Indian states of Bihar, Jharkhand, Chhattisgarh and Orissa due to droughts in the year 2000 and 2002 total rice production declined by 60-90 per cent, resulting in significant increases in poverty (Pandey et. al. 2007). In this situation maize is the crop which maintain the decline of total cereal production and income stabilization also.

Maize crop at the global level utilized as staple food (17.0 per cent), as feed (61.0 per cent) and Industrial purposes (22.0 per cent). However, in India it is highly utilized for poultry feed (51.0 per cent) followed by food (23.0 per cent) for starch and cattle feed (12.0 per cent each). The production of maize for poultry feed providing opportunity of employment and income generation in one hand and poverty reduction in other hand.

In the state of Bihar maize is cultivated at about 7.12 lakh hectare with production of 28.20 lakh tonnes (DES, GOB 2014-15). The productivity in the state is much higher (3975kg/ha) than that of national average (2500kg/ha) (Kumar et. al. 2005). The state is divided into three sub-agro-climatic zones, but the main maize productizing zones are zone- I and zone II which constitutes about 86 per cent area. These zones are facing constraints of floods, drought and water logging during the kharif season frequently and their extent is varied.

In the district it is cultivated under 45 thousand hectares in three seasons *i.e.*, summer (12.0 percent), kharif (16.0 percent) and *rabi* (72.0 percent) in total maize cultivated area.

The production and productivity of maize in the district is around 1.64 lakh quintal with an average productivity of 36.50 quintal per hectare. In the total production of maize (1.64 lakh quintal) *rabi* maize constitutes higher percentage about 72.0 followed by kharif 15.0 percent and summer 13.0 percent (DES, GOB).

In the study area of Dalsingh Sarai and Vidyapati Nagar about 3200ha of gross cropped area occupied by maize crop in each block. The area under *rabi* season was higher (51 per cent) than that of kharif (41 per cent) and summer (8 per cent). In case of production *rabi* maize constitute (72 per cent) share followed by kharif (16 per cent) and summer (12 per cent).

In the sampled blocks the main source of irrigation was private tube wells and diesel pump set but hand pump and wells are also used for irrigation purpose. The common variety namely pioneer, buyer, paragon, 900m, krishi dhan, bio seed and local variety. The study areas are characterized by flood prone area and a large proportion of agricultural land were waterlogged more than six month in a year from August to January. In this seasons due to risk limits of input use which causes low productivity. In the areas maize production and marketing links are weak. Since the late 1990's maize particularly in *rabi* season become a main part of cropping pattern in the areas however it was cultivated during the kharif season only. This was mainly due to growing population and demand for poultry feed etc.

Against the growing importance of abiotic stress in maize production and backdrop, the present paper plan to analyse the maize production and utilization system in the Samastipur district of Bihar. The major objectives of the paper are three fold i.e., (1) Existing maize production system in the study area (2) Identify the opportunity for maize utilization and (3) Focus on constraints related to production and utilization.

Methodology:

The study is based on mainly primary data. The data was collected from Samastipur district of Bihar through well structured and pre tested questionnaire. The detail of ultimate sample selection procedure is presented here under: The district selection was purposive to capture flood and water logging scenario of maize production system and utilization pattern. The Samastipur (Bihar) comes under the impact of both conditions but during the study period, the water logging stress was not severe. The main characteristics of the district, it lies between 25⁰55'N and 85⁰5'E and covers an area of about 3000sq. km. Agriculture is the main source of income to the population. About 83 percent population depends on farming. The district comes under the fertile indo-genetic plains, with relatively high farming intensity. Maize, rice, wheat are the three major cereal crops in the district. The district receives an

average annual rainfall of 1205mm (Source GOB) and about 84 percent of net area sown under irrigation facilities (Mostly ground water). Some parts of the district is submerged with flood and water logging from July to November almost every year and drought occurs during kharif.

The study follows a stratified random sampling approach. Two blocks on the basis of widely maize grown selected for the study. Thereafter 3 villages were selected per block and 20 farmers from each village. The survey was conducted in the year 2010-11 by using structured questionnaire and was conducted by trained enumerators. For analytical purpose, sample farmers were classified into small, medium and large categories based on the size of cultivated farm land. Details of the sampling process are presented in table 1, table 2 and table 3.

Table 1: Details of Selected Villages

| State -Bihar | Selected Blocks | Selected villages |
|----------------------|-----------------|--|
| District- Samastipur | Patori | 1. Araiya 2. Bhauaa 3. Dumduma |
| | Vidhyapatinar | 1. Bangaraha 2. Hetimpur 3. Subhanipur |

The random sampling technique was used to select farmers within the village.

Table 2: Farmer categorization based on land cultivated.

| Category of farm | No. of farmers selected |
|------------------|-------------------------|
| Small farmers | 40 |
| Medium farmers | 42 |
| Large farmers | 38 |
| Total | 120 |

| Land cultivated in acres | | |
|--------------------------|-----------------------------|------------|
| Category of farm | Average per house-hold (HH) | Min.-Max. |
| Small farmers | 0.37 | 0.04-0.71 |
| Medium farmers | 1.67 | 0.89-2.68 |
| Large farmers | 5.74 | 3.00-22.32 |

Table 3: Share of maize acreage across farms categories average area under maize.

(acre)

| Season | Small | Medium | Large |
|------------------|-------------|-------------|--------------|
| Kharif | 0.20 (39.0) | 0.49 (22.0) | 1.33 (21.0) |
| Rabi (Monocrop) | 0.24 (13.0) | 0.63 (13.0) | 1.90 (11.0) |
| Rabi (Intercrop) | 0.23 (2.2) | 0.91 (8.10) | 1.85 (15.90) |
| Summer | 0.13 (0.1) | 1.12 (3.70) | 0.66 (2.4) |

Parenthesis indicates percent of cultivable land for maize.

Result and Discussions:

Maize production systems in the study area: an overview

In the study area maize is being cultivated in diverse production system. There is a wide variation regarding the season of cultivation, and cropping pattern. The detail of crop grown by sample farmers is presented in Table 4.

Table 4: Crops grown by sample farmers season-wise.

| Crop | Kharif season | | | Rabi season | | | Summer season | | |
|----------------|---------------|-----------|------------------|-------------|-----------|------------------|---------------|-----------|------------------|
| | % household | % acreage | % area irrigated | % household | % acreage | % area irrigated | % household | % acreage | % area irrigated |
| Maize | 83 | 22 | 80 | 31 | 12 | 100 | 19 | 6 | 36 |
| Maize Potato | 0 | 0 | NA | 68 | 26 | 99 | 0 | 0 | NA |
| Potato | 0 | 0 | NA | 16 | 3 | 100 | 0 | 0 | NA |
| Rice | 78 | 42 | 76 | 0 | 0 | 0 | 0 | 0 | NA |
| Wheat | 0 | 0 | NA | 83 | 37 | 99 | 0 | 0 | NA |
| Vegetable | 16 | 5 | 68 | 18 | 6 | 73 | 34 | 11 | 43 |
| Oilseeds | 0 | 0 | NA | 2 | <1 | 0 | 1 | <1 | 100 |
| Spices | 5 | 1 | 70 | 0 | 0 | 0 | 3 | <1 | 100 |
| Pulses & Grams | 9 | 1 | 43 | 28 | 6 | 74 | 61 | 22 | 66 |
| Other crops | 34 | 7 | 57 | 7 | 1 | 65 | 33 | 7 | 57 |
| Fallow land | 58 | 22 | NA | 33 | 9 | 00 | 77 | 54 | NA |
| Total | - | 100.00 | 74 | - | 100 | 95 | - | 100 | 83 |

It may be observed from the table 4 that in kharif season out of total acreage during the season maize constitute 22 percent in 80 percent irrigated area. In rabi season this crop is cultivated under 12 percent of the GCA and cent-percent area under irrigation. In summer season around 6 percent areas under the crop with 36 percent irrigated area.

The table further indicates that the crops like- rice, vegetable, spices, pulses and other crops were also cultivated during the season. In the season fallow land also exists up to 22 percent of the GCA. In rabi season wheat, vegetable and pulses were considerably grown but fallow land also exists up to 9% of the GCA. In case of summer the other crops, vegetable & pulses were grown considerably but the fallow land during the season was much higher 54 percent. The overall analysis indicates that across the season percentage area of fallow land was found higher in kharif and summer season mainly due to risk involve in production of crop due to drought, flood, water logging and heavy rains during the kharif season. In summer season irrigation water crisis, ground water table goes down and agriculture practices become expensive. So sample farmers in good number (58) in kharif and (77) in summer kept their, cultivated land fallow at overall. In rabi season assured irrigation was available so only 9 percent of the area kept fallow by farmer (33) in number due to some un-explained reasons.

Varieties adopted by the farmers in maize production:

During the field survey, it was observed that farmers were cultivating maize crop in all three seasons *i.e.*, kharif, rabi and summer. The detail adoption of maize hybrid variety across the season and farms were collected and presented under table 5.

Table 5: Adoption of maize hybrids across the season by the sampled farmers.

| Season | Total number of farmers | | | Percentage of full adoption | | |
|---------------|-------------------------|--------|-------|-----------------------------|---------|---------|
| | Small | Medium | Large | Small | Medium | Large |
| Kharif | 28 | 34 | 37 | 3 (11) | 1 (3) | 0 (00) |
| Rabi | 35 | 42 | 38 | 33 (94) | 37 (88) | 33 (87) |
| Summer | 02 | 10 | 11 | 0 (0) | 6 (60) | 4 (36) |
| All | 65 | 86 | 86 | 36 (55) | 44 (51) | 37 (43) |

Note: Parenthesis indicates percentage.

It may observed from the above table that during the kharif season, rabi season and summer season 28, 35 and 02 farmers respectively were found grown maize crop and their full adoption of hybrid maize seed was 3, 33 and 0 respectively by small farmers. In case of medium farmers during the kharif rabi and summer season 34, 42 and 10 farmers respectively were found growing maize out of which 1, 37 and 6 were found full adoption of hybrid seed of maize. Again in large farmers during the kharif, rabi and summer it was 37, 38 and 11 farmers were found maize growing and out of it 0, 33 and 4 respectively were reported that the use of hybrids maize with full adoption in their farm. At the overall level 65 small farmers, 86 medium farmers and 86 large farmers across the season growing maize but hybrid seed adoption in fuller sense was 36 (55 percent) by small categories farmers, 44 (51 percent) by medium categories and 37 (43 percent) by large categories farmers. The analysis indicates that in rabi season a large number of all existing size group were using hybrid variety of maize in full adoption however in kharif season it is very low and summer season only medium and large categories farmers up to some extent were using the hybrid in full adoption. The farmers were reported that the main reason for adoption of hybrid maize variety in full adoption due to higher productivity which is ensure during the rabi season only. But in kharif and summer season irrigational facilities not supported them due to lowering of ground water table during summer season and water logging problem in kharif season compel them to non-adoption of hybrid maize seed in their farm. This is the reason for low adoption of hybrid seeds in kharif and summer season.

Reason behind selecting maize variety across the seasons:

The sampled farmers were asked about the reason behind selection of maize variety according to season and presented in table 6.

Table 6: Selection of maize variety with reasons as reported by sample farmers.

| Season | Variety | Reasons for selection of variety | | | |
|--------|---------|----------------------------------|--------------|-------------|--------|
| | | Yield | Adaptability | Consumption | Others |

| | | | | | |
|--------|--------|--------------|-------------|------------|-------------|
| Kharif | Hybrid | 50 (50%) | 7 (7.14%) | 7 (7.14%) | 35 (35.31%) |
| | OPVs | 5 (5.31 %) | 73 (74.34%) | 8 (7.95%) | 14 (12.39%) |
| Rabi | Hybrid | 101 (88.13%) | 12 (10.5%) | 0.0 (0.0%) | 2 (1.88%) |
| | OPVs | 62 (53.85%) | 35 (30.77%) | 0.0 (0.0%) | 18 (15.38%) |
| Summer | Hybrid | 15 (66.67%) | 2 (8.33%) | 0.0 (0.0%) | 6 (25.08%) |
| | OPVs | 0.0 (0%) | 13 (57.14%) | 6 (28.57%) | 4 (14.29%) |

The above data shows that the farmers were selecting variety of maize seeds according to the season. They reported that hybrid variety of maize seed is most prominent production tools of maize and the most important reasons they have reported that yield, adaptability, consumption and other purposes, In kharif season hybrid variety was found selecting by the farmers due to yield potential and other purposes about 50.00 percent and 35.31 percent farmers were reported respectively. In the same season very small numbers only 7 farmers were reported the hybrid seeds of maize selection for adaptability and consumption purposes. The table further indicates that in the same season open pollinated variety (OPVs) or local variety were selected by 73 farmers (74.34%) for adaptability in the season. The table further indicates that during the rabi season 101 farmers were reported that they select hybrid variety for the yield potential. Only 12 farmers were reported for adaptability in the season and no farmers were reported for selection of hybrid seeds for consumption purposes. In case of OPVs in the same season yield and adaptability was major focus for selection. In summer season 15 farmers were reported for selection of hybrid for yield, however 13 farmers were reported OPVs selection for adaptability. At the overall level it says that farmers were found selecting hybrid and local variety of maize as per the behaviour of the seasons and the risk involve. In risk free season farmers were used hybrid variety and stress prone situation or risk condition they uses local or OPVs variety as a production risk management tools as stated by a large number of sampled farmers.

Measures adopted during the abiotic situations as reported by the sampled farmers:

The sample farmers reported that in almost every year they facing flood or water logging situation especially during the kharif season. The intensity of flood or water logging varied year to year but considerable losses occurs by these a-biotic factors to the maize crop. A large number (47 farmers) were reported that in the flood and water logging situation, two measurers *i.e.*, bund repairing and use of short duration variety were taken by them as coping practices. Some of the farmers were also reported that in their field from the month of July to last week of November water logging situation prevails. The farmers were also reported that due to risk involve in maize production during the season they use very low

level of inputs in their farm and generally grown the maize for fodder purposes mainly in low land areas. Some other measures as local level they received from their ancestors also found used in medium land situation and grown maize as a green cob purposes. The farmers were also reported that due to lack of suitable varieties in flood and water logging situation of maize production they generally kept fallow of their land in the season of kharif and summer also.

Consumption of maize by the farmers

It was reported by maize farmers of the sampled area that due to lack of consumption utility of hybrid grains they generally cultivated local variety for various form of maize consumption like fried maize (Bhuja), sattu, dara, atta etc. farmers has also indicated that OPVs are good for home consumption (72 percent) farmers were reported and they believe that better adoptability in risk situation. The hybrid maize grain is cultivated mostly for marketing purpose (94%) hybrid output is marketed. However, only 34 percent OPVs were marketed as per the data. The OPVs were found marketed due the consumer preferences. The marginal and small farmers were reported that they prefer OPV maize production for consumption and they followed subsistence farming in the kharif and summer seasons.

Conclusion

This paper, developed from household survey of Samastipur district of Bihar during 2010-11 periods provides a picture of diverse season-wise production and consumption of maize in the district. The rate of hybrid adoption in fullerenes was found varying across the seasons and farm also. The hybrid adoption was found high in rabi season in the study area. The farmers in the sampled area recognise composite or local variety more suitable for growing under a-biotic stress like – flood and water logging situation, compared to the available hybrid. Another important thing observed during the course of study that the low consumption use of hybrid maize is the reason for farmers adoption of even low- yielding local variety during the risk free season like- rabi season. The study observed that there is a gap between existing productivity and production to expected or potential level in the area. If proper knowledge and suitable variety provide to cultivator of maize in the area there is a high potential for this crop in future. In addition across the study area especially in kharif and summer a large population of cultivable land is kept fallow due to inadequate irrigation facilities which can be brought under cultivation and thereby increase the maize production.

The other concrete measures for practices on maize production, developed by public-private partnership basis for kharif and summer season and needs to suitable variety for both flood & drought stress conditions in the area. This measure will certainly increase the

production and consumption level of maize in the study area and will also increase the food availability as well as nutritional security for the poor section of the society in coming years.

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