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Sustainability of Hybrid Maize Cultivation during spring in the Hilly Region of Koraput District of Odisha

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ABSTRACT

Maize (*Zea mays L.*) is an important cereal crop in world after rice and wheat. Maize is grown on around 2.3 lakh hectares in Orissa. Kharif maize alone accounts for about 2.2 Lakh hectares. In Koraput district, Kharif maize is cultivated around in 20,000 ha whereas Rabi Maize is cultivated in 3250 ha. Maize cultivation during the spring season was introduced by the KrishiVigyan Kendra, Koraput during 2013-14 under the ISOPOM maize programme. The demonstration was given to 40 nos of beneficiaries covered 3 villages such as Maliburuda and Muliaput of Nandapur block and Luhaba village of Semiliguda block. The demonstration on hybrid maize (Var: JK 101) was conducted in 12 ha. The maize crop was sown during 10th to 18th January, 2014 and was harvested during 20th to 25th April 2014. Only seeds and fertilizer have been supplied to the farmers for the demonstration programme. The average maize yield was found to be 46.34q/ha which is 57.8% higher yield than the control plot of local variety. The average cost of cultivation of the maize crop was Rs. 40,500 per hectare and gross return was found to be Rs. 85,500 per hectare. Average net profit of Rs. 45,000 per hectare was found by cultivating the maize in the spring season. KrishiVigyan Kendra, Koraput is playing a vital role in disseminating the technology of cultivating the hybrid maize cultivation during spring season. It was found from the technology transfer result that highest adoption was the irrigation and water management followed by farm mechanization. Overall full adoption of the scientific technology in maize production was found to be 46.17%. Farmers expressed their satisfaction over the yield performance of the maize during spring season. The technology transferred is also profitable and acceptable to the farming community. Further research needs focus on the problems and constraint for adoption of the technology.

1. Introduction

Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. Maize is the third largest cultivated crop in India after Rice and Wheat. *kharif* maize contributes to over 80 percent of the maize output in the country. The total maize area in the state of Orissa has been on a steady increase between 2000-01 and 2012-13, there has been a 28% increase in the area. The pace at which maize seed is shifting to High Yielding Varieties and Hybrids is equally rapid from 68.14% of total maize area in 2000-01 to 83.13% in 2012-13. Similarly, area under irrigated maize is growing rapidly and has nearly doubled between 2003-04 and 2012-13. Maize yield has nearly doubled during this period along with total maize production in the state. It is important to note that irrigated maize area is also increasing phenomenally (Sekhawat et al. 2010). Maize is grown on around 2.3 lakh hectares in Orissa.

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Kharif maize alone accounts for about 2.2 lakh hectares. It is cultivated mostly in Ganjam, Gajapati, Keonjhar, Koraput, Nabarangpur, Mayurbhanj and Kalahandi districts. Production is higher than demand in the country by a few million tonnes. Currently, 49% of India's maize output is used as poultry feed, 25% as food for human consumption, 13% in starch and other industries, 12% in animal feed and around 1% as seed. It is therefore important to note that this crop, though classified as a food grain in official classifications, is actually going into poultry and animal feed mostly. In that context, arguments that maize is to be promoted for food security of this country also need to be firmly re-visited (Taipodia and Sukla 2013).It is reported that today in the country, 42% of the country's maize produce comes from hybrid seeds. The Directorate of Maize Research has developed and released as many as 234 cultivars since its inception, with the active support of an All India Coordinated Research Project on Maize 132 of these are hybrids. Nearly 48 are public-bred single cross hybrids for cultivation in different agro-climatic conditions of the country. 56 proprietary hybrids of the private sector have also been released so far through the AICRP (Chopra and Agiras 2008). Maize cultivation is mostly confined to inland districts of the State which contribute more than 80 percent of production in the State. A Special programme for popularization of hybrid maize has been taken up in 20 districts namely Bolangir, Mayurbhanj, Koraput, Keonjhar,Sundargarh, Gajapati, Kandhamal, Kalahandi, Nuapada, Rayagada, Nayagarh, Deogarh, Angul, Ganjam, Khurda, Jharsuguda, Sambalpur, Baragrah, Dhenkanal and Malkangiri of the State in PPP mode. With these backgrounds of consideration, the main objective of the study is to introduce the maize cultivation and popularize the scientific technology during the spring season by the Krishi Vigyan Kendra, Koraput under the ISOPOM maize programme.

2. Materials and Methods

The demonstration on maize cultivation during the spring season was introduced by the Krishi Vigyan Kendra, Koraput during 2013-14 under the ISOPOM maize programme. Three villages such as Luhaba (Block: Semiliguda), Muliaput (Block: Nandapur) and Maliburuda (Block: Nandapur) have been selected for the maize demonstration purposefully because in these villages have more area in maize. Total 40 Nos of farmers have been selected for the demonstration in 30 acres (12 ha) of land. The hybrid maize (Var: JK 101) has been selected for the demonstration. The maize crop was sown during 10^{th} to 18^{th} January 2014 and was harvested during 20^{th} to 25^{th} April 2014.

Only seeds and fertilizer have been supplied to the farmers for the demonstration programme. The organic (FYM: 10-15 q/ha) and chemical fertilizer (N: P: K: 80:50:50) has been used for the maize cultivation. The data on maize such as plant population, grain yield and net return have been collected for the performance of maize during spring season. Producing higher maize yields on existing cultivated land is therefore the surest way of generating the extra maize grain. To achieve this goal, a number of scientific cultivation practices such as fertilizer management, weed control, liming, insect and disease control and technology transfer has been undertaken. In fertilizer management frequent soil analysis has been conducted in the farmers' field. Fertilizers were applied in the balanced way to achieve the highest return from the expensive inputs. Fertilizers particularly N and K were applied in split doses rather than a single dose. In weed management, timely weeding has been conducted in individual field and crops during critical growth stage of the crop. It also involved keeping the whole field clean and ensuring that a minimum of weed seed is allowed to come to maturity. Soil analysis has been conducted and on the basis of analysis liming has been given to the maize crop. Where the use of chemicals seems to be the only way of solving an immediate plant protection problem, pesticides has been used within the context of integrated pest control to increase their efficiency and minimize unwanted side effects such as: pest resurgence pest resistance to pesticides destruction of natural enemies, beneficial insects and non-target species persistence residual problems and hazards. Major effort must be made to transfer modern technology through education, training and raising the levels of knowledge of the smallholder farmers. More farmers should be involved in the development of new research packages since they usually understand better the possible impacts of new technologies on their farming systems.100 farmers who were adopted the technology of maize production during spring were selected from the abovementioned three villages for detailed survey. The required information was collected by survey method by personal interview on component wise of crop production technology.

3. Results and Discussion

3.1 Effect of technology on crop production

Maize can be grown in all seasons *viz. Kharif* (monsoon), post monsoon, *Rabi* (winter) and spring. During *Rabi* and spring seasons to achieve higher yield at farmer's field assured irrigation facilities are required. The hybrid maize (Var: JK 101) has been selected for the demonstration. The maize crop was sown during 10^{th} to 18^{th} January 2014 and was harvested during 20^{th} to 25^{th} April 2014.

The nutrients such as chemical and organic fertilizer were applied based on the soil nutrient status/balance and cropping status. To get the higher economic yield of maize, farm yard manure (FYM) was applied 10-15 days prior to sowing @ 10-15 q/ha. The chemical fertilizers were applied @ 100 kg N, 50 kg P_2O_5, 50 kg K_2O per hectare. Total of 7-8 irrigation were applied during the crop growth periods. The details of the input applied are given in the Table 1.

Table 1. Details of inputs applied to maize during the crop period of 2014

Sl. No.	Inputs applied	Amount applied
1.	Seed (Var: JK-101)	16.5 kg/ha
2.	Nitrogen (N)	100 kg/ha
3.	Phosphorus (P_2O_5)	50 kg/ha
4.	Potash (K_2O)	50 kg/ha
5.	FYM	10-15 q/ha
6.	Irrigation	7-8 Nos
7.	Intercultural operation	3 Nos

It was found from the result that the average plant population during harvest of the crop was found to be 60,000/ha, 59,500/ha and 60,500/ha in village Luhaba, Muliaput and Maliburada, respectively. Plant populations were found satisfactory in all the three villages. Average grain yield of maize was found to be 4612 kg/ha, 4679 kg/ha and 4731 kg/ha in village Luhaba, Muliaput and Maliburada, respectively. Similarly net return from the maize was found to be Rs. 40,500/ha, Rs. 39,900/ha and Rs. 39,500/ha in village Luhaba, Muliaput and Maliburada, respectively. The details growth and yield parameters are given in the Table 2. Farmers in all the three villages expressed their satisfaction in maize cultivation during the spring season.

3.2 Technology transfer and adoption

The data on transfer of technology in scientific method of maize cultivation were collected in spring season under the different thematic area/components such as fertilizer management, irrigation, insect and pest control, liming, farm mechanization and weed control. The data collected from the selected respondents are presented in the Table 3. It was found from the technology transfer result that highest adoption was the irrigation and water management followed by farm mechanization. Overall full adoption of the scientific technology in maize production was found to be 46.17%.

Table 2. Growth and yield parameter of maize during spring 2014

Sl. No.	Parameters	Village: Luhaba	Village: Muliaput	Village: Maliburuda
1.	Average plant population during harvest / ha	60,000	59,500	60,500
2.	Average maize grain yield (kg/ha)	4,612	4,679	4,731
3.	Sale of produce (Rs./ha)	83,016	84,222	85,158
4.	Total value of produce including byproducts like straw, etc. (Rs./ha)	85,500	86,400	86,800
5.	Cost of cultivation (Rs./ha)	45,000	46,500	47,300
6.	Net return (Rs./ha)	40,500	39,900	39,500

Table 3. Technology transfer and adoption by the respondents in different scientific methods of maize cultivation during 2013-14

Sl. No.	Thematic area	Spring (n=100)		
		C	P	N
1.	Fertilizer management	35	47	18
2.	Weed management	42	52	6
3.	Irrigation and water management	66	22	12
4.	Liming	38	44	18
5.	Insect pest control	42	46	12
6.	Farm Mechanization	54	36	10
	Adoption index (%)	46.17	41.17	12.66

Conclusion

Crop was found excellent and farmers were very much interested to produce maize in spring season. Farmers got good return but marketing of the dry grains seemed to be the major problem. Farmers prefer to harvest maize in green cobs instead of seeds. Farmers became aware on spring maize production technology. It was found from the technology transfer result that highest adoption was the irrigation and water management followed by farm mechanization. Overall full adoption of the scientific technology in maize production was found to be 46.17%. It was also found that in view of the changing farming scenario in the country, maize has been emerging as one of the potential crops that addresses several issues like food and nutritional security, climate change, water scarcity, farming systems, bio-fuel etc.

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