

Impact of farming practices on productivity of local potato cultivar under rain-fed ecosystem, Dibrugarh, Assam, India

ABSTRACT

A field trial was conducted at Krishi Vigyan Kendra Dibrugarh, Assam Agricultural University (AAU) to study the production performance of local potato cultivar under different farming practices viz Natural, Organic and Conventional farming during rabi season of 2022-2023. The results revealed that significant increase in growth, yield attributes and yield of local potato was observed in organic farming followed by conventional and natural farming. Growth characters of potato like Plant height both in vegetative (22cm) as well as reproductive stage (28cm) was found higher in organic farming as compared to conventional and natural farming. Results also indicated that the yield attributing characters like number of tuber plant⁻¹ and average individual tuber weight were significantly higher in organic (4.91g and 9.1 nos) practices followed by conventional (9 nos and 4.49g) and natural farming practices (4.65g and 8.3 nos). Organic practice resulted better yield of local potato (107.23qtha⁻¹) as compared to conventional (92.94qtha⁻¹) and Natural farming (88.77qtha⁻¹) practices. The net economic return was also significantly higher in Organic practice (222.83⁰⁰⁰Rs ha⁻¹) in comparison to conventional (161.85⁰⁰⁰Rs ha⁻¹) and Natural farming (141.33⁰⁰⁰Rs ha⁻¹) practices with more B:C ratio in Organic practice (1:2.08).

Keywords: Farming practices, Potato, growth, Yield, Net return, B:C ratio

Introduction

Increasing population demands higher agricultural produce to ensure food and nutritional security, according to International Food Policy Research Institute the world needs to double the production per unit area per day (Korat and Mathukia, 2022). Green revolution in India brought a significant increase in production. It replaced the traditional hardy varieties of crops by hybrids and high fertilizers and agrochemicals responsive varieties which leads to degradation of soil properties viz biological and physical properties. Due to the detrimental effect of the chemicals and reduction in soil micro-organisms in soil, response of crops to the applied chemicals also reduced (Yogananda Babu, 2015). To feed the world there is a need to enhance resource use efficiency as well as reduce the input costs to achieve the desired yield, which can be achieved through alternative farming strategies like natural farming, organic farming (Korat and Mathukia, 2022). Natural and organic farming discourage the use of chemicals and are more or less poison free farming. Natural and organic farming has the potential to efficiently use the soil and water resources and to minimize the input cost and also encourage cultivation of local varieties (Lal, 2008). Potato is one of the important major

vegetable crop of Assam and ranks fourth in terms of area among other crops of the state but the state average is lower than the national average (Borah *et al.*, 2016). Relatively fewer research works has been conducted so far exclusively on potato cultivation in the different production system. Therefore, the present research was carried out to study the influence of different production system on growth, yield attributing characters and yield of local potato cultivar in Dibrugarh district of Assam

Materials and Methods

A field trial was conducted under Krishi Vigyan Kendra (Assam Agricultural University) Dibrugarh in order to study the productivity of local potato cultivar under different farming practices viz Natural, Organic and Conventional farming during rabi 2022-23. The experimental soil was sandy loam in texture, acidic in reaction (pH 5.13), with organic carbon (1.26%) and available nitrogen (450 kg ha^{-1}), high in available phosphorous (26 kg ha^{-1}) and medium in available potassium (204 kg ha^{-1}). A net area of 375sqm (125sqm each farming system) was considered for the experiment with individual plot size of 25sqm with five replications. Potato crop was shown in the mid of November during Rabi 2022 by following a recommended practices including fertilization in organic and conventional system. In natural farming all the five principals of natural farming were considered. The details of practice followed mentioned below (Table 1).

Indigenous formulations used in natural farming (Lal, 2019)

Preparation of Bijamrit

Bijamrit = Indigenous cow dung (5 kg) + Indigenous cow urine (5 liters) + Slaked lime (250 g) + Water (20 liters) + forest soil (handful) , it is used for seed treatment. It is useful to prevent seed and soil borne pathogens.

Preparation of Jivamrit

Jivamrit = Indigenous cow dung (10 kg) + Indigenous cow urine (10 liters) + Jaggery (2 kg) + Gram flour (2 kg) + soil (200 g) + water (200 liters). Kept for 48 hours to ferment with regular stirring.

Preparation of Agnistra

Agnistra= Neem leaves (5 kg)+ Indigenous cow urine (10 liters) + Chilli (0.5 kg) +Garlic (0.5 kg) + tobacco leaves (1 kg)

Preparation of Brahmastra

Brahmastra = Neem leaves (5 kg)+ Indigenous cow urine (10 liters) + leaves of Dhatura (5 kg) + Leaves of eucalyptus (2 kg)+ wild tegetus (2 kg)+ Guava leaves (2 kg) +Castor leaves(2 kg) + Papaya leaves (2 kg)

Preparation of Neemastra

Neemastra =Neem leaves (5 kg) + Indigenous cow urine (5 liters) + Indigenous cow dung (1 kg) +Water (100 litres)

Table. 1. Practices followed during the experiment.

Farming practices	Seed treatment	Soil Applicant	Crop protection measure
Natural farming practices	In natural farming indigenously prepared Beejamrit was used. Sufficient quantity of Beejamrit used to soak the treated seed by spraying on seed, mixed it and shade dried before sowing	Application of Jivamrit @ 250kg/ha along with FYM @ 250 kg/ha at sowing and foliar spray of jivamrit@ 250 kg/ha in 15, 30, 60 DAS	Need base application of Agniastra, Brahmastra, and Neemastra@ 7 litres in 200 litres of water was applied
Organic farming practices	Seed treatment with PSB (Phosphate solubilizing Bacteria) and Azotobacter @ 400 g/litre of water then shade dried before sowing	Application of vermicompost @ 2 t/ha, FYM@ 10t/ha, at sowing and foliar application of Panchagavya@ 5ml/ltat 15, 30 and 60 DAS	Organic bio-fungicide <i>Trichoderma viridie</i> @5 g/litre of water was applied
Conventional farming practices	Seed treated with Mancozeb @ 5g/litre of water for about 10 minutes as per package of practices	Fertilizer application @ 60:50:50: N:P:K as recommended	Conventional package of practices of Assam Agricultural University, Jorhat was followed viz. Mancozeb 75% a.i @ 2.5 g/litre of water

Data on growth and yield attributing characters of potato crop viz plant population per m², plant height, number of tubers per plant, tuber weight, yield from each plot were recorded at regular interval and analysed statistically in SPSS computer based software.

Results and Discussion

The experiment was conducted to study the different farming practices viz Natural, Organic and Conventional farming during rabi season of 2022-2023. The results revealed that significant increase in local potato growth and yield attributes was observed in organic farming followed by conventional and natural farming (Table 2).

Growth characters of potato like Plant height both in vegetative (22 cm) as well as reproductive stage (28 cm) was found more in organic farming as compared to conventional and natural farming. Results also indicated that the yield attributing characters like more number of tuber plant⁻¹ (9.1) and average individual tuber weight (4.91g) were achieved

in organic practices followed by conventional and natural farming practices that showed (9 nos), (8.3 nos) & (4.49g), (4.65g) in tuber plant⁻¹ and average individual tuber weight respectively (Table 2). The better performance on organic farming might be due to the application of external bio-agent as well as bio-pesticides whereas natural farming needs a time frame to increase the microorganism population to boost up the effect on production.

Organic farming practices produces higher yield and yield attributes then the conventional in potato was reported by Barmaki *et al.* (2008). A higher average yield in Non-Natural Farming was observed as compared to those of Natural Farming without FYM in black gram and sugarcane (Kumar *et al.*, 2020) that confirms the present findings.

Yield and Economic benefit data present in table 3 indicated that Organic practice performed better yield of local potato (107.23qt ha⁻¹) as compared to conventional (92.94qtha⁻¹) and Natural farming (88.77qtha⁻¹) practices. The net economic return was also significantly higher in Organic practice (222.83⁰⁰⁰Rs.ha⁻¹) in comparison to conventional (161.85⁰⁰⁰Rs.ha⁻¹) and Natural farming (141.33⁰⁰⁰Rs.ha⁻¹) practices with mare B:C ratio in Organic practice (1:2.08) and enumerated in Table 3. In a comparative study of farming system done by Manjulatha *et al.* (2022) revealed similar results in sweet corn. A lower B:C in Natural Farming without FYM was also observed by Kumar *et al.* (2020) in his experiment that supports the present result.

Table. 2. Growth and Yield attributing character of in different farming system

Farming practices	Plant population (No. per sqm)	Plant height (cm)		No of tubers per plant	Tuber weight(g)
		Vegetative stage	Reproductive stage		
Natural	23	20.50	25.90	8.3	4.65
Organic	24	22.00	28.00	9.1	4.91
Conventional	23	21.20	27.50	9.0	4.49
CD (5%)	-	-	-	0.56	0.97

Table 3. Yield and Economic benefit from the Farming practices

Farming practices	Yield (qt/ha)	Cost of cultivation (⁰⁰⁰ ,Rs./ha)	Gross return (⁰⁰⁰ ,Rs.)	Net return (⁰⁰⁰ ,Rs.)	B:C ratio
Natural Farming	88.77	213.74	355.07	141.33	1.66
Organic Farming	107.23	206.11	428.94	222.83	2.08
Conventional	92.94	209.92	371.77	161.85	1.77
CD (5%)	11.26	-	-	19.20	-

Considering Sale price @ Rs. 4000/- per qt

Conclusion:

The present study revealed that organic farming practices produced significantly higher yield attributes and yield of local potato cultivar than the natural and conventional farming practices. B: C ratio of organic farming system was also found higher than the other two farming system. Hence, according to studies the organic farming is much better than organic and inorganic.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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