

## Performance Analysis of Potato Seed Production at Different Agroclimatic Regions of Bihar

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### ABSTRACT

The major drawback to higher potato productivity in Bihar is the non-availability of quality and disease-free potato seeds. However, the aeroponic system followed by adopting the SPT method is a potential method for obtaining good quality seed tubers. Therefore, in this study, the potato mini-tubers that were produced under the Aeroponic system *viz.*, Yushimap, Bari Aloo-7015, Kufri Thar-2, Kufri Neelkanth, Kufri Mohan and Kufri Lima were evaluated at all 18 locations of Bihar. Results revealed that the different varieties expressed significant differences in their productivity at different locations. The varieties Yushimap and Bari Aloo-7015 performed better at all locations therefore, these varieties have an ability of higher yield potential under agro-climatic conditions of Bihar. The varieties such as Kufri Thar-2, Kufri Neelkanth, Kufri Mohan and Kufri Lima performed better than local varieties in terms of heat, moisture, disease and pest tolerance. The study indicates that these new potato varieties may manifold potato productivity and encourage potato growers and entrepreneurs to expand quality seed production businesses in Bihar.

**Keywords:** Aeroponic, Bihar, Mini-tuber, Potato, Yield

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### INTRODUCTION

Potatoes (*Solanum tuberosum* L.) are fat-free and gluten-free and provide a dietary fiber of about 2 g in 5.3oz (Beals, 2019). They are more energy-packed than any other popular vegetable. It contributes to combating hidden hunger, which is a major global public health problem. It is also rich in vitamin C, B<sub>6</sub>, phenols, iron, potassium, phosphorus and magnesium (Robertson *et al.*, 2018) and has protein content comparable to that of cereal grains. Due to the presence of vitamin C, it is often called the "lemon of the North" (FAO 2008). Moreover, coloured potatoes are a rich source of antioxidants such as polyphenols,  $\beta$ -carotene, carotenoids, anthocyanins and flavonoids (Soare *et al.*, 2020).

Potato is grown in almost all the districts of Bihar by small and medium land-holding farmers. In Bihar, Nalanda district is very popular for potato production with average productivity of 36.46 t/ha while the average productivity of Bihar is 27.60 t/ha (Anonymous 2021). It is noticed that the major potato-producing district of Bihar is surrounded by the holy river Ganges which is enriched with highly fertile sandy-loam soil. However, the major drawback for higher potato productivity in Bihar is the non-availability of quality, disease-free and high-temperature tolerance potato seeds. So, it is very important to use good quality seed tubers to achieve higher productivity but the production of large quantities of quality seed tubers, in a relatively short period is difficult (Mateus-

Rodriguez *et al.*, 2013) which can be overcome by the aeroponic system followed by adopting SPT method. The mini-tubers developed from the aeroponics system are considered G<sub>0</sub> and are the purest seed material that is almost free from viruses, diseases and pests. Thus, the present research work is the very first in Bihar to broadly evaluate different potato varieties including a few new bio-fortified varieties at 18 diverse locations. This will benefit potato researchers, farmers and stakeholders in the state by knowing the performance of these new potato varieties. This will also enhance the quality of seed tuber production and promote potato growers and entrepreneurs to expand quality seed production businesses in Bihar.

### MATERIALS AND METHODS

The potato seed (mini-tubers; G<sub>0</sub> generation) of varieties *i.e.*, Yushimap, Bari Aloo-7015 and Kufri Lima were collected from Potato Technology Centre, Shamgarh (Karnal) and distributed among 16 different KVVKs *i.e.*, Kishanganj, Lakhisarai, Nalanda, Bhojpur, Rohtash, Bhagalpur, Banka, Araria, Saharsa, Madhepura, Seikhpura, Munger, Aurangabad, Jahanabad, Patna, Jamui and 2 Institutes *i.e.*, Bihar Agricultural College, Sabour (Bhagalpur) and Nalanda College of Horticulture, Noorsarai (Nalanda) during the year 2022-2023 to analyze the performance of these varieties at

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different agro-climatic zones of Bihar (Fig. 1). The selected varieties, such as Yushimap, Bari Aloo-7015, and Kufri Neelkanth, are biofortified varieties, *i.e.*, rich in anthocyanin and high in antioxidants. These varieties were evaluated in a randomized block design (RBD) with three replications and the standard package of practices was followed for raising

healthy potato crops (Thamburaj & Singh 2014) at all 18 locations. The agronomical data of all distributed varieties along with the local check were recorded from five randomly selected plants from respective locations thereafter statistical analysis was done as suggested by Panse and Sukhatme (1967).

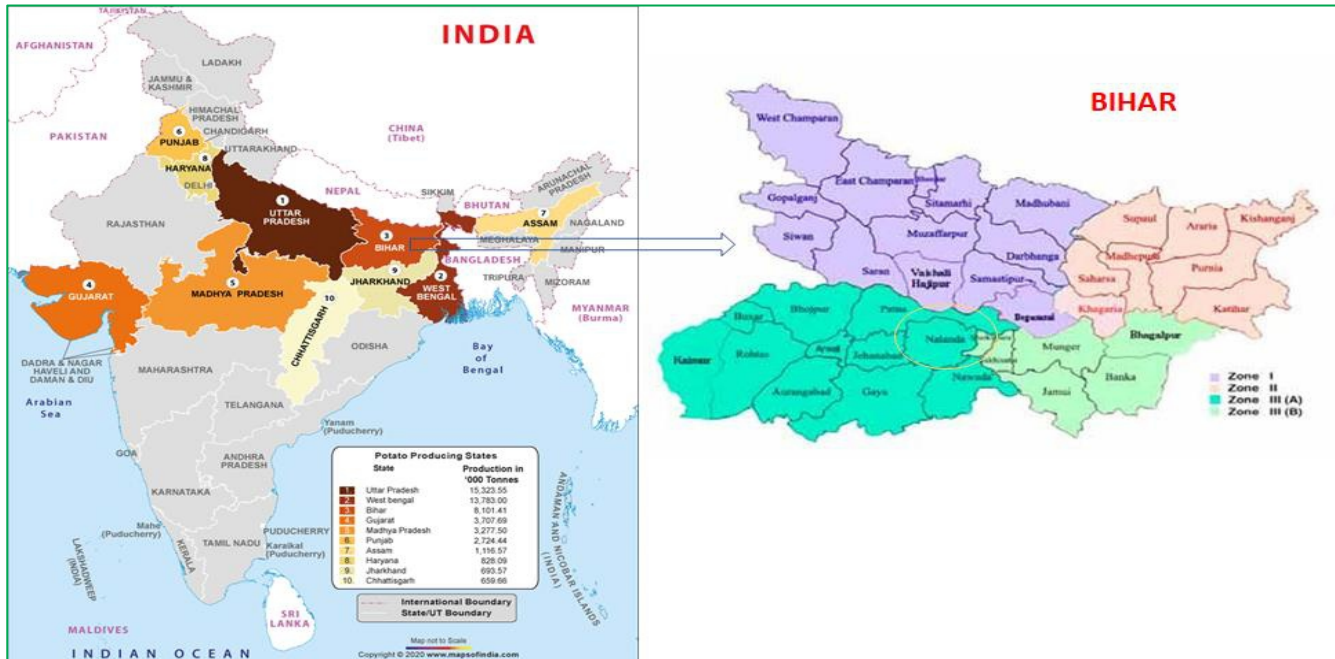


Fig. 1: Leading potato-producing states in India and agroclimatic zones of Bihar

Table 1: Performance of different potato varieties at 18 locations (KVKs/ Institutes) in Bihar

Sl.No.	KVK'S/ Institute	Productivity (t/ha)			
		Yushimap	Bari Aloo-7015	Kufri Lima	Local check
1	Kishanganj	24.67	20.40	-	-
2	Lakhisarai	23.33	25.65	-	-
3	Nalanda	23.20	26.27	-	-
4	Bhojpur	22.80	27.09	-	(Kufri Sinduri) 21.59
5	Rohtash	27.23	29.87	-	(Kufri Khyati) 21.33
6	Bhagalpur	22.53	21.47	-	-
7	Banka	-	-	20.69	(Kufri Pukhraj) 42.51
8	Araria	27.52	27.73	-	-
9	Saharsa	27.25	22.37	-	-
10	Madhepura	28.00	22.67	-	-
11	Seikhpura	23.07	22.35	-	(Kufri Pukhraj) 21.47
12	Munger	25.20	40.00	-	-
13	Aurangabad	23.39	25.79	-	-
14	Jahanabad	26.00	23.47	-	-
15	Patna	27.20	25.87	-	-
16	Jamui	32.00	29.00	-	(C- 40) 36.00
17	BAC, Sabour	25.05	26.52	-	-
18	NCoH, Noorsarai	28.80	23.33	22.00	-
	C.D. at 5% d.f.	2.691	2.776	-	4.67
	SE(m)±	0.93	0.959	-	1.41
	C.V. (%)	6.261	6.422	-	8.55

## RESULTS AND DISCUSSION

The different varieties showed significant differences in their productivity at different locations (Table 1 & Fig. 2). The yield of Yushimap was quite higher at Kishanganj, Saharsa, Bhagalpur, Madhepura, Seikhpura, Jahanabad, Patna, Jamui and NCoH, Noorsarai; whereas the yield of Bari Aloo-7015 was higher at Lakhisarai, Nalanda, Bhojpur, Rohtash, Araria, Munger, Aurangabad and BAC, Sabour. The highest yield of Yushimap was recorded at KVK Jamui (32.00t/ha) followed by NCoH, Noorsarai (28.80t/ha). The highest yield of Bari Aloo-7015 was recorded at KVK Munger (40.00t/ha) followed by KVK Rohtash (29.87t/ha). Hence, both potato varieties (Yushimap and Bari Aloo-7015) have the ability of high yield potential (except at KVK Banka and KVK Jamui) than local check, as well as their yield, may be increased in future generation under agro-climatic conditions of Bihar. However,

Kufri Lima performed better at both locations *i.e.*, KVK Banka (20.69t/ha) and NCoH, Noorsarai (22.00t/ha). The lower yield of Yushimap and Bari Aloo-7015 at KVK Banka and KVK Jamui might be due to the difference in seed sowing stages as the G<sub>1</sub> seeds may have less number of active buds (eyes) as well as the newly introduced varieties require a certain period for acclimatization. Performance-based on heat and drought tolerance, disease and pest tolerance, Kufri Thar-2, Kufri Neelkanth, Kufri Mohan and Kufri Lima performed better than local varieties. In this context as per the findings of Tiwari (2021), Kufri Thar-2 saves 20% of water, Kufri Lima is resistant to potato virus X and potato virus Y and tolerant to early heat and pests as well as Kufri Mohan and Kufri Neelkanth are resistant to potato late blight disease.

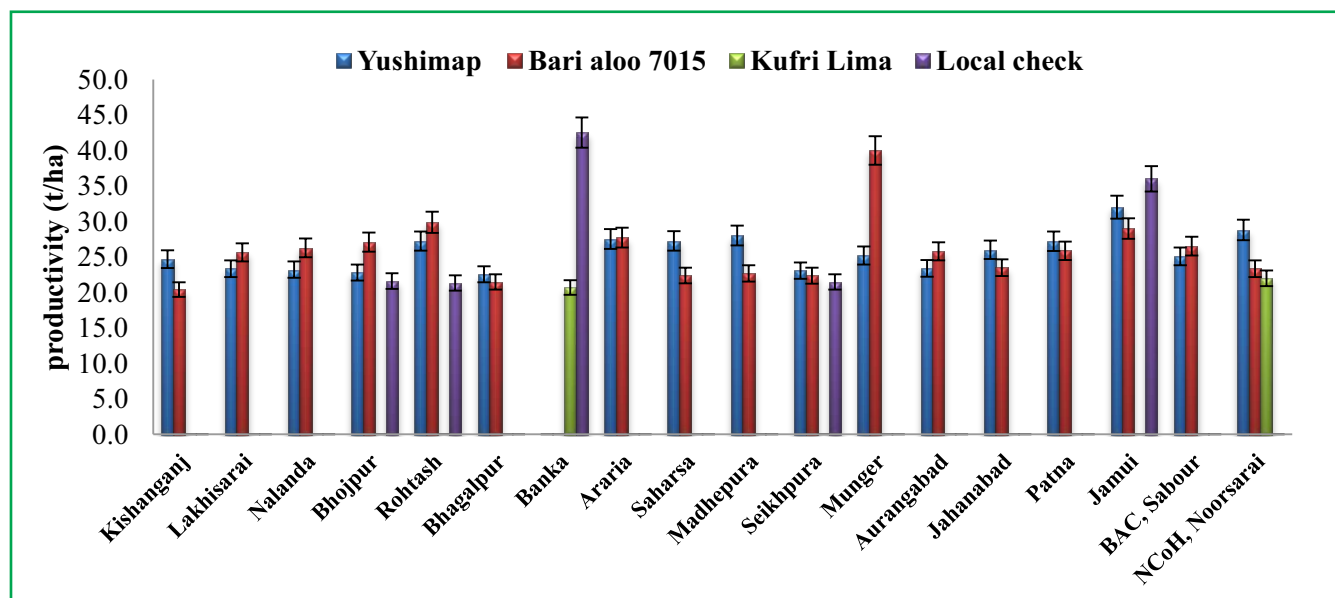


Fig. 2: Graphical representation of the performance of different potato varieties at 18 locations of Bihar at 5% d.f.

Table 2: Morphological characterization of different potato varieties

Character <sub>s</sub>	Potato Varieties					
	Yushimap	Bari Aloo-7015	Kufri Lima	Kufri Thar-2	Kufri Neelkanth	Kufri Mohan
Tuber skin colour	Red	Red	White Cream	Light Yellow	Dark Purple	White Cream
Tuber flesh colour	Light Yellow	Light Yellow	Cream	Light Yellow	Cream	White
Depth of tuber eyes	Shallow	Shallow	Shallow	Shallow	Medium	Shallow
Eyes per tuber	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate	Intermediate
Stem colour	Green	Green	Green	Green	Green	Green

Morphological characterizations are the foundation of the description of plant genotypes based on visual appearance (Table 2). Morphological characterizations make it possible to identify genotypes for use in the breeding program and plant duplicates in gene banks (Franco 2005; Laurentin 2009). Tuber skin colour and texture are very essential traits that directly affect consumer's preferences. The tuber skin colour of Yushimap and Bari Aloo-7015 was red while, white cream in Kufri Lima and Kufri Mohan as well as Dark purple in Kufri

Neelkanth (>1 ppm anthocyanin). Moreover, Yushimap, Bari Aloo-7015 and Kufri Thar-2 show light yellow tuber flesh colour, whereas cream tuber flesh colour was observed in Kufri Lima and Kufri Neelkanth, beside these, Kufri Mohan has white tuber flesh colour. The depth of tuber eyes was shallow in all varieties, except medium in the case of Kufri Neelkanth. Moreover, intermediate eyes per tuber and green stem colour were recorded in all evaluated varieties. The difference in morphological characteristics of these varieties

showed that there was genetic variation in traits, which will be helpful for a better understanding of the selection of genotypes for potato improvement programs.

### CONCLUSION

From the present experiment, it is concluded that the initial yield potential of Yushimap and Bari Aloo-7015 is quite better under agro-climatic conditions of Bihar as compared to the local checks. Moreover, performance based on heat, moisture, disease and pest tolerance, Kufri Thar-2, Kufri Neelkanth, Kufri Mohan and Kufri Lima performed better than local varieties. Thus, these varieties may enhance potato productivity in Bihar in the coming years.

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### CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest among the authors.

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