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Original Research Article

Comparison of Potato Cultivation through TPS and HYV under Diverse Climatic Conditions of Bihar

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A B S T R A C T

The objective of the study was to compare the potato production in two different agro climatic zones of Bihar state by comparisons between tuberlet (92-PT-27) / true potato seeds (TPS), high yielding potato varieties (kufri Ashoka) and farmers' variety (chandramukhi in Madhepura, sathi in Supaul and jyoti jalandhar in Banka) using true potato seed technology and evaluating for yield and against major disease, late blight. This trial was conducted on a few selected farmers' field in Supaul, Madhepura and Banka districts of Bihar state during three consecutive years 2012, 2013 and 2014. Raghopur, Basantpur and Saraigarh were the blocks selected from Supaul district; Uda Kishanganj, Murliganj and Kumarkhand from Madhepura district and Banka, Amarpur and Baunsi blocks were selected from Banka district. From every block that was selected, 10 potato growers were chosen, making a total sample size of 90 potato growers. Selections were done by random sampling. It was found that average yield of 92-PT-27 was the highest at all three locations as compared to high yielding varieties and farmers' variety. The benefit cost (BC) ratio was 2.86 for 92-PT-27, which was substantially higher than 1.87 of Kufri Ashoka and 1.63 of local check. The results reveal that the 92-PT-27 (tuberlet) has a great potential for commercial production of potato. The TPS technology may serve as a potential alternative to mitigate the problem on non-availability of quality seeds.

Keywords

True Potato Seed, tuberlet, Late blight, High Yielding varieties, B: C ratio

Introduction

Seed of potatoes (*Solanum tuberosum* L.) are not easily available; even if it is available it is of poor quality, degenerated and not appropriate for diverse climatic conditions. Farmers are facing problem, there is need to find a suitable alternative. True Potato Seed (TPS) is one of the possibilities to mitigate the problem on non-availability of quality seeds.

The major drawback are that, Potato tubers are bulky, heavy and perishable, so transportation costs to import potatoes are not worth it. To overcome these problems, researchers have tried to exploit the ability of potato plants to produce seeds as well as make available to the farmers. To differentiate these from "seed potatoes" the seeds are called "true potato seeds" (TPS).

Potato cultivation is highly dependent on climatic condition, which may affect plants at various levels viz. from genes to populations, from ecosystem to distributional ranges; from environmental conditions to host vigor/susceptibility; and from pathogen virulence to infection rates.

Thus, it will be proved worthy in food security as well as sustain its production in different climatic circumstances. The major limitation in this traditional technology is non-availability of quality tuber seed for planting materials, which causes incidence of various tuber borne diseases and consequently, reduction in crop yield.

There are many restriction factor in which quality seed is an important factor for potato production. The price and availability of quality seeds become the limiting factor for potato production in developing countries (FAO, 2009). Therefore, in order to overcome these problems, a new production technology using true potato seeds as planting material for potato production was introduced in the 18^{th}, 19^{th} and 20^{th} century by the farmers of Europe, North America and Asia. For raising crops in one hectare, about 3 tons of seed tubers are required as compared to only 1.3 tons of tuberlet. The quality seeds of 92-PT-27, being resistant to late blight *(Phytoptera infestanes*), one of the most devastating diseases of potato crop, singularly increases the yield by 30-50% and also brings reduction in cost of cultivation (Wang, 2008). Iqbal and Khan (2003) also reported the great potential of TPS which can successfully be adopted for commercial crop production due to late blight resistance and high yield. Tuberlet has never reached to a substantial number of farmers. Even in China, which once had gained recognition for its pioneer work on true potato seed, little area is now under potato crop grown from tuberlet (Gopal *et al.,* 2004)

The main aim of the research was to popularize this low cost technology among the farmers by conducting an on-farm trial.

Materials and Methods

The trial was conducted at three different locations in each district. The districts were Supaul, Madhepura and Banka of Bihar state where the experiment was conducted in 2012, 2013 and 2014 respectively to evaluate and introduce true potato seed technology. Ultimately, the income of the farmers improved. The blocks selected in Supaul district were Raghopur, Saraigarh and Basantpur whereas in Madhepura, the blocks were Uda Kishanganj, Murliganj and Kumarkhand and those of Banka were Amarpur, Baunsi and Banka.

The land is endowed with assured irrigation facilities. Despite this, the farmers were not aware about the use of tuberlets and a negative response for adoption of TPS technology was seen. A number of training programs were conducted by Krishi Vigyan Kendras (KVKs) for motivation of farmers. After the training, a few farmers were ready for an on farm trial. Seeds of 92-PT-27 and Kufri Ashoka were procured from Central Potato Research Station, Patna, India. Three technological interventions were introduced in the adopted villages of respective places. Seeds of Kufri Ashoka and 92-PT-27 were distributed among ten farmers and each farmer planted K. Ashoka, tuberlet (92-PT-27) and local variety of their respective places for comparative evaluation. About 200msq. of area was used by farmers for each treatment in all three locations. Seed treatment was ensured with Bavistin 50 WP (fungicide) @2g/kg seed half an hour prior to sowing. Preventive measures have been taken during cold and humid weather in between second fortnight of December to January by spray of redomil.@2lt/ha.

Table.1 Evaluation of 92-PT-27, Kufri Ashoka and local check of respective places for potato cultivation (2012-14)

Observations	Supaul (2012)			Madhepura (2013)			Banka (2014)		
	92-PT-27	Kufri Ashoka	Local check	92-PT-27	Kufri Ashoka	Local check	92-PT-27	Kufri Ashoka	Local check
Germination %	97.6	92.9	81.2	94.2	90.5	79.8	96.7	89	80.3
Late blight incidence %	5	22	80	5	25	82	3	20	75
No. of tubers per plant	13	11	8	12	11	8	13	10	9
Avg. wt. of tubers / plant	484	396	255	448	384	267	467	344	288
Yield per hectare (q)	285.4	276.3	211	288	272.4	206	282.6	275.6	204.2
CD @ 5% (yield)	1.80			2.22			2.15		

Table.2 Pooled data of three different locations

Sl. No.	Parameters	Treatments		
		92-PT-27	Kufri Ashok	Local Check
1.	Germination %	96.16	90.8	80.43
2	Late blight incidence %	4.33	22.33	79.0
3	No. of tuber/plant	12.67	10.67	8.33
4	Wt. of tuber/plant (gm)	466.33	329.33	270
5	Yield/ha (q)	285.33	274.77	207.06
CD@5% 6.384				

Table.3 Comparative cost of cultivation (per hectare)

	Different Operation	92-PT-27	Kufri Ashoka	Local check
1.	Field preparation by tractor & planking	Rs. 3000	Rs. 3000	Rs. 3000
2.	Cost of seed	13q@ Rs.1800/q= 23400	28q@Rs. 1800/q= 50400	28q@Rs.1200/q=33600
3.	Fungicide @Rs 1500/kg	Not applied	2dose@2kg/ha= 6000	3dose@2kg/ha= 9000
4.	Fertilizer 150:80:100			
i.	Urea	1400	1400	1400
ii.	DAP	2400	2400	2400
iii.	MOP	1500	1500	1500
	Total (i+ii+iii)	5300	5300	5300
5.	Irrigation @ Rs.250	4x250= 1000	3x250=750	4x250=1000
6.	Manpower @ Rs.142 / day			
a.	For land preparation	20	20	20
b.	For seed sowing	40	40	40
c.	For fertilizer application	08	08	08
d.	Per fungicide/ spray (2)	No spray	2 spray= 4	3 spray=6
e.	Per irrigation (2)	4 irrigation =8	3 irrigation = 6	4 irrigation = 8
f.	For earthing up	40	40	40
g.	For harvesting	50	50	50
	Total manpower (a+b+c+d+e+f+g)	166	168	172
	Total cost of manpower	166 x 142= 23572	168 x 142= 23856	172 x 142=24424
	Total cost of cultivation (1+2+3+4+5+6)	**59784**	**88256**	**76324**
	Yield(quintal/ha)	285.33	274.77	207
	Gross return (Rs.600/q)	171198	164862	124200
	Net return	**111414**	**76606**	**47876**
	BC Ratio	**2.86**	**1.87**	**1.63**

Fig.1 Comparative evaluation of infestation of late blight in tuberlet, Kufri Ashoka and local check over three locations at Supaul (2012), Madhepura (2013) & Banka (2014)

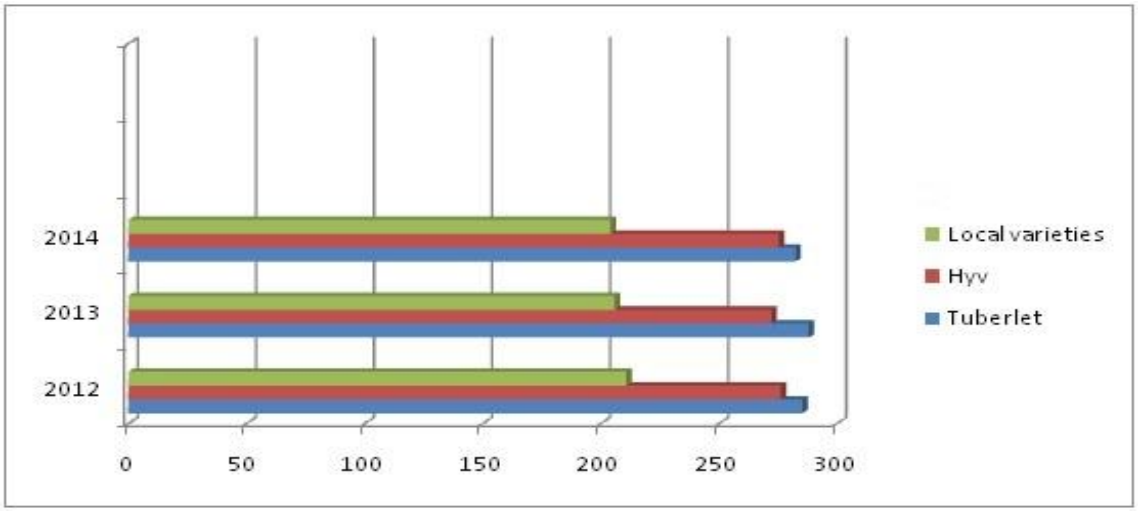
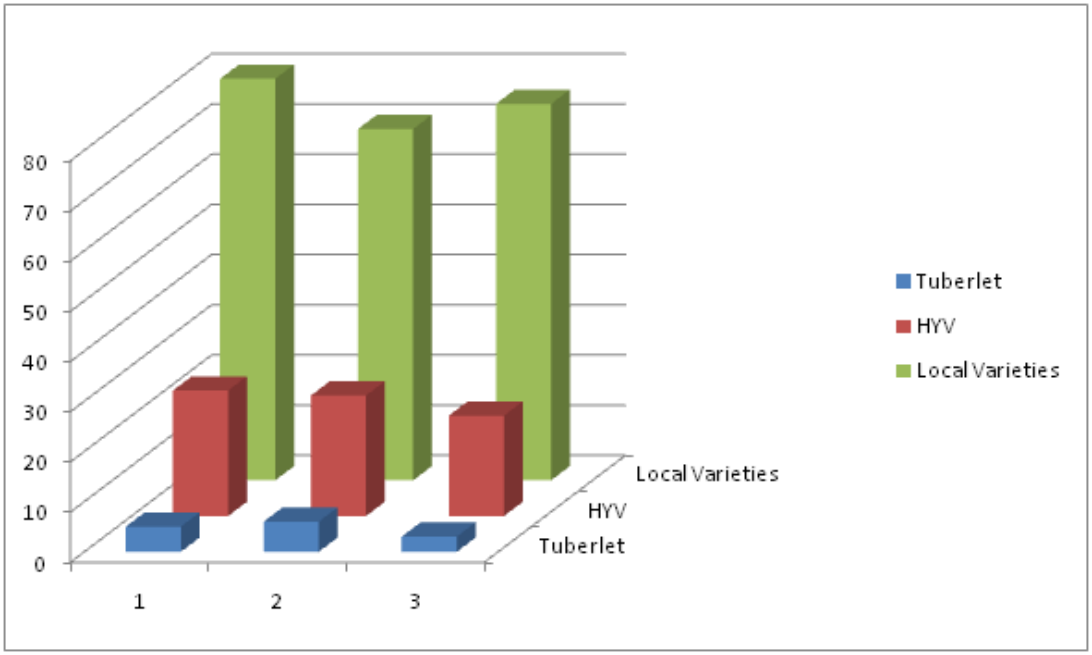


Fig.2 Comparative evaluation of yield for tuberclet (92-PT-27), Kufri Ashoka and local check in year 2012 (Supaul), 2013(Madhepura) and 2014(Banka)



Kufri Ashoka was protected from pathogen *Phytophthora infestans*, which causes late blight by spraying the chemical twice whereas three applications of the same chemical was required for the protection of local check. Fungicide was not necessary in potato variety 92-PT-27. The evaluation was done on the basis of yield attributing characters namely germination percentage, number of tubers per plant, incidence of late blight and yield of tuber.

Results and Discussion

There were significant differences among all the character which are germination percentage, number of tubers per plant, incidence of late blight and yield among all three treatments namely farmers' variety, Kufri Ashoka and 92-PT-27. The pooled data of yield for 92-PT-27 was 285.33 q/ha which was significantly higher than local check.

Infestation of late blight for the 92-PT-27 at different locations was low (3-5 %) during the trial years. However, 20-25% incidence was recorded in high yielding varieties during these years while maximum infestation was observed in the local check at all three locations (75- 82%) for the same time period. As the infestation of late blights in 92-PT-27 were found to be insignificant at all the locations, the application of fungicide was futile, hence producing potatoes free of fungicides for consumption. Similar results were reported by Khan *et al.*, (2010). Besides lowering the cost of cultivation, it also helps in reduction of soil pollution.

Out of the three technological interventions, adoption of TPS (92-PT-27)) technology proved to be better than the other two interventions. As the tuberlets of 92-PT-27 are smaller in comparison to the tubers which are used as seeds for local check or Kufri Ashoka, less amount of seeds were required for each hectare. Thus, the cost of cultivation was found to be highest for Kufri Ashoka followed by local check, which had less cost due to cheaper seeds. The cost was least for 92-PT-27 due to introduction of tuberlet technology (Table-2). The BC ratio was also observed to be highest in 92-PT-27 (2.86) mainly because of tuberlet technology followed by Kufri Ashoka (1.87) and local check (1.63). Therefore, it could be easily adopted by farmer as low cost technology. The crops grown from seed tubers have other drawbacks as well. The seed tubers are fresh, heavy, bulky and expensive to transport over long distances. Also, the tubers may also get destroyed or sprout too early, thus leading to losses. Some of them also sprout poorly inducing lower yields. This is a result of non-availability or high pricing of quality seed tubers. Thus, it can be seen that this technology has immediate relevance in the regions where quality seeds are not available. The seeds used by farmers were degenerated fast and hence needed frequent replacements. Tuberlet (92-PT-27) as low cost alternative for Potato production is suitable for Bihar. It is free from diseases and also gives healthy insecticide free potato.

As per evaluation, there is a need for awareness programs and training of marginal farmers of Bihar to adopt this technology; the use of tuberlet for increasing the productivity as well as for the sustainable potato production in the future will be profitable. Hence, the 92-PT-27 emerges as a low cost alternative of potato production suitable for diverse agro climatic conditions in Bihar.

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