

Improving farmer based seed systems in sub-tropical highlands of Nagaland, India

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Abstract

Inadequate and untimely supply of planting material and high transportation cost limits potato productivity in Nagaland. The improved seed production technologies such as positive and negative seed selection and utilizing TPS derived planting materials were evaluated for maintaining better seed health and to use same seed for greater generations without significant reduction in economic yields. Farmers and extension workers were trained on different seed production techniques. The seed produced by positive selection, multiplied from basic seed supplied in 2007 and produced from conventional system by five farmers each were evaluated at two locations in 2008. The fresh basic seed of Kufri Jyoti was supplied for comparison. At one location, the fresh basic seed gave significantly higher tuber yield (18.9 t/ha) compared to 13.9 t/ha of conventional seed and practices. The second generation basic seed and seed produced by adopting positive selection techniques also gave greater yield than local seed. The suitability of TPS as cheap quality seed source was also studied. In 2006 summer, 600 gram TPS was provided to "Self Help Group" who produced 50 MT quality tuber seed by transplanting in 5ha. In 2007, six individual farmers and a Self Help Group of 10 women farmers produced 20 MT healthy seed tubers. TPS derived seeds yielded 18.6 t/ha compared to 17.4 t/ha of traditional seeds. The Department of Agriculture facilitated the marketing of TPS derived seed tubers. The farmers response was encouraging for both improved clonal seed production technologies and for TPS as supplement planting material.

Keywords: Positive and negative selection technologies, True Potato Seed.

Introduction

Potato is an important food and cash crop for the farmers of Nagaland. The potato yield of Nagaland is just 8.6t/ha compared national yield 18.9t/ha. Inadequate and untimely supply of planting material to farmers and high transportation cost from North India are the main limiting factors for poor productivity. The seed supplied by public sector meets a meager demand. Farmers in this region use highly degenerated seed that reduces productivity. State Department of Agriculture purchases certified and foundation seeds at exorbitant prices from Himachal Pradesh State (North India) to distribute among farmers. Improving farmers own seed system needs to be implemented to increase potato productivity. With the improved seed production technologies such as positive and negative seed selection, farmers could use the same seed for more generations without significant reduction in yields. International Potato Center (CIP-SWCA) and Department of Agriculture Nagaland have jointly assisting farmers to improve their seed systems. In the year 2007 and 2008, farmers of Khuzama and Kigwema blocks of Kohima district in Nagaland were trained on improved seed selection systems. In addition, the True Potato Seed (TPS) technology was also implemented in Wokha district. TPS technology is found to be an alternate for the existing seed system. The objective of the present work was to enhance income of resource poor farmers of Nagaland by increased potato productivity through quality seed.

Material and methods

Two blocks of Kohima district were selected as models to evaluate and execute the positive and negative seed production techniques. Twenty and ten farmers were selected to evaluate and compare positive and negative

seed production techniques respectively with traditional system in 2007. The farmers planted their own seed and adopted local cultural practices. The first visual observation to select healthy looking plants free from diseases mainly viruses were taken after 30 days of planting. The healthy plants selected and pegged were monitored regularly. The pegged plant/plants were rejected if they show any disease symptoms before deahulming. The selected plants were harvested separately. The produce of plants giving greater and uniform tuber number and shape were selected and bulked. The plants not giving satisfactory yields were rejected. The selected tubers of healthy plants were treated with 3% boric acid to check spread of tuber skin borne diseases. The treated tubers were dried and stored for next year planting. To evaluate negative selection technology, the basic seed of variety Kufri Jyoti was supplied to the farmers as starting material for multiplication. The tuber seeds produced in 2007 through positive and negative selection techniques were compared with traditional practices. The data recorded was analyzed statistically for analysis of variance by using RBD (Panse and Sukhatme, 1978).

During 2006, a Self Help Group (SHG) of 28 farmers of Wokha district formed for on farm demonstration trials. Two TPS families 92-PT-27 and HPS-1/13 were used as starters for this experiment. Test location was in Nagaland at 1500MSL. There was staggered sowing of TPS in nursery beds. A total of 3.0 ha land was transplanted with HPS 1/13 and 2.0 ha with 92-PT-27. seedlings were transplanted at 60X30 cm. Seed tubers were harvested and stored in traditional stores. During 2007, a women self help group consisting of 10 farmers and 5 individual farmers were selected for the study. A total area of 2.0 ha was under study. Same methodologies as that of previous year were used carry out the study. .

Results and discussion

In 2007, 14 farmers out of 20, implemented the positive selection properly. The average tuber number and weight/plant in Khuzama and Kigwema of selected plants varied between 7-14 and 260-735 gm, respectively (Table 1). The farmers were able to harvest 4008 tubers from healthy looking plants from their fields for next year multiplication. The farmer looked positive for new technology and showed confidence that they could improve the health standard of their seed which they have using for many generations.

Seeds from 2007 year's positive and negative selection were planted during 2008 to compare their performance with fresh basic seeds and traditional system. The significant higher yields were obtained by improved seed and practices when compared with local seed and practices (Table 2). The highest yield of 18.9 t/ha and 21.6 t/ha were obtained from basic seed in Khuzama and Kigwema, respectively. The planting of healthy seed and practicing improved seed production technologies enhanced the tuber number and weight. The seed plot (improved) technique is recommended to enhance income of seed potato farmers through increased productivity (Kumar *et. Al*, 2000). In both the villages, average tuber weight was found to be significantly higher by improved practices than local practices. In Khuzama, the positively selected seed tubers from local seed in 2007 gave significantly higher marketable yield than local seed (mixture) when planted in 2008 (Table 2). Gildemacher *et.al* (2007) reported that, positive selection a valuable addition to commercial production of seed potatoes.. . In both villages average tuber weight from improved practices were significantly higher than local practices.

The fellow farmers of two villages where positive selection was implemented to improve local seed quality were convinced that they can also improve their own home used seed for enhanced productivity and improved quality through positive selection. 15 new farmers of two villages adopted positive selection at their fields. The observations recorded on the quality seed produced through positive practices are presented in Table-3. The average tuber number and weight/plant in Khuzama and Kigwema of selected plants varied from 7-13 and 315-645 gm, respectively. The farmers harvested 3959 tubers from healthy looking plants which they will use as quality seed for commercial potato production in 2009.

The area covered and tuber yield obtained by farmers during 2006 from TPS are presented in the Table 4. A total of 52.5 tones of seed potato was produced in 5 ha area with average yield of 10.5 t/ha. It was also observed that, the TPS family 92-PT-27 took longer time for germination. The performance of the 92-PT-27 was a better than HPS 1/13. The tubers produced from 92-PT 27 were oblong and bigger whereas HPS 1/13 are round and small. The survival rate of seedling at the time of transplanting was very high about 85%. Farmers showed much interest towards TPS technology. Self Help Group made a country store of locally available materials to store TPS produce to use as seed in the next season. Due to declaration of year of farmers by Nagaland state, seed tubers of Kufri Jyothi and Kufri Giriraj were supplied to farmers at free of cost. Farmers did not show much interest on

TPS technology during the year 2007. 220 gm TPS (HPS 1/13) from Tripura government were distributed to a self help group and five farmers. 20 tones of seed tubers were produced from 2 ha field by transplanting method. The crop grown with the TPS were found to be more tolerant to blights.

Table 1. Quality seed produced by farmers through positive selection in Nagaland, 2007

Farmers	Number of plants		Tubers number and weight of plants harvested		Average tuber number and weight/plant		Average tuber weight (g)
	Harvested	Selected in starting	Number	Weight (kg)	Number	Weight (g)	
1	60	23	180	9.4	8	408	52
2	55	50	433	27.8	9	556	64
3	110	61	419	28.5	7	468	68
4	55	28	194	8.0	7	285	41
5	60	20	148	7.3	7	363	49
6	100	30	222	18.3	7	610	82
7	55	30	209	8.2	7	274	39
KHUZAMA VILLAGE							
1	75	36	289	16.5	14	555	43
2	79	41	310	20.5	11	735	73
3	60	33	174	13.81	10	570	58
4	60	50	492	29.75	11	680	60
5	70	49	388	22.45	9	535	63
6	38	31	213	8.4	8	260	36
7	80	46	337	18.23	7	498	73

It is clear from the Table 2 that, the average yield obtained from TPS derived planting materials was higher compared to traditional seed tubers. On an average, 18.6 t/ha yield was obtained from TPS derived planting materials compared to 17.4 t/ha yield of traditional seeds. Plants from traditional seed showed leaf curl and chlorosis symptoms.

Table 2. Comparative performance of different seed categories and practices at farm level in Nagaland, 2008

Seed Categories/Practices	Average tuber number/plant	Tuber yield t/ha			Average tuber weight (g)
		Marketable (>.20g)	Non-Marketable (<20g)	Total	
KHUZAMA VILLAGE					
Local seed selected positively/improved practice	5	14.3	2.2	16.5	40
Basic seed second yr./improved practice	7	15.1	1.7	16.9	34
Basic seed first yr./improved practice	8	16.8	2.1	18.9	34
Local seed/local practice	8	11.1	2.8	13.9	21
CD at 5%	1	3.0	0.6	3.0	6

Seed Categories/Practices	Average tuber number/plant	Tuber yield t/ha			Average tuber weight (g)
		Marketable (>.20g)	Non-Marketable (<20g)	Total	
CV%	19	20.0	27.9	15.0	25
KIGWEMA VILLAGE					
Local seed selected positively/improved practice	7	16.1	2.0	18.1	33
Basic seed second yr./improved practice	7	14.5	1.9	16.4	30
Basic seed first yr./improved practice	11	19.4	1.5	21.6	32
Local seed/local practice	9	13.8	2.5	16.8	24
CD at 5%	1	3.0	0.5	NS	NS
CV%	23	18.1	24.4	18.9	22.1

Table 3. Quality seed produced by farmers through positive selection in Nagaland, 2008

Farmers	Number of plants		Total tubers number and weight of plants harvested		Average tuber number and weight/plant		Average tuber weight (g)
	Selected in starting	Harvested	Number	Weight (kg)	Number	Weight (g)	
KIGWEMA VILLAGE							
1	45	29	232	9.0	7	315	47
2	49	38	370	13.5	13	545	44
3	36	26	167	8.5	7	345	50
4	47	32	247	14.5	9	610	72
5	49	28	243	13.0	12	645	52
6	42	34	254	14.0	9	530	62
7	31	22	128	10.0	7	495	73
8	39	32	214	15.5	7	555	80
KHUZAMA VILLAGE							
1	47	45	312	18.5	13	520	41
2	39	36	356	22	12	570	50
3	58	55	324	21	10	480	49
4	48	40	378	23.5	11	600	57
5	42	34	298	16	11	515	46
6	51	42	325	12	8	475	59
7	45	42	325	12	7	405	59

Av. tuber number: average tuber wt are mean of 10 plants

Table 4. Potato production using TPS by transplant method

TPS family	Quantity of TPS given (gm)	Area covered (ha)	Total tuber Yield (tons)	Average (t/ha)
HPS I/13	300	3.0	29.5	9.8
92-PT-27	200	2.0	23.0	11.5

Table 5. Yield comparisons between traditional seeds and TPS derived tubers

Farmer	Yield (Kg/plot)		Yield (ton/ha)	
	Tubers from TPS	Traditional seed	Tubers from TPS	Traditional seed
1	22	21	19.80	18.90
2	19	18	17.10	16.20
3	21	19	18.90	17.10
Average	21	19	18.60	17.40

Size of plot: 9m²

Number of replications in each farmer's field: 3

Conclusions

During the year 2007, farmers were able to produce nearly 237 kg of healthy potato seeds by positive selection technique. The planting of healthy seed and practicing improved seed production technologies enhanced the tuber number and weight. In 2005-06, 52.5 MT of tubers were produced from direct transplanting of TPS in 5 ha land and were distributed to farmers. During 2006-07, 20 MT of seed tubers were produced from 2 ha field by transplanting method. TPS derived planting materials yielded better than traditional varieties under in same agro-ecology.

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