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Full Length Research Article

"Sialkot-Red" A high yielding, short season, red skinned potato variety

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Abstract

"Sialkot Red" is a high yielding, short season (early bulking), red skinned variety of potato (Solanum Tuberosum L).It was developed by Potato Research Station, Sahowali (Sialkot) by crossing "SH-5" and "Cardinal" during summer 2005 at its Potato Breeding Sub-Station, Murree followed by clonal selection in 2006. The developed variety "SH-1035" was evaluated against the standard variety "SH-5" in different yield trials during 2008-2016. On an average, in NUYT (National Uniform Yield Trials), it exhibited 29.5% higher tuber yield than the standard variety with the average and potential yield of 27.6 t/ha and 46.7 t/ha respectively. Its plant is medium in length (55mm-60mm) with 7-9 semi-erect stems per plant and 10-12 green compound leaves per stem. It takes 90-100 days to mature. Its tuber is medium in size and oblong in shape having 7-9 shallow eyes. It bears 8-9 tubers per plant. It performs best with 75cm row to row and 20cm plant to plant spacing. Its optimum sowing time is last week of October. It requires 8-10 irrigations and 100-50-50 kg/hectare NPK fertilizer. High tuber yield, early bulking and tolerance against frost and blight are major attributes of this new potato variety.

Keywords: Potato, hybridization, evaluation, tuber yield, bulking, variety, tolerance

Introduction

Potato is 4th important food crop after wheat, Rice and Maize. It has great potential to bridge the gap between food demand and supply and address the challenge of food security due to its highest productivity per unit area (Devaux *et al*., 2014). It is a poor man's diet, being low cost, rich in starch, good source of vitamins and minerals. In Pakistan, potato was cultivated on an area of 179.3 thousand hectare with the production and average yield of 3849.5 t/ha and 21.5 t/ha respectively during 2016-17 (Economic survey of Pakistan, 2016-17). Total 90% of Pakistan's potato production is contributed by Punjab province, 70% of which comes from the Districts of Okara, Sahiwal, Pakpattan and Kausar, which is known as potato core area. Seed plays a key role in the production of any crop and same is the seed potato for potato crop. In Pakistan, Potato crop is raised mainly from the seed potato of the exotic potato varieties imported by the commercial seed companies which on one hand is very costly and on the other hand vulnerable to frost and diseases (Plant and Tie, 1998). So, the importance of locally bred potato varieties cannot be denied, which are not only high yielding but also tolerate the biotic and abiotic stresses (Almekinders *etal*., 2014). In the current scenario of climate change (late onset of winter) and downfall of potato market rates during full crop season, the concept of short season (early bulking) potato varieties has gained much importance. So, it warrants to develop high yielding potato varieties which can better withstand the local environmental hazards and give good marketable tuber yield on early digging, this will fetch reasonable profit for the potato growers (Howard, 1977). The existing early bulking potato variety "SH-5" has become susceptible to late blight and viruses. So, there was dire need to evolve a new high yielding, climate resilient potato variety tolerant to biotic and abiotic stresses with wider adaptability (Pavek *et al*., 1981). Hence, it was planned to develop a new climate resilient, short season (early bulking), high yielding and tolerant to frost and diseases potato variety (Woldegiorgis *et al*., 2008). The research work executed by the researchers of Potato Research Institute, Sahiwal, Potato Research Station, Sahowali (Sialkot) and Potato Breeding Sub-Station, Murree resulted in the release of a climate resilient, disease and frost tolerant high yielding red skinned potato variety "Sialkot Red" general cultivation in potato core and sub-core areas of Punjab.

Materials and Methods

The potato variety "Sialkot Red" was developed by crossing the two existing potato varieties "SH-5 and "Cardinal". SH-5 was selected for early bulking & high tuber yield while cardinal for yield and other desirable characters. The hybridization was accomplished during summer 2015 at PBSS, Murree. True potato seed (TPS)/ Botanical seed were extracted from the berries and nursery was raised during summer 2006 in pots. Healthy plants were tagged and the minitubers obtained from them were stored for raising next crop during summer 2007. The individual clones were kept under keen observation and the desirable ones were selected and shifted to Potato Research Station,

Sahowali (Sialkot) during 2008 for further evaluation including primary evaluation (2008-09), secondary evaluation (2009-10), station yield trials (2010-13) and out station/National Uniform Yield Trials from 2014-16 in which the experimental variety/strain "SH-1035" was evaluated against the existing standard check varieties "SH-5" and "Sante". On the basis of overall performance, it was presented to be released for general cultivation. Agronomic, Plant Pathological and DUS studies were accomplished simultaneously. The agronomic requirements were determined and data regarding late blight reaction were recorded.

Statistical Analysis

All the experiments were sown under Randomized Complete Block Design (RCBD) with three replications and the recorded data in above experiments were subjected to analysis of variances (ANOVA) and the mean comparison test (LSD) was performed to compare mean values.

Results and Discussion

Station (Secondary evaluation, Varietal & Advance varietal) yield trials

The results (Table. 1) reveal that the new variety "Sialkot Red" exhibited 27.5 t/ha average tuber yield in station yield trials which is 23.3% higher than that of the check variety "SH-5" (22.3 t/ha) ranging from 12.4 t/ha to 40.3t/ha.

National uniform yield trials

These trials were conducted consecutively for two years i.e. 2014-15 and 2015-16 across the country. The data (table.2) reveal that the new variety Sialkot Red showed 31.3% (23.9 t/ha) to 52.1% (32.7 t/ha) higher tuber yield than the check variety "Sante" which showed 18.2 t/ha and 21.5t/ha tuber yield respectively. In trials, average performance of "Sialkot Red" exhibited 42.2% higher tuber yield (28.3t/ha) than of the check variety Sante (19.9t/ha). On summarizing the yield data (table 3), it is revealed that the new variety "Sialkot Red" surpassed the checks (22.7 t/ha) by 29.5% for tuber yield on pooled average basis with 29.4t/ha (Abebe et al., 2013).

Reaction towards diseases

In pathological studies conducted during 2014-15 and 2015-16, "Sialkot Red" was found to be fairly resistant to late blight in comparison with the check variety "SH-5" which showed susceptibility in the same environment condition.

General Discussion

Potato crop in Pakistan is cultivated in a wide range of agro-ecological zones and ranks third among food crops following wheat and rice. In Pakistan potato is cultivated over 0.179 million hectares with production of 3.85 million tons (GOP, 2017). Its average yield is 21.5 tones per hector which is far less as compared to other potato growing countries. There are number of factors responsible for its low productivity. One of the most important factors is that potato crop in those temperate countries is grown under long days and long growing season of 160-180 days. In contrast, major portion of the crop in Pakistan is grown in sub-tropical plains under short days and short growing season of 90 days (Pandey, 2007). So there was a need to evaluate such varieties which are high yielding, early bulking and resistant to late blight and viruses. Therefore, a breeding program had launched by Potato Research Station Sahowali, Sialkot to develop new varieties which were best suited to local conditions. The potato variety "Sialkot Red" was developed by crossing the two existing potato varieties "SH-5 and "Cardinal". SH-5 was selected for early bulking & high tuber yield while cardinal for yield and other desirable characters. The resultant cross was evaluated under local conditions and further evaluated under National uniform yield trials in which its performance proved it to be high yielding, early bulking and disease resistant variety "Sialkot Red" as compared to standard checks used in this breeding programme.

Conclusion

"Sialkot Red" is a short season/early bulking, red skinned, high yielding and disease resistant potato variety with 90 days maturity. Its average tuber yield is 27.6 t/ha with the potential of 46.7 t/ha. It fairly bridges the yield gap between locally produced Potato varieties and world potato production.

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Table. 1: Yield Performance of "Sialkot Red" in Station yield trials

Year	Title of the Trial	Tuber yield (t/ha)		LSD at 5%	Increase over check (%)
		Sialkot Red	SH-5		
2009-10	Secondary evaluation yield trial	46.7	40.3	5.23	15.9
2010-11	Varietal yield trial	28.3	25.0	4.03	13.2
2011-12	Varietal yield trial	20.7	15.4	N.S.	34.7
2012-13	Varietal yield trial	19.6	12.4	3.34	58.1
2013-14	Advance varietal yield trial	22.0	18.5	3.78	18.9
	Average	**27.5**	**22.3**		**23.3**

Table. 2: Yield Performance of "Sialkot Red" in National Uniform Yield Trials

Year	No. of locations	Tuber yield t/ha		Increase over check %
		Sialkot Red	Sante	
2014-15	3	32.7	21.5	52.1
2015-16	4	23.9	18.2	31.1
	Average	**28.3**	**19.9**	**42.2**

Table. 3: Evaluation of Sialkot Red for late blight resistance

Year	Entry	Late blight (%)	Reaction
2014-15	Sialkot Red	10	Fairly resistant
	SH-5	50	Susceptible
2015-16	Sialkot Red	10	Fairly resistant
	SH-5	40	Susceptible
Average	Sialkot Red	10	Fairly resistant
	SH-5	45	Susceptible

Table. 4: Yield performance of "Sialkot Red" (summarized)

	No. of trials	Average tuber yield t/ha		Increase over check %
		Sialkot Red	Check SH-5	
Station yield trials	5	30.5	25.2	19.6
National Uniform Yield Trials	7	28.3	19.9	42.2
Pooled average		29.4	22.7	29.5

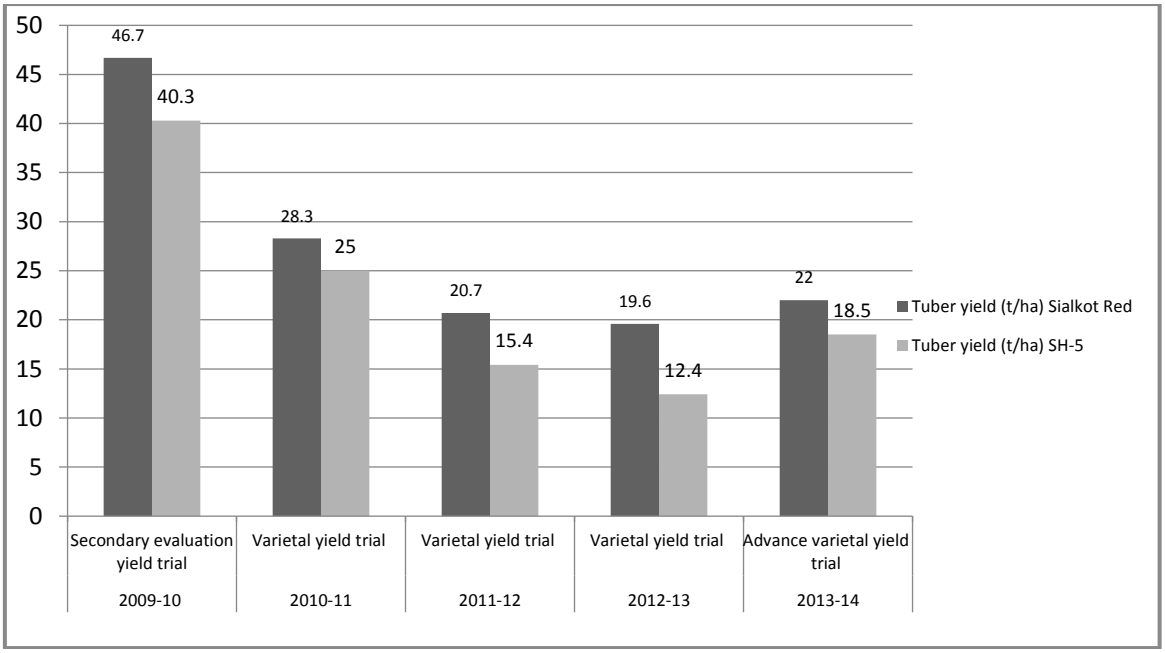

Fig.1 Yield Performance of "Sialkot Red" in Station yield trials

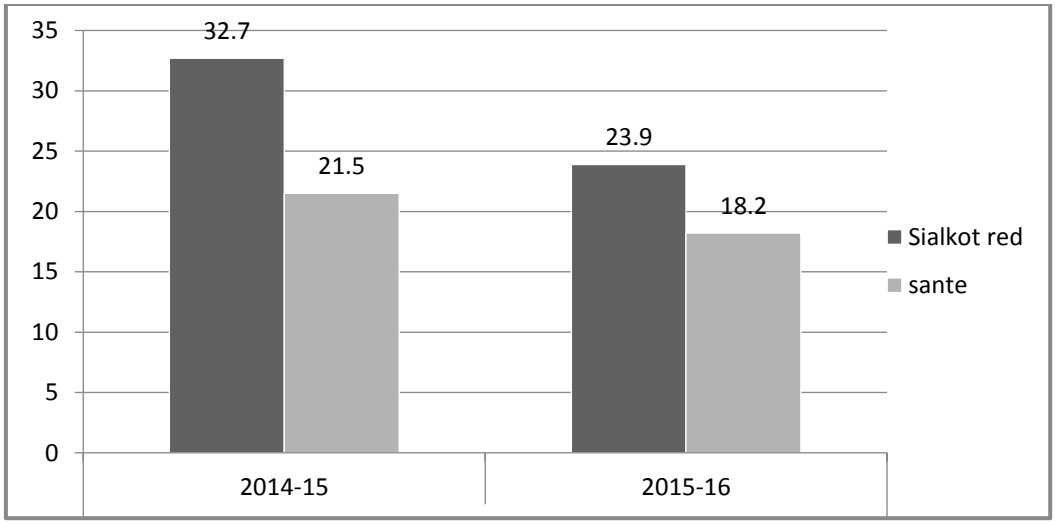

Fig.2 Yield Performance of "Sialkot Red" in National Uniform Yield Trials

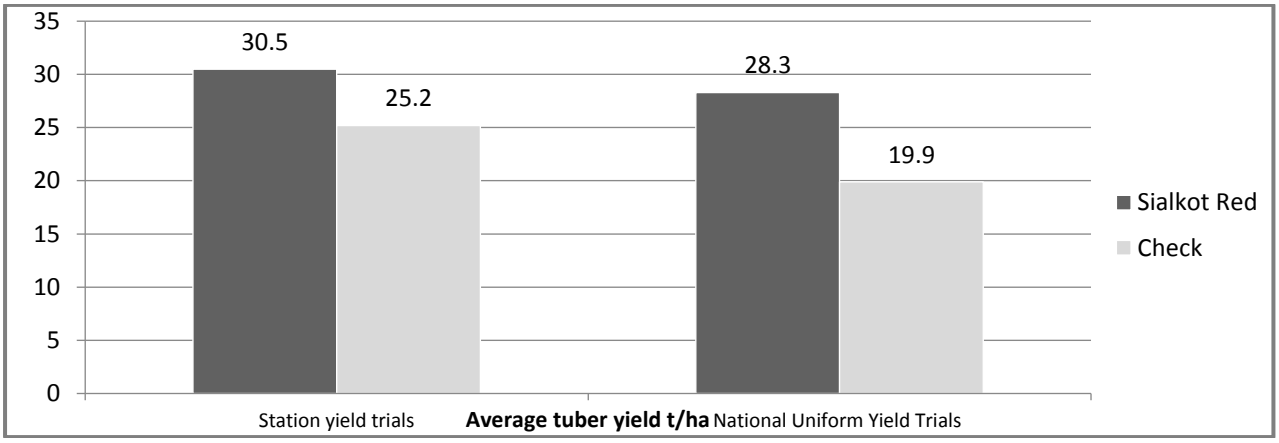

Fig.3 Summarized Yield performance of "Sialkot Red"