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Screening of heat tolerant potato varieties for their yield potentiality in Karnataka

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Abstract

A field study was conducted on screening of heat tolerant potato varieties for three consecutive years from 2015 to 2017 at HREC, Hassan, Karnataka under AICRP-Potato. An experiment was laid out in RCBD with four replications. The crop was sown at standard spacing of 60 cm X 20 cm with soil application of recommended dose of fertilizers of 75: 75: 100 kg NPK per hectare and FYM (25 t/ha). The varieties such as Kufri Lima, Kufri Surya and Kufri Himalini were evaluated for marketable, total tuber yield and dry matter during harvest at 75 and 90 days after planting. The pooled data of three years indicated that, Kufri Lima documented highest marketable tuber yield of 17.86 and 17.53 t/ha and total tuber yield of 18.98 & 19.31 t/ha at 75 and 90 DAP followed by Kufri Himalini recorded 14.36 & 16.98 t/ha of marketable tuber yield and 16.36 & 19.24 t/ha of total tuber yield at 75 and 90 DAP, respectively. Whereas, dry matter percentage was noticed significantly highest in Kufri Himalini (19.88%) followed by Kufri Surya (19.48%). Therefore, it was concluded that Kufri Lima was found best suitable heat tolerant variety for cultivation in Karnataka during *Kharif* season.

Keywords: Potato, heat tolerance, varieties, yield and dry matter

Introduction

Potato (*Solanum tuberosum* L.) is an annual, herbaceous, tuber crop of family Solanaceae that contains almost all the essential food ingredients required for maintaining proper health. Hence, cultivar selection is very important for growers trying to produce market quality product. The farmers need varieties that shows high performance towards yield and other essential agronomic traits having reliable superiority over a wide range of environmental conditions and also over the years. An even though India stands in fourth place with respect to the production of potato in the world, but the productivity is very low as compared to other advanced countries. The possible reason could be varied agro-climatic conditions. The higher productivity could be achieved by selection of proper varieties specific to areas and other agronomical practices.

In India potato is grown under diverse agro-climatic conditions, where planting and harvesting periods are different. In the hills, it is grown during March-April to August-September, while in the Indo-gangetic plains; it is grown during October-November to January-February. In certain states, like Karnataka, Maharashtra, Jharkand and hills of Chhattisgarh, it is grown during *Kharif* season from June-July to September-October. In general climatic requirements for potato cultivation are similar to that of temperate to sub-tropical regions. About 18-20°C temperature is favorable for tuberization. The tuberization is adversely affected, when temperature rises above 30 °C. Thus, finally open sunny days coupled with cooler nights are favourable for high bulking of tubers. However, heat tolerant varieties are highly suitable to Karnataka region because of fluctuation in temperature. Keeping in view of the above point, the study was planned to screen heat tolerant potato varieties for their yield potentiality in Karnataka.

Materials and Methods

The present investigation was conducted at the Horticultural Research and Extension Center, Somanallikaval, Hassan for three consecutive years during the *Kharif* season from 2015 to 2017.

An experiment was laid out in Randomized Complete Block Design (RCBD) with four replications and three varieties (Kufri Lima, Kufri Surya and Kufri Himalini). The treatments were allocated to different plots by using random method (Gomez K. A. and Gomez A. A., 1984) [4]. An experimental plots were 3m x 3m and each plot consisted of 5 rows keeping spacing of 60 cm in between row to row and 20 cm between plant to plant. A well rotten farm yard manure of 25 tones for hectare was incorporated in all plots in equal quantity. It was well mixed in the soil and ridges were prepared at 60 cm apart in each plot. The height of ridges was kept at 20 cm. The recommended dosage of NPK 75:75:100 kg/ha was incorporated. The full dose of phosphorous & potassium and half dose of nitrogen were applied at the time of planting. The weeding and earthing-up operations were practiced with the top dressing of nitrogen fertilizer at 30 days after planting. An observations of different growth parameters, yield parameters and dry matter were recorded as follows.

Growth parameters

Plant emergence (%) at 30 days after planting

$$\text{Plant emergence (\%)} = \frac{\text{Total number of tubers germinated}}{\text{Total number of tubers sown}} \times 100$$

Plant spread (cm²)

The plant spread was measured in north to south and east to west direction from five randomly selected plants at 45 days

after planting and average of plant spread was calculated in centimeter square.

Yield parameters

Marketable tuber yield (t/ha)

Out of total tubers obtained in each plant, tubers were sorted in to four different grades based on their weight as small (<25g), medium (26-50g), large (51-75g) and extra-large (>76g). Of these, excluding small tubers all other grades were considered as marketable and weight was recorded further using this data marketable tuber yield per hectare was calculated.

Total tuber yield (t/ha)

Total tuber yield (t/ha) = Marketable tuber yield (t/ha)+small tuber yield (<25 g)

$$\text{Dry matter (\%)} = \frac{\text{Dry weight (g)}}{\text{Fresh weight (g)}} \times 100$$

Disease scoring

Late blight incidence and late blight intensity were also computed using the following formula and Malcomson scale.

$$\text{Late blight incidence (\%)} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

$$\text{Late blight Intensity (\%)} = \frac{\text{Sum of individual ratings}}{\text{Total number of plants}} \times \frac{100}{\text{Maximum scale}}$$

Table 1: Malcomson scale

Area Infected (%)	Score
Trace of infection	9
10	8
11-25	7
26-40	6
41-60	5
61-70	4
71-80	3
81-90	2
Collapsed	1

Results and Discussion

The results obtained from the present investigation as well as discussion have been summarized under the following heads:

Growth parameters

There was no significant difference between varieties regarding plant emergence (%) and plant spread (cm²) (Table 2).

Yield parameters and late blight incidence percentage

The data on marketable tuber yield, total tuber yield at 75 and 90 days after planting are furnished in Table 3 & 4, Fig 1 & 2. The pooled two years data at 75 DAP and three years data at 90 DAP indicated that, Kufri Lima documented highest marketable tuber yield of 17.86 and 17.53 t/ha and total tuber yield of 18.98 and 19.31 t/ha at 75 and 90 DAP with tolerance to late blight disease (3.27%) followed by Kufri Himalini recorded 14.36 & 16.98 t/ha of marketable tuber yield and 16.36 & 19.24 t/ha of total tuber yield at 75 and 90 DAP, respectively with late blight incidence of 8.88 per cent. The results of this study are in agreement with Elfinesh (2008) [3]

Asmamaw (2007) [1] and Tekalign (2003) [8] who reported that yield differences among genotypes were attributed both by the inherent yield potential of genotypes and growing environment as well as the interaction of genotype x environment. Singh and Singh (1973) [6] also indicated that yield per unit area is the end product of components of several yield contributing characters, which are highly influenced by the environment. Muthuraj *et al.*, (2005) [5] reported that the effect of heredity was the significant with regard to tuber grades.

Dry matter percentage

The dry matter percentage was noticed significantly highest in Kufri Himalini (19.88%) followed by Kufri Surya (19.48%) at 90 days after planting (Table 4). Burton (1966) reported that genetic differences among varieties in their ability to produce high solids, when grown on the same test plot. The report of Tekalign and Hammes (2005) [7] also indicated that cultivars differed significantly with respect to total dry matter production.

Table 2: Growth parameters of heat tolerant potato varieties at 30 days after planting

Hybrid/ Variety	Plant emergence (%)				Plant spread (cm ²)			
	2015	2016	2017	Pooled	2015	2016	2017	Pooled
Kufri Lima	82.89	84.27	86.20	84.45	44.00	55.10	74.40	57.83
Kufri Surya	92.96	82.15	83.01	86.04	41.00	39.80	42.80	41.20
Kufri Himalini	63.33	79.42	82.04	74.93	43.50	50.50	53.50	49.17
S.Em±	5.75	NS	NS	NS	NS	NS	1.91	NS
CD(p=0.05)	17.20	-	-	-	-	-	6.16	-
CV (%)	12.49	-	-	-	-	-	5.82	-

NS: Non Significant

Table 3: Tuber yield (t/ha) of heat tolerant potato varieties at 75 days after planting

Hybrid/Variety	Marketable tuber yield (t/ha)			Total tuber yield (t/ha)			Dry matter (%)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
Kufri Lima	18.13	17.58	17.86	19.93	18.03	18.98	12.11	16.42	14.27
Kufri Surya	12.55	12.29	12.42	14.80	14.01	14.41	19.82	18.93	19.38
Kufri Himalini	14.07	14.64	14.36	16.18	16.53	16.36	18.70	19.50	19.10
S.Em±	NS	0.87	0.24	NS	0.96	0.60	0.45	0.46	NS
CD(p=0.05)	-	2.55	1.09	-	3.02	2.71	1.45	1.46	-
CV (%)	-	12.46	12.27	-	19.37	15.13	5.38	5.01	-

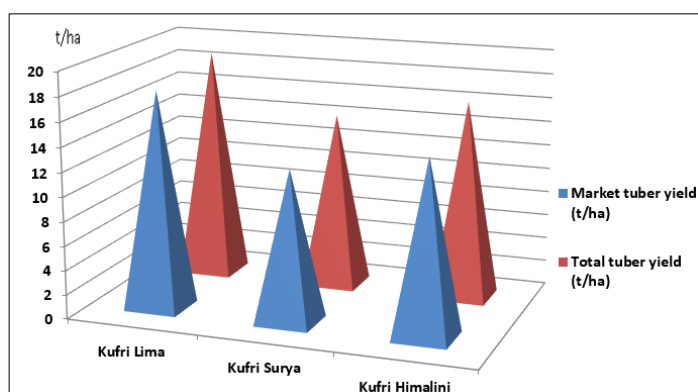
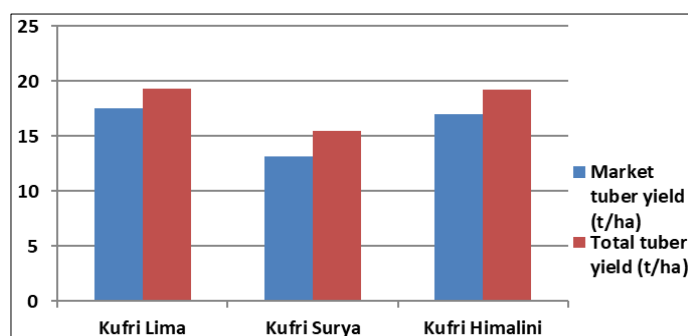
Table 4: Tuber yield (t/ha) of heat tolerant potato varieties at 90 days after planting

Hybrid/Variety	Marketable tuber yield (t/ha)				Total tuber yield (t/ha)				Dry matter (%)			
	2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled
Kufri Lima	12.90	20.86	18.83	17.53	15.40	22.62	19.92	19.31	16.73	15.58	17.50	16.60
Kufri Surya	10.90	15.69	12.97	13.17	12.40	18.04	15.88	15.44	19.00	19.51	19.93	19.48
Kufri Himalini	18.50	16.77	15.67	16.98	20.80	19.18	17.75	19.24	20.02	19.38	20.25	19.88
S.Em±	1.68	1.01	0.97	0.88	1.77	NS	NS	0.91	NS	0.84	0.35	0.38
CD(p=0.05)	5.82	3.49	3.10	2.70	6.13	-	-	2.82	-	2.71	1.13	1.34
CV (%)	19.64	9.87	17.04	18.13	19.35	-	-	17.07	-	9.31	3.66	3.61

NS: Non Significant

Table 5: Performance of heat tolerant potato hybrids against late blight disease tolerance during *Kharif* season

Variety	Late Blight incidence (%)	Late Blight Intensity	Leaf Spot Disease (%)
Kufri Lima	3.27	9	-
Kufri Surya	11.11	7	-
Kufri Himalini	8.88	8	-

**Fig 1:** Marketable and total tuber yield (t/ha) at 75 days after planting**Fig 2:** Marketable and total tuber yield (t/ha) at 90 days after planting

Best performing potato varieties**Fig 3:** Kufri Lima plot view**Fig 4:** Kufri Lima tubers**Fig 5:** Kufri Himalini plot view**Fig 6:** Kufri Himalini tubers**Conclusion**

In the present investigation confirmed the existence of variations among regionally released potato varieties for yields. This justifies that different varieties had different genetic potential across the locations. The results of an experiments conducted at HRES, Hassan on potato revealed that, the variety Kufri Lima was recorded significantly higher yield and tolerance to late blight over other varieties evaluated at this centre in all the three years. Based on the results, it was concluded that Kufri Lima was found best suitable heat tolerant variety for cultivation in Karnataka during *Kharif* season.

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