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Performance of advanced potato hybrids for yield potential and suitability to Southern Dry Zone of Karnataka

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Abstract
A field study was implemented on performance of advanced potato hybrids for three consecutive years from 2015 to 2017 during *Kharif* season at HREC, Hassan, Karnataka under AICRP-Potato. A total of eight hybrids were evaluated by adopting RCBD with four replications. The tubers were planted at 60 cm x 20 cm spacing with soil application of RDF (75:75:100 kg NPK/ha) and FYM (25 t/ha) as per the package of practices of UHS, Bagalkot. The hybrids such as AICRP-P-15, AICRP-P-16, AICRP-P-17, AICRP-P-18 AICRP-C-13, AICRP-C-17, AICRP-C-20 and AICRP-C-24 were adopted for evaluation studies. All hybrids were tested for marketable and total tuber yield during harvest at 75 and 90 days after planting. The pooled data of three years indicated that, hybrid AICRP-P-16 documented highest marketable tuber yield of 15.57 and 20.78 t/ha, total tuber yield of 18.18 and 24.42 t/ha at 75 and 90 DAP, which was on par with AICRP-C-24 (15.01 & 17.76 t/ha) of marketable tuber yield and (17.27& 20.02 t/ha) of total tuber yield at 75 and 90 DAP, respectively. Therefore, it was concluded that hybrid AICRP-P-16 was high yielding and found suitable for cultivation in Southern Dry Zone of Karnataka during *Kharif* season.

Keywords: Potato, varieties, yield and *Kharif*

Introduction
Potato belongs to the genus s*olanum* that comprises about 2000 species of which only less than 10 per cent is tuber bearing. The latin name for the tetraploid potato genotypes that are grown today is *Solanum tuberosum* L with a genomic constitution of 2n = 4x = 48. The diversity in potato explains the wide spread cultivation in all over the world, while individual cultivar appears best suited to specific environments (niches) (Vos, 1999) [7].

In Hassan district of Karnataka, it is grown during *Kharif* season from June-July to September-October. The general climatic requirementfor potato cultivation are similar to that of temperate to sub-tropical regions. About 18-20 ^{0}C temperature is favourable for tuberization. The tuberization is adversely affected, when temperature rises to 30 ^{0}C. Thus, finally open sunny days coupled with cooler nights are favourable for high bulking of tubers.

Besides, one of the most important factor governing on productivity of a crop is the 'variety'. Thus breeding of improved cultivars is of paramount importance. A variety development, however is a continuous process as new biotic and abiotic stresses continue to arise and the variety previously resistant or tolerant to such stresses may become susceptible due to the evolving of new strains/races of the pathogens or insects and also due to emerging abiotic factors. The performance of a variety depends on the agro-climatic conditions under which it is grown and also the purpose for which it has to be used. India has the potential to emerge as a major potato exporter at least in the neighboring countries (Pandey *et al*., 2000) [5]. Due to physiological and geographical advantages like diverse soil types and agro-climatic conditions. The plateau regions of south-eastern, central and peninsular India constitutes about six per cent area, where potato is grown mainly as rainfed or irrigated winter crop.

The higher productivity could be achieved by selection of proper varieties specific to areas and other agronomical practices. In India, a number of improved potato varieties have been released by different research centres and institutions.

However, there are still many farmers who grow not well adapted and poor in yield performance. With the objectives of finding out suitable variety with higher yield potentiality and suitability to Southern Dry Zone of Karnataka following experiment was conducted at HREC, Hassan during *Kharif* season.

Materials and Methods

An experiment was conducted in AICRP-Potato, Horticultural Research and Extension Center, Somanahallikaval, Hassan for consecutively for three years during *Kharif* season from 2015 to 2017 to know the yield potentiality and suitability of eight different potato hybrids. An experiment was laid out by using Randomized Complete Block Design with four replications. The hybrids such as AICRP-P-15, AICRP-P-16, AICRP-P-17, AICRP-P-18 AICRP-C-13, AICRP-C-17, AICRP-C-20 and AICRP-C-24 were adapted for evaluation studies. The tubers were planted at 60 cm x 20 cm spacing with soil application of recommended dose of fertilizers (75:75:100 kg NPK/ha) and FYM (25 t/ha) as per the package of practices of UHS, Bagalkot. Fifty per cent of urea applied during planting and remaining fifty per cent after 30 days of planting i.e. during earthing-up operation. The recommended package of practices were followed during the different stages of crop growth and harvesting at 75 and 90 days after planting. An observations related to vegetative growth, yield attributes and disease scoring were recorded as follows.

Growth parameters

Plant emergence (%) at 30 days after planting

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

Plant height (cm)

The maximum plant height was measured from the ground to the tip of longest leaf documented at 45 days after planting. The mean of five plants in each treatment was worked out.

Plant width (cm)

The plant width was measured in north to south and east to west from five randomly selected plants at 45 days after planting.

Yield attributes

Marketable tuber yield (t/ha)

Out of total tubers obtained in each plant, all 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). Out 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)

Rottage tubers (t/ha)

The weight of rotten tubers were recorded and using the data of rottage tubers yield in tones per hectare was calculated.

Disease scoring

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

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

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

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

An observations on percentage of plant emergence, plant height, plant width, marketable tuber yield, total tuber yield and tuber rottage were documented for three consecutive years (2015-17). All varieties shown significant differences over their growth performance and yield potentiality.

Growth parameters

The pooled data over the years showed the highest plant emergence of 88.96 per cent in AICRP-P-15 at 75 days after planting and 87.33 per cent in AICRP-P-15 at 90 days after planting (Table 2). The highest plant height of about 60.17and 59.38 cm were noticed in AICRP-P-17 at 75 and 90 DAP, respectively (Table 2). The plant width in East-West was highest in AICRP-C-24 (45.57 cm) at 75 days after planting (Table 3). Whereas, highest plant width in North-South of about 55.25 and 52.50 cm in AICRP-P-18 at 75 and 90 DAP, respectively (Table 3). The better performance of these varieties might be due to its genetic make-up and its better adoptability to prevailing environmental conditions (Gobana, 2002) [3].

Yield parameters and late blight incidence

The marketable tuber yield (t/ha) and total tuber yield (t/ha) at 75 and 90 DAP of different potato hybrids are given in Table. 3, Fig. 1 & 2. The pooled data of three years indicated that, hybrid AICRP-P-16 was recorded highest marketable tuber yield of 15.57 and 20.78 t/ha, total tuber yield of 18.18 and 24.42 t/ha at 75 and 90 DAP with least percentage of late blight incidence (7.41%) (Table. 6), which was on par with AICRP-C-24 (15.01 & 17.76 t/ha) of marketable tuber yield and (17.27 & 20.02 t/ha) of total tuber yield at 75 and 90 DAP, respectively. However, there was no significant differences in rottage at 75 and 90 days after planting (Table 4). The variation in total yield of the genotypes may be due to adaptability, crop maturity and inherent ability of potato genotypes in producing marketable tubers per plant. The results are in agreement with other researchers who investigated that marketable tuber yield was significantly varied by variety, location and genotypes x environment interaction (Elfinesh, 2008, Gebreselassie *et al*., 2016, Pandey *et al*., 2004 and Kumar *et al*., 2007) [1, 2, 4,, 6].

Table 2: Growth performance of advanced potato hybrids at 75 and 90 days after planting

Sl. No.	Hybrids	Plant emergence (%) at 75 DAP				Plant emergence (%) at 90 DAP				Plant height (cm) at 75 DAP				Plant height (cm) at 90 DAP			
		2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled
1	AICRP-P-15	90.00	87.92	-	88.96	86.67	84.00	-	85.34	46.00	51.00	-	48.50	59.00	53.25	-	56.13
2	AICRP-P-16	84.17	88.34	73.09	81.87	93.30	89.70	79.00	87.33	49.50	50.25	56.50	52.08	49.50	47.50	59.25	52.08
3	AICRP-P-17	92.50	80.00	80.08	84.19	94.50	84.67	82.59	87.25	61.00	54.25	65.25	60.17	51.50	53.50	73.15	59.38
4	AICRP-P-18	71.67	72.08	-	71.87	83.00	79.17	-	81.09	61.50	48.50	-	55.00	62.50	47.75	-	55.13
5	AICRP-C-13	77.50	75.00	74.75	75.75	84.00	83.75	81.33	83.03	41.50	49.25	48.00	46.25	49.00	47.13	49.50	48.54
6	AICRP-C-17	86.67	84.17	86.42	85.75	86.65	86.67	87.67	87.00	44.00	49.00	62.00	51.67	56.00	45.13	59.25	53.46
7	AICRP-C-20	82.49	83.75	84.00	83.41	89.67	84.75	85.75	86.72	42.00	47.75	44.75	44.83	46.00	44.00	48.95	46.32
8	AICRP-C-24	62.27	80.84	71.67	71.59	88.00	82.84	82.50	84.45	62.00	52.75	52.50	55.75	50.50	51.25	50.30	50.68
	S. Em+	7.64	3.00	3.38	3.01	5.00	1.85	1.55	1.75	2.99	2.66	2.34	3.11	4.80	2.87	3.28	2.98
	CD(p=0.05)	24.91	8.75	10.19	9.14	16.31	5.41	4.68	5.32	9.75	7.76	7.05	9.44	15.64	8.37	9.90	9.05
	CV (%)	12.95	7.41	8.63	6.49	8.41	4.40	3.73	3.56	8.45	10.81	8.53	10.41	12.48	12.02	11.58	9.80

DAP: Days After Planting

Table 3: Growth performance of advanced potato hybrids at 75 and 90 days after planting

Sl. No.	Hybrids	Plant width (EW) (cm) at 75 DAP				Plant width (EW) (cm) at 90 DAP				Plant width (NS) (cm) at 75 DAP				Plant width (NS) (cm) at 90 DAP			
		2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled
1	AICRP-P-15	41.00	40.25	-	40.63	43.00	38.50	40.75	40.75	54.00	44.75	-	49.38	54.50	44.25	49.38	49.38
2	AICRP-P-16	43.00	36.00	52.43	43.81	44.50	36.50	54.00	45.00	45.00	42.00	51.65	46.22	47.50	44.75	55.50	49.25
3	AICRP-P-17	50.50	28.25	44.90	41.22	50.50	27.00	44.50	40.67	54.00	37.75	45.85	45.87	55.50	33.50	42.13	43.71
4	AICRP-P-18	39.00	40.50	-	39.75	53.50	41.88	47.69	47.69	61.00	49.50	-	55.25	56.50	48.50	52.50	52.50
5	AICRP-C-13	50.50	40.75	45.00	45.42	49.00	40.00	47.75	45.58	51.50	47.75	46.55	48.60	60.50	47.75	46.00	51.42
6	AICRP-C-17	44.50	34.25	51.80	43.52	50.50	33.75	53.75	46.00	50.00	41.50	50.75	47.42	54.00	46.50	50.50	50.33
7	AICRP-C-20	45.00	31.25	43.50	39.92	45.50	34.25	46.75	42.17	41.00	37.00	44.50	40.83	54.50	38.25	45.50	46.08
8	AICRP-C-24	46.00	40.00	50.70	45.57	42.50	40.75	51.50	44.92	54.00	47.50	48.98	50.16	49.00	47.25	49.88	48.71
	S. Em+	4.17	2.73	2.91	2.81	5.53	2.99	2.90	NS	2.98	3.06	2.25	1.86	5.73	3.69	2.73	2.53
	CD(p=0.05)	13.59	7.97	8.76	8.53	18.01	8.72	8.74	-	9.71	8.93	6.78	5.64	18.69	10.78	8.22	7.69
	CV (%)	13.16	14.90	12.10	11.47	16.14	16.46	11.67	-	8.21	14.29	9.37	6.72	15.04	17.26	11.30	8.98

DAP: Days After Planting
NS: Non-significant

Table 4: Tuber yield performance of advanced potato hybrids at 75 and 90 days after planting

Sl. No.	Hybrids	Marketable tuber yield (t/ha) at 75 DAP				Marketable tuber yield (t/ha) at 90 DAP				Total tuber yield (t/ha) at 75 DAP				Total tuber yield (t/ha) at 90 days			
		2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled	2015	2016	2017	Pooled
1	AICRP-P-15	10.10	10.09	-	10.10	13.62	13.26	-	13.44	11.81	13.03	-	12.42	15.32	15.25	-	15.29
2	AICRP-P-16	13.69	18.26	14.75	15.57	25.30	20.25	16.78	20.78	15.76	21.12	17.66	18.18	29.80	23.34	20.13	24.42
3	AICRP-P-17	9.83	11.35	6.82	9.33	12.02	14.38	9.08	11.83	10.90	15.24	9.51	11.88	13.97	17.47	12.42	14.62
4	AICRP-P-18	11.55	8.49	-	10.02	15.35	11.68	-	13.52	13.50	11.13	-	12.32	17.03	13.57	-	15.30
5	AICRP-C-13	14.01	16.50	12.53	14.35	17.80	17.79	14.44	16.68	15.32	19.46	14.80	16.53	21.20	19.86	16.86	19.31
6	AICRP-C-17	10.90	11.68	9.97	10.85	14.88	16.03	12.81	14.57	12.49	15.31	12.66	13.49	16.39	18.58	15.41	16.79
7	AICRP-C-20	13.32	10.52	10.73	11.52	16.11	14.89	12.14	14.38	15.25	13.83	12.92	14.00	17.13	16.94	14.88	16.32
8	AICRP-C-24	15.46	16.81	12.77	15.01	18.90	19.07	15.32	17.76	16.44	19.70	15.67	17.27	20.10	22.17	17.80	20.02
	S. Em+	0.90	0.86	0.98	0.88	0.77	0.80	1.11	0.98	0.93	0.76	1.15	0.91	0.93	0.85	1.29	1.18
	CD(p=0.05)	2.95	2.50	2.96	2.68	2.52	2.33	3.34	2.97	3.03	2.22	3.47	2.77	3.05	2.48	3.88	3.57
	CV (%)	11.58	13.64	17.42	12.65	9.76	10.45	16.51	11.04	9.81	9.72	16.58	10.89	10.54	9.57	15.83	11.48

DAP: Days After Planting'

Table 5: Tuber rottage (t/ha) of advanced potato hybrids at 75 and 90 days after planting

Sl. No.	Hybrids	Tuber rottage (t/ha) at 75 DAP				Tuber rottage (t/ha) at 90 DAP			
		2015	2016	2017	Pooled	2015	2016	2017	Pooled
1	AICRP-P-15	0.91	0.60	-	0.76	0.78	0.86	-	0.82
2	AICRP-P-16	0.85	0.92	2.26	1.34	1.10	1.14	3.44	1.89
3	AICRP-P-17	0.38	0.90	2.43	1.24	1.17	1.15	3.42	1.91
4	AICRP-P-18	1.06	0.64	-	0.85	1.26	1.08	-	1.17
5	AICRP-C-13	0.83	0.88	1.79	1.17	1.47	1.22	3.08	1.92
6	AICRP-C-17	1.70	1.63	2.49	1.94	1.36	1.69	3.59	2.21
7	AICRP-C-20	0.73	0.79	1.97	1.16	1.18	1.18	2.91	1.76
8	AICRP-C-24	1.16	0.78	2.17	1.37	1.53	1.03	2.87	1.81
	S. Em+	NS	0.05	NS	NS	0.09	0.08	NS	NS
	CD(p=0.05)	-	0.14	-	-	0.29	0.22	-	-
	CV (%)	-	10.83	-	-	13.30	12.86	-	-

DAP: Days After Planting, NS-Non Significant

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

Variety	Late blight incidence (%)	Late blight intensity	Leaf spot disease (%)
AICRP-P-15	23.36	7	-
AICRP-P-16	7.41	8	-
AICRP-P-17	11.48	7	-
AICRP-P-18	17.52	7	-
AICRP-C-13	25.18	6	-
AICRP-C-17	14.81	7	-
AICRP-C-20	18.15	7	-
AICRP-C-24	14.77	7	-

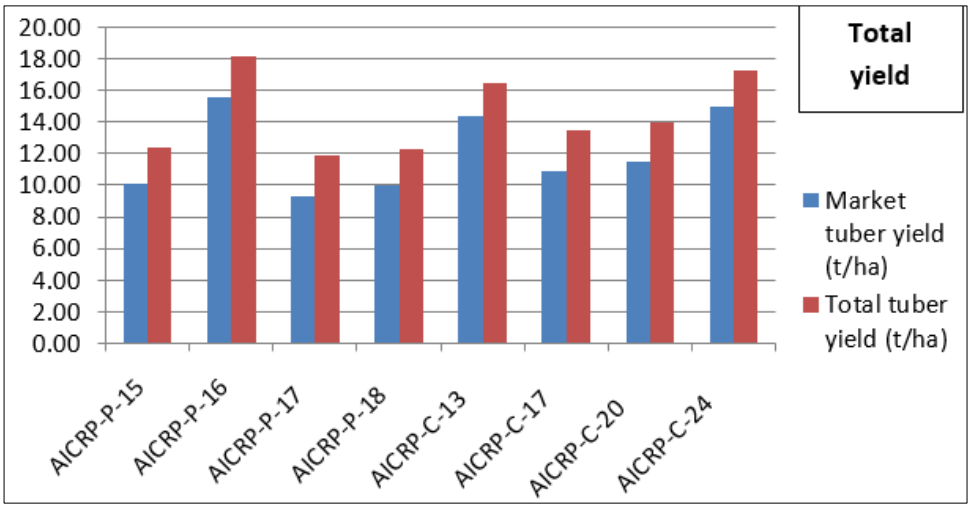

Fig 1: Marketable and total tuber yield (t/ha) at 75 days after planting

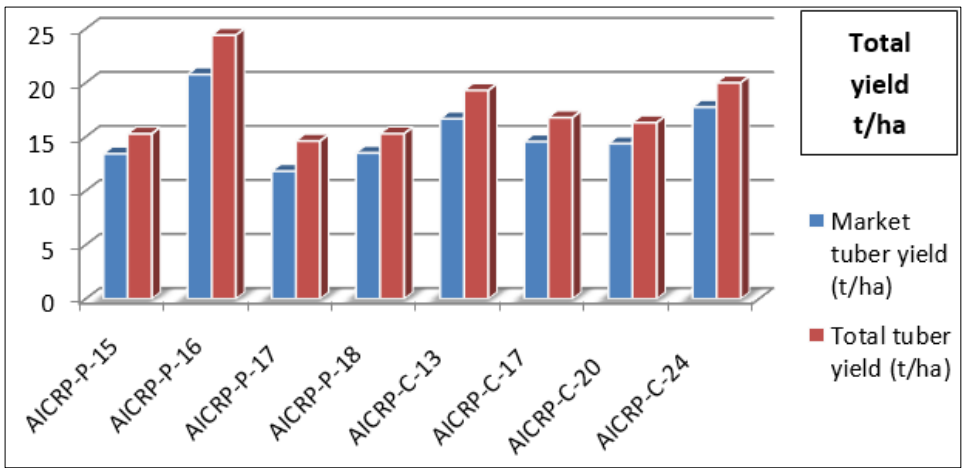

Fig 2: Marketable and total tuber yield (t/ha) at 90 days after planting

Best performing potato hybrids

Fig 3: AICRP-P-16 plot view

Fig 4: AICRP-P-16 tubers

Fig 5: AICRP-C-24 plot view

Fig 6: AICRP-C-24 tubers

Conclusion

The results of an experiments conducted at HREC, Hassan on potato for yield potentiality and suitability, The results revealed that hybrid AICRP-P-16 was recorded significantly higher yield and tolerance to late blight disease over other hybrids evaluated at this centre in all the three years. Based on the results, hybrid AICRP-P-16 is recommended to scale-up for production in Southern Dry Zone of Karnataka during *Kharif* season.

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