The Pharma Innovation Journal 2022; 11(8): 1553-1557

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(8): 1553-1557

www.thepharmajournal.com
Received: 19-05-2022
Accepted: 29-07-2022

Payal Patidar
Department of Horticulture and Vegetable Science, RVSKVV, Gwalior, Madhya Pradesh, India

Murlidhar J Sadawarti
ICAR, Central Potato Research Station, Gwalior, Madhya Pradesh, India

PKS Gurjar
Department of Horticulture and Vegetable Science, RVSKVV, Gwalior, Madhya Pradesh, India

VK Gupta
ICAR, Central Potato Research Station, Modipuram, Uttar Pradesh, India

RK Samadhiya
ICAR, Central Potato Research Station, Gwalior, Madhya Pradesh, India

SP Singh
ICAR, Central Potato Research Station, Gwalior, Madhya Pradesh, India

Reema Lautre
Department of Vegetable Science, IGKVV, Raipur, Chhattisgarh, India

RS Dangi
Department of Agronomy, RVSKVV, Gwalior, Madhya Pradesh, India

Hirdesh K
Department of Horticulture and Vegetable Science, RVSKVV, Gwalior, Madhya Pradesh, India

Corresponding Author:
Payal Patidar
Department of Horticulture and Vegetable Science, RVSKVV, Gwalior, Madhya Pradesh, India

Evaluation of advanced processing hybrids and varieties for yield and economic assessment for central Indian region

Payal Patidar, Murlidhar J Sadawarti, PKS Gurjar, VK Gupta, RK Samadhiya, SP Singh, Reema Lautre, RS Dangi and Hirdesh K

Abstract
Six advanced Potato processing hybrids and eight processing varieties were grownet ICAR-Central Potato Research Institute RS, Gwalior, Madhya Pradesh during 2018-19 and 2019-20 to evaluate growth, yield and economics for commercial cultivation for the Central Indian region. The experiment was planned in three replications in randomized block design. Variation in growth parameters *viz*., days to emergence, days to 50% emergence final emergence and germination % were recorded. Total tuber yield was recorded highest in MP/6-39. Non-processing grade (<45 mm) yield (q/ha) recorded high in hybrid MP/10-172 at 75 DAP & at senescence and hybrid MP/8-1900 for 90 DAP over others. Whereas, for processing grade (45-75 mm tuber) high yield observed in Kufri Lauvkar for 75 DAP, Tauras for 90 DAP and MP/10-172 at senescence. Processing grade (>75 mm) higher yield was recorded at 75 DAP and senescence in hybrid MP/6-39 and for 90 DAP high yield was recorded in K. Frysona and hybrid MP/6-39. High net return and B:C ratio was recorded highest in hybrid MP/6-39 and after that MP/10-172 and Kufri Chipsona-4. This processing varieties have high yield potential and will generate high income as compare to table purpose varieties, which help farmers to sustain their income in Central Indian region.

Keywords: Potato, variety, hybrid, processing grade tuber, non-processing grade tuber, tuber yield, cost of cultivation, Benefit-cost ratio

Introduction
Potato (*Solanum tuberosum*) ascended as fourth most important food crop. India ranked 3rd in area and 2nd in potato production. (Kumar *et al*., 2021) [11], India produced 48562 000'MT potato from area of 2051 000'ha in 2019-20 and 54230 000'MT potato from 2248 000'ha area (2020-2021 third estimation) (Agricultural statistics at a glance, 2021) [3]. The market for processed potato products is gaining momentum at faster pace in India since last one decade (Pandey *et al*., 2005) [16] mainly due to upgraded living standard, amplified urbanization, preference to fast foods and increasing tourist trade. Processing industry has also emerged fast due to economic liberalization committed with growing urbanization and expanding market options. To fulfill industry demands, farmers need variety of excellent processing quality with high yield potential, ICAR has developed six processing varieties *viz.* Kufri Chipsona-1 & Kufri Chipsona-2 in 1998, Kufri Chipsona-3 in 2005 (for the Indian plains), Kufri Chipsona-4, Kufri Himsona (for hills) and Kufri Frysona. Apart from this some exotic varieties like Lady Rosetta, Atlantic for chips and Kennebec and Sanata for French fries etc. are cultivated (Sadawarti *et al*., 2019) [25]. These varieties contains >20% dry matter and low reducing sugars (<0.1% on fresh weight) which is important aspects for processing and have potential to produce high processing-grade tuber yield.

Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Assam, Chhattisgarh, Jharkhand and Haryana are the states, which holds major production share in India. (www.fao.org). The state of Madhya Pradesh has arisen as retail hub of processing of potato and Malwa potato has gained prestige for potato chips processing because produced potato have a value of high dry matter and low sugar, (www.mponline.com, 2013) [31]. Kufri Jyoti and Kufri Lauvkar are two major processing varieties that are cultivated in this area. In North-Central India especially Agra and Gwalior are important seed and ware potato growing region of the country having high yield potential due to mild winters, but are constrained by high water deficit (Govindakrishnan *et al*., 2015) [8]. For high yield potential selection of cultivar is extremely important for growers trying to produce market quality produce (Mohammadi *et al*.

2010) [14]. Generally minimum of 70-90 days of favorable cool season is required to obtain an economical yield. It is reported that processing potato gives high net return as compare to table purpose potato so that it is needed to evaluate processing new hybrids comparing cultivars to get high yield potential for the farmers to generate higher income.

Materials and Methods

The experiment was conducted at ICAR-Central Potato Research Station, Gwalior during 2018-19 and 2019-20. Soil was silt clay loam with ph. 7.4. 14 genotypes, in which 6 advanced processing hybrids and 8 processing cultivars recommended for Central India were planted in this trail, *viz.* hybrids-MP/4-816, MP/6-39, MP/8-1900, MP/9-28, MP/10-172 and Tauras and varieties K Chipsona-3, K Chipsona-1, Atlantic, K Chipsona-4, K Frysona, K Lauvkar, K Jyoti and K Surya. Planting was done at 30th October in 2018-19 and 18th November in 2019-20. Experiment was planted in Random Block Design in three replications with well sprouted tubers of 35-45 g at a spacing of 66cm×25cm in the plot of 3.96 m x 3.75 m. 50% of the nitrogen (112.5 kg/ha) through AS, full phosphorus (100kg/ha) through SSP and potassium (120 kg/ha) through MOP were applied at planting. Remaining 50% of Nitrogen (112.5 kg/ha) was applied through urea during earthing up (after 25 DAP). Crop was dehaulmed at 75, 90 and at senescence after planting. Growth parameters like days to emergence, days to 50% emergence and germination % was observed. Harvesting was done after 15 days later of dehaulming after skin set in both season. Total weight of processing and non-processing grade tuber was recorded at harvest. Tuber were divided into 3 grades <45 mm (non-processing) and in processing grade it is 45-75 mm (for chips) and >75mm (for French fries). Data were pooled and analyzed statistically and means were separated according to the least significant differences (LSD) at 0.05 level of probability.

Economics of different treatments was worked out on the basis of prevailing prices of input and output. A net return was calculated by subtracting the cost of total input from the cost of total produce. Machinery, Irrigation, water, gunny bags and labors was the variable components of total cost of inputs. Economics was worked out by taking mean tuber yield and B:C ratio where B:C ratio indicates the returns one rupee gets after investing one rupee. It was calculated by dividing the net return with total cost of cultivation.

Results and Discussion

Tuber growth parameters

Result revealed that significantly highest days to emergence recorded in MP-4/816 (10.33 days) whereas lowest days to emergence recorded in hybrid MP/8-1900 (8.33 days) which was found at par with MP/10-172 and Atlantic. Days to 50% emergence ranged from 11.83 to 13.00 days as there was no significant variation recorded. MP/10-172 (97.78%) give average highest germination % and at par with MP/4-816 and MP/8-1900 and lowest germination % recorded in MP/9-28 (92.13%) (Table no. 1). Probable reason for time of germination varies from variety to variety and physiologically older tubers emerge early as compare to the younger ones (Agrawal *et al*., 2016) [1]. These studies are in agreement with the findings of Kumar *et al*. (2011) [10]. Similar results recorded by Sadawarti *et al*., 2016 [23] where highest germination of 93.27% in the year of 2014-15 recorded, when 4 varieties were tested under breeder seed production. Most of the potato cultivars showed considerable variation for this trait, variation also depends on genetic structure of cultivar and sprouting ability of tuber. This finding is also supported by Sadawarti *et al*., 2018 [24].

Processing grade, non-processing grade and total tuber yield (q/ha)

For 75 days crop, significantly mean higher yield of processing grade (45-75 mm) tuber was recorded in hybrid MP/10-172 (153 q/ha) among hybrids but overall control Kufri Lauvkar (189.30 q/ha) recorded significantly high yield and low yield observed in MP/4-816 (113.20 q/ha) over all other hybrids and varieties. For 90 days crop, hybrid Tauras (231.10 q/ha) recorded significantly high processing grade tuber yield among all hybrids and varieties and at par with hybrid MP/10-172, MP/9-28, Kufri Chipsona-1, Kufri Lauvkar and Kufri Chipsona-4 over others. Kufri Frysona (161.90 q/ha) recorded lowest among all. In tuber harvested at senescence, significantly mean high processing grade tuber yield recorded in hybrid MP/10-172 (247.50 q/ha) whereas, lowest recorded in Kufri Jyoti and Kufri Surya (161.90 q/ha) over all other hybrids and varieties (Table no. 1). Ullah and Saikia (2008) [29] reported that Kufri Chipsona-1, Kufri Chipsona-2 and Kufri Chipsona-3 were superior over rest of the varieties in yield performance, which produced higher processing grade tuber during two year of experimentation.

For 75 and for senescence crop, significantly mean high yield of processing grade (more than 75 mm) tuber was recorded in MP/6-39 (127.80 q/ha) and (313.30 q/ha) respectively. For 90 days MP/6-39 (172.30 q/ha) found high among hybrid but Kufri Frysona (175.20 q/ha) recorded overall highest over other hybrids and varieties. Lowest yield recorded in Tauras (27.60 q/ha), (51.90 q/ha) and (80.80 q/ha) respectively at 75, 90 days and senescence (Table no. 1). Similar findings also reported by Pandey *et al.* (2008) [18]. Harvesting time can influence the biomass accumulation in potato tuber (Marwaha *et al*., 2005 and Patel *et al.*, 2005) [13, 20].

For 75 days crop, mean higher non-processing (less than 45 mm) grade tuber yield (q/ha) recorded in hybrid MP/10-172 (78.40 q/ha) and lowest was in Kufri Surya (30.50 q/ha). For 90 days crop hybrid MP/8-1900 (72.10 q/ha) observed significantly mean high tuber yield which was at par with MP/10-172, MP/6-39, Kufri Chipsona-4, Kufri Chipsona-3 and Kufri Chipsona-1 and lowest was recorded in Kufri Jyoti (34.30 q/ha) over other hybrids and control. For crop harvested at senescence, hybrid MP/10-172 (84.80 q/ha) recorded significantly high tuber yield whereas, low tuber yield was found in Tauras (40.00 q/ha) over all other hybrids and varieties (Table no. 1). Variation in non-marketable yield % of the genotype may be due to crop vigour/maturity, inherent ability of potato genotypes (Patel *et al*., 2008) [17], stem no. and plant height may strongly influence the non-marketable yield of potato cultivars (Arsenault and Christie, 2004) [4].

Total tuber yield (q/ha)

For 75, 90 days and for crop harvested at senescence, significantly mean higher total tuber yield (q/ha) was recorded in MP/6-39 (325.90 q/ha), (435.50 q/ha) and (542.20 q/ha) respectively and it was at par with Kufri Chipsona-4 (320.30 q/ha) in crop harvested at 75 DAP and low tuber yield recorded in MP/4-816 (203.60 q/ha). Kufri Chipsona-4

(419.50 q/ha) & Kufri Chipsona-1 (420.40 q/ha) found at par with over all other hybrids and varieties at 90 DAP. For crop harvested at senescence, MP/10-172 (525.40 q/ha) found at par with MP/6-39(542.20 q/ha) over all hybrids and varieties. Lowest tuber yield recorded in Kufri Jyoti (274.30 q/ha) and (304.80 q/ha) sequentially at 90 DAP and at senescence. In related work there were 27 clones and 8 commercial varieties tested total and marketable tuber yield increased linearly with the delay in harvesting time because of the formation of maximum number of tubers after 70 DAP, tuber weight continued to increase till the last harvest Pandey *et al*., (2005) [16]. Singh *et al*., (2005) [26] reported that the hybrid MP/97-644 found significantly higher total and process grade yield, and outstanding processing quality as compared to Indian and exotic processing cultivars, when grown in relatively warmer west-central regions of the country. Maximum tuber yield was from Kufri Gaurav (44.1 t/ha) which was significantly higher over other varieties under Jalandhar condition of Punjab (Jatav *et al*., 2013) [9]. Genotypic differences for yield were not significant for 75 days harvest, but were significant for 90 days harvest. At 90, days harvest hybrids MS/94-899 was the highest yielder (Patel *et al*., 2006) [19]. Apart from that, various reports confirm present study where the variations in total tuber yield was reported in different genotypes/varieties under different locations and climatic conditions (Sharma *et al*., 2005) [28] (Patel *et al*., 2005) [20] (Vashisht *et al*., 2005) [30] (Patel *et al*., 2008) [17] (Amanullah *et al*., 2010) [2] and (Bhuwneshwari *et al*., 2013) [5].

Economics

The economics of different potato hybrids and varieties is presented in table no. 3. For 75 Days crop, among all hybrids and varieties cost of cultivation (₹/ha), gross return (₹/ha), net return (₹/ha) and B:C ratio was significantly higher in hybrid MP/6-39 (₹ 152882, ₹ 391080, ₹ 238199 and 1:1.6) and after that recorded in K Chipsona-4 (₹ 151937, ₹ 384360, ₹ 232423 and 1:1.6) and K Lauvkar (₹ 149263, ₹ 365340, ₹ 216077 and 1:1.5) whereas, it was lowest recorded in MP/4-816 (₹ 132268, ₹ 244440, ₹ 112172 and 1:0.9). For 90 days crop, among all hybrids and varieties cost of cultivation, gross return, net return and B:C ratio was found significantly higher in hybrid MP/6-39 (₹ 173715, ₹ 522600, ₹ 348885 and 1:2.0) and after that recorded in K Chipsona-1 (₹ 171168, ₹ 504480, ₹ 333312 and 1:2.0) and K Chipsona-4 (₹ 171025, ₹ 503460, ₹ 332435 and 1:2.0) and lowest recorded in K Jyoti (₹ 146532, ₹ 329160, ₹ 182629 and 1:1.2). Potato harvested at senescence, among all hybrids and varieties cost of cultivation, gross return, net return and B:C ratio was significantly higher in hybrid MP/6-39 (₹ 191714, ₹ 650640, ₹ 458926 and 1:2.4) and after that recorded in MP/10-172 (₹ 188872, ₹ 630420, ₹ 441548 and 1:2.4) and K Chipsona-4 (₹ 185186, ₹604200, ₹ 419014 and 1:2.3) but it was recorded lowest in K Jyoti (₹151676, ₹ 365760, ₹ 214084 and 1:1.4). Sadawarti *et al*., (2018) [24], reported similar findings. In the past various researchers had studies economics of potato production in different parts of India (Peer *et al*., 2013) [21], (Durgawati *et al*., 2005) [6], (Lal and Sharma, 2006) [12], (Rajput *et al*., 2003) [22]. In potato cultivation, expenditure on seed, labour and fertilizer contribute major in the cost of cultivation (Noonari *et al*., 2016) [15] (Lal and Sharma *et al*. 2006) [12] (Peer *et al*., 2013) [21]. Singh *et al*., 2019 [25] concluded that with an investment of one rupee in potato cultivation the small, medium and large farmers earned respectively of ₹ 3.42, ₹ 2.61 and 2.21.

Based on study it was concluded that prevailing climatic conditions during experiment has profound effect on yield and to fulfill increased industry demand cultivation of MP/6-39 will give high return to the farmers as it recorded high processing grade tuber yield and total tuber yield and also give high gross return, net return and B:C ratio when cultivated in central India.

Table 1: Performance of different potato hybrids and varieties for emergence and yield parameters at 75, 90 and at senescence

Treatment	Days to emergence	Days to 50% emergence	Germination %	Less than 45 mm			45-75 mm Tuber			More than 75 mm			Total yield		
				75 DAP	90 DAP	Senescence	75 DAP	90 DAP	Senescence	75 DAP	90 DAP	Senescence	75 DAP	90 DAP	Senescence
MP/4-816	10.33	13.00	97.59	42.7	50.4	47.6	113.2	177.3	193.6	47.8	100.7	240.5	203.6	328.4	481.7
MP/6-39	9.17	12.33	94.58	48.9	69.3	43.8	149.2	193.9	185	128	172.3	313.3	325.9	435.5	542.2
MP/8-1900	8.33	12.17	97.55	70	72.1	67.2	148.7	199.5	223.5	55.6	91.9	167.1	274.3	363.4	457.7
MP/9-28	9.00	11.83	92.13	65.6	59.8	51	146.3	225.4	201.1	48.3	97	206	260.2	382.3	458.1
MP/10-172	8.83	12.00	97.78	78.4	70.8	84.8	153	225.1	247.5	37.4	87.8	193	268.7	383.7	525.4
Tauras	8.50	12.33	97.08	45.3	50.7	40	134.9	231.1	190.1	27.6	51.9	80.8	207.8	333.7	311
K Chipsona-3	9.50	12.17	96.16	43.9	65.3	64.3	156.8	178.7	167.7	64.1	125.6	176.8	264.8	369.7	408.7
K Chipsona-1	10.00	12.67	95.33	53.6	64.2	61	163.3	219.2	198.4	71.1	137.1	205	287.9	420.4	464.5
Atlantic	8.83	12.17	96.71	40.4	48.2	47.4	139.2	187.9	176.8	41.5	105.8	158.1	221.1	341.9	382.3
K Chipsona-4	9.00	12.00	96.57	52.9	71.7	60.3	172.4	226.7	201.2	95	121.2	242	320.3	419.5	503.5
K Frysona	9.50	12.50	93.24	38.7	57	48.6	126.5	161.9	201.8	75.1	175.2	233.1	240.4	394.1	483.5
K Lauvkar	9.17	11.83	97.36	51.9	44.3	50.6	189.3	221.7	164.3	63.3	61.1	143.4	304.5	327.1	358.3
K Jyoti	9.00	11.83	96.75	45.1	34.3	41	153	167.7	161.9	65.3	72.3	102	263.4	274.3	304.8
K Surya	9.83	12.17	97.36	30.5	52.3	42.1	140.6	171.7	161.9	115	167.2	244.6	285.9	391.2	448.6

Table 2: Cost of cultivation (₹/ha), gross return (₹/ha), net return (₹/ha) and B:C ratio of different hybrids and varieties

Treatment	At 75 DAP				At 90 DAP				At Senescence			
	COC (₹/ha)	GR (₹/ha)	NR (₹/ha)	B:C Ratio	COC (₹/ha)	GR (₹/ha)	NR (₹/ha)	B:C Ratio	COC (₹ /ha)	GR (₹/ha)	NR (₹/ha)	B:C Ratio
MP/4-816	132268	244440	112172	0.9	155641	394020	238379	1.6	181500	577980	396480	2.2
MP/6-39	152882	391080	238199	1.6	173715	522600	348885	2	191714	650640	458926	2.4
MP/8-1900	144186	329160	184975	1.3	161553	436080	274527	1.7	177460	549240	371780	2.1
MP/9-28	141799	312240	170441	1.2	164738	458760	294022	1.8	177528	549720	372192	2.1
MP/10-172	143233	322440	179208	1.3	164969	460380	295411	1.8	188872	630420	441548	2.4
Tauras	132976	249480	116504	0.9	156535	400380	243846	1.6	152714	373200	220486	1.5

K Chipsona-3	142566	317700	175134	1.2	162616	443640	281025	1.8	169195	490440	321246	1.9
K Chipsona-1	146471	345480	199009	1.4	171168	504480	333312	2	178599	557280	378681	2.1
Atlantic	135209	265320	130111	1	157918	410220	252302	1.6	164750	458820	294070	1.8
K Chipsona-4	151937	384360	232423	1.6	171025	503460	332435	2	185186	604200	419014	2.3
K Frysona	138459	288480	150021	1.1	166740	472920	306180	1.8	181813	580200	398388	2.2
K Lauvkar	149263	365340	216077	1.5	155430	392520	237090	1.6	160693	429960	269267	1.7
K Jyoti	142330	316020	173690	1.3	146532	329160	182629	1.2	151676	365760	214084	1.4
K Surya	146134	343080	196946	1.4	166243	469440	303198	1.9	175925	538320	362395	2.1

*COC-Cost of cultivation, GR-Gross Return, NR-Net return, B:C Ratio-Benefit cost ratio

References

1. Agrawal S, Jaiswal RK, Kadwey S, Prajapati S, Jaswani N. Assessment of Varietal Performance in Diverse Potato (*Solanum tuberosum* L.) Genotypes. International Journal of Bio-resource and Stress Management. 2016;7(6):1308-1314.
2. Amanullah ASM, Talukder SU, Sarkar AA, Ahsanullah ASM. Yield and water use efficiency of four potato varieties under different irrigation regimes. Bangladesh research publications journal. 2010;4(3):254-64.
3. Anonymous. Agricultural statistics at a glance. Directorate of Economics and Statistics, ministry of Agriculture, New Delhi, 2021.
4. Arsenault WJ, Christie BR. Effect of whole seed tuber size and pre-plant storage conditions on yield tuber size distribution of russet Burbank. Amer J potato Research. 2004;81:371-76.
5. Bhuwneshwari Verma SK, Narayan K, Paikra MS. Evaluation of processing potato genotypes for growth, yield and yield attributes under Chhattisgarh condition. Theasian journal of horticulture. 2013;8(1):241-45.
6. Durgawati W, Rajput AM, Saraf GP. Economic analysis of potato and onion in Malwa region of Madhya Pradesh. Indian Journal of Economics and Development. 2005;38(3):77-79.
7. FAO (Food and Agriculture Organisation). Barried treasure: The potato, 2019. (http://www.fao.org).
8. Govindakrishnan PM, Singh BP, Sharma S, Rawat S. Plausible impacts of climate change on potato in some important potato growing pockets in India based on inference from their climate analogue. Potato J. 2015;42(1):72-75.
9. Jatav MK, Kumar M, Trehan P, Dua VK, Kumar S. Effect of nitrogen and varieties of potato on yield and agronomic N use efficiency in north-western plains of India. Potato J. 2013;40(1):55-59.
10. Kumar S. Stability analysis in potato (*Solanum tuberosum* L.) for yield and quality traits. Annals of Biology. 2011;27(2):147-151.
11. Kumar Harday, Kumar Vijay Pal, Verma Satish Chandra, Rwt Vinay Kumar, Kumar Sugriv Maurya. Economics of Potato Production in Gorakhpur District of Eastern Uttar Pradesh. International Journal of Creative Research Thoughts. 2021;9:2320-2882.
12. Lal H, Sharma KD. Economics of potato production in Lahaul Valley, Himachal Pradesh. Journal of the Indian Potato Association. 2006;33(3-4):139-143.
13. Marwaha RS, Pandey SK, Singh SV, Khurana SP. Processing and nutritional qualities of Indian and exotic potato cultivars as influenced by harvest date, tuber curing, pre-storage holding period, storage and reconditioning under short days. Adv. Hortic. Sci. 2005;19:130-140.
14. Mohammadi J, Khasmakhi-sabet SA, Olfati JA, Dadashpour A, Lamei J, Salehi B. Comparative studies of some new potato cultivars and their morphological characteristics. Biosciences, Biotechnology Research Asia. 2010;7(1):121-126.
15. Noonari S., Hakimzadi W, Noor I, Ahmed F. Economic analysis of potato production in Sindh Pakistan. Journal of Biology. Agriculture and Healthcare. 2016;6(5):100-107.
16. Pandey SK, Singh SV, Manivel P. Yield structure, agronomic performance and stability of new potato (*Solanum tuberosum* L.) hybrids in western Uttar Pradesh. Indian Journal of Agricultural Sciences. 2005;75(7):417-21.
17. Patel CK, Patel PT, Chaudhari SM. Effect of Physiological age and seed size on seed production of potato in North Gujrat. India. Potato J. 2008;36(2-3):18-23.
18. Patel RN, Patel NH, Pandey SK, Patel JM, Kanbi VH, Patel CK. Adaptability of some potato cultivars in north Gujarat. Potato J. 2008;35(1-2):19-22.
19. Patel RN, Patel NH, Pandey SK, Kanbi VH, Patel CK. Yield performance and shelf life of some advanced potato hybrids in Gujarat. Potato J. 2006;33(3-4):149-150.
20. Patel RN, Patel NH, Singh SV, Pandey SK, Patel JM, Patel SB. Assessment of potato varieties/hybrids for french fries and storage behavior in Gujarat. Potato J. 2005;32(3-4):217-218.
21. Peer QA, Ahmad N, Kaur J, Chesti MH, Ahman HS, Bhat A, Bhat BA. Study on economics of potato growing towards livelihood security in Jammu division, India. African Journal of Agricultural Research. 2013;8(45):5639-5644.
22. Rajput AM, Verma AR, Jain SK. Relative profitability of potato varieties in Indore district of Madhya Pradesh. Agricultural Research New Series. 2003;24(2):437-439.
23. Sadawarti MJ, Pandey KK, Samadhiya RK, Singh SP, Roy S. Standardization of planting date for potato (*Solanum tuberosum* L.) breeder seed production in Gwalior region of north central India under prevailing climatic situations. Indian Journal of Agricultural Sciences. 2016;86(8):1050-8.
24. Sadawarti MJ, Patel K, Samadhiya RK, Gupta, PK, Singh SP, Gupta VK, *et al*. Evaluation of table and processing varieties of potato (*Solanum tuberosum* L) for North-Central India. International Journal of Chemical Studies. 2018;6(4):823-833.
25. Sadawarti MJ, Singh SP, Sharma SK, Singh RK, Katare Shubhash, Samadhiya RK, *et al*. Madhya Pradesh an emerging state in the production of horticulture crops especially potato, 2019. www.krishisewa.com
26. Singh SV, Pandey SK, Kumar D Patel, NH Khurana, SM Paul, Kumar P, *et al*. Scope and suitability of potato (*Solanum tuberosum*) genotypes for industrial processing for French fries in Gujarat and western Uttar Pradesh.

Indian J Agric Sci. 2005;75(12):781-5.
27. Sinha AK, Singh SK. Economics of Potato Production in Northern Hills of Chhattisgarh. Economic Affairs. 2019;64(1):01-07.
28. Sharma YK, Thakur KC, Bhutani RD, Trivedi SK, Singh BP, Verma RB, *et al*. On-farm evaluation of promising potato genotypes for adaptability in northern plains and plateau regions of India. Potato J. 2005;32(3-4):238.
29. Ullah Z, Saikia M. Yield performance of processing potato varieties in the plains of Assam. Global Potato Conference, 9-12 Des, New Delhi, 2008, 22.
30. Vashisht VK, Rani A, Lal T. Stability' analysis in potato (*Solanum tuberosum* L.) Potato J. 2005;32(3-4):235.
31. www.mponline.com, 2013.