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Performance of Medium duration Potato Hybrids and varieties for Morphology, Growth and Yield Characters under Chambal Region of Madhya Pradesh

Hirdesh Kumar[1*], Murlidhar J. Sadawarti[2], Rashmi Bajpai[3], S.P. Singh[2], R.K. Samadhiya[2], Rajesh Lekhi[1], Priyanka Gurjar[4], Prince Mahore[4] and Payal Patidar[4]

[1]Department of Horticulture, RVSKVV, College of Agriculture, Gwalior (Madhya Pradesh), India.
[2]ICAR-Central Potato Research Institute, RS, Gwalior (Madhya Pradesh), India.
[3]Krishi Vigyan Kendra (RVSKVV) Gwalior (Madhya Pradesh), India.
[4]Department of Entomology, RVSKVV, Gwalior (Madhya Pradesh), India.

(Corresponding author: Hirdesh Kumar)*
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ABSTRACT: A field experiment was conducted during the Rabi seasons of 2019–20 and 2020–21 at CPRI RS Gwalior (Madhya Pradesh) to study the morphological, growth, and yield characteristics of twenty-one (11 hybrids and 10 controls) Columba, MCIP/12-185, MS/12-2116, MS/10-1529, PS/06-88, P-12, MS/8-1148, PS/6-39, P-28, MS/9-2196, J/7-37, and 10 control varieties K. Bahar, K. Khyati, K. Lalima, K. Pukhraj, K. Pushakr, K. Lalit, K. Garima, K. Mohan, K. Ganga, and K. Neelkanth potato hybrids and varieties in RBD with three replications. The objective of this work was to evaluate tuber yield at medium maturity. Keeping this view in mind, the present study set out to select suitable and improved varieties of potato having superior growth and yield characteristics and better economic variability for commercial production in the Chambal region. Results revealed that the control K. lalima recorded the lowest (5.50 days) to emergence, while the highest (8.33 days) to emergence were recorded in the hybrid P-28. Final emergence among hybrids and varieties differed significantly and ranged from 91–93%. The highest stem or plant was recorded in K. Pushkar (8 stem), and the lowest stem was recorded in hybrid PS/6-39 (4.27). Maximum compound leaves/plant was recorded in control K. Pushkar (79.17), and minimum compound leaves/plant were observed in hybrid MS/8-1148 (49.72). Control Kufri Neelkanth produced the maximum (30.17 cm) leaf length, while Control K. Khyati (17.47 cm) recorded the maximum leaf width. Plant height was greatest in hybrid MS/12-2116 (75.85 cm) and lowest in hybrid Columba. The hybrids MS/12-2116, PS/06-88, and control K. Lalima (5.0) (scale 1–5) recorded the highest plant vigour, while hybrid MS/10-1529 (4.33) recorded the lowest plant vigour. The hybrid P-12 (10.75 mm) obtained the maximum diameter of the stem, while the minimum was recorded in the hybrid Columba (5.94 mm). Control K. Khyati and control K. Lalima showed maximum canopy cover (1466.67 cm^2), and minimum canopy cover was recorded in control variety K. Ganga and hybrid Columba (1341.67 cm^2). The hybrid P-12 recorded the minimum days (98.50 to 70% maturity), while the hybrid K. Neelkanth (104.17) recorded the maximum days. At 75 days, the maximum total and marketable tuber yield with the highest net return and B:C ratio was obtained in Hybrid MC/12-2116 (Rs. 155355 and 1.95) and in control K. Neelkanth (Rs. 166485 and 2.08). At 90 days maximum total and marketable tuber yield with highest net return and B: C ratio was obtained in hybrid P-28 (Rs. 202253 and 2.17) and in control K. Lalit (Rs. 235039 and 2.30). At senescence, the maximum total and marketable tuber yield with the highest net return and B: C ratio was obtained in hybrid P-28 (Rs. 377278 and 2.74) and in control K. Lalima (Rs. 359467 and 2.67). Hybrid MC/12-2116, hybrid P-28, and controls K. Neelkanth, K. Lalit, and K. Lalima were found to be suitable for cultivation in the Chambal region of Madhya Pradesh.

Keywords: Potato, varieties, hybrids, growth, B: C ratio, yield and morphological character.

INTRODUCTION

The potato (*Solanum tuberosum* L.) is an annual, tetraploid (2n = 48), herbaceous, tuber crop of the Solanaceae family that contains many essential food ingredients required for maintaining proper health. The potato is the world's leading vegetable food crop, both

for developed and developing countries, and is grown worldwide. Potato is popularly known as 'the king of vegetables' and has emerged as the fourth most important food crop after rice, wheat and maize in the world. In India, about 68% of potatoes are used for table purposes, 7.5% for processing, 8.5% for seed, and the remaining 16% of produce is wasted due to pre- and post-harvest handling (Gupta *et al*. 2014). India is one of the major potato-producing countries in the world. In India, potato is cultivated in the 2158 ('000 Ha) area with an average production of 51300 ('000MT) and productivity of about 24.55 MT/ha (Anon, 2019-2020).

The average composition of the potato is about 80% water, 2% protein, and 18% starch. As a food, it is one of the cheapest and easily available sources of carbohydrates and proteins and contains an appreciable amount of vitamins B and C as well as some minerals. Moreover, the protein in potatoes is of high biological value (Qasim *et al*., 2013).

The potato is a highly nutritious, easily digestible, wholesome food containing carbohydrates, proteins, minerals, vitamins, and high-quality dietary fiber. The crop finds a prime position in the economies of poor and marginal farmers and plays a vital role in nutritional security by producing more food per unit area and time compared to wheat, rice, and maize in a short period of time. The potato contains a substantial quantity of energy: edible protein (2.8 g), starch (16.3 g), total sugar (0.6 g), crude fibre (0.5 g), carbohydrate (22.6 g), and vitamin C (25 mg) per 100 g of fresh tubers (Bhuwneshwari *et al.,* 2013).

In India, the potato is grown in almost all states except Kerala under diversified agro-climatic conditions. About 90% of the total potato area is located in the subtropical plains, 6% in the hills, and 4% in the plateau region of peninsular India (Chadda, 2005).

In the north-central plains of India, the potato crop is grown during the autumn. The early crop is planted in mid- September and harvested from mid November onwards. The main crop is planted from mid-October to mid-November and harvested from January onward. Thus, it is necessary to develop varieties that are suitable for planting and harvesting at varying times. Information on the stability of potato varieties and hybrids, advanced hybrids, and exotic germplasm lines is lacking for exploitation under varying planting and harvesting times in the west-central plains of India. In the present study, 21 treatments (11 hybrids and 10 varieties) were evaluated for stability parameters of tuber yield and its components over two years.

Most European varieties, introduced earlier in India, performed poorly because conditions in India are entirely different from those prevalent in temperate countries. A need was, therefore, felt that potato cultivation in India cannot depend on exotic varieties and technologies and the country must have its own research and development programme for potatoes. Before recommending any variety or crop suitable for the region, it is pertinent to evaluate genotypes, with an emphasis on the aspects of genotypic suitability and yield (Kanaujia and Manjai Phom 2016).

The adoption of new potato varieties, Kufri Lalit and Kufri Neelkanth, by farmers will increase their farm productivity and income, thus improving the farmers' livelihoods and meeting the food and nutritional requirements of the country's burgeoning population.

MATERIAL AND METHODS

A field experiment was conducted at the Central Potato Research Station, Gwalior, during Rabi 2019–20 and 2020–21. The experimental site is located at 26°13′ North latitude, 78°14′ East longitude, and 206 metres above sea level in the northern tract of M.P., which enjoys a subtropical climate, with extreme heat of about 44.4°C in summer and a minimum temperature of 3.9°C in the winter season. The annual rainfall ranges between 750 to 800 mm, most of which is received from the end of June to the end of September, with few showers in the winter months. Eleven hybrids, viz. PS/06-88 P-12 MS/8-1148 PS/6-39 P-28 MS/9-2196 J/7-37 MS/10-1529 MS/12-2116 MC/12-2116, Columba and ten control varieties Kufri Bahar, Kufri Khyati, Kufri Lalima, Kufri Pukharaj, Kufri Pushkar, Kufri Lalit, Kufri Garima, Kufri Mohan, Kufri Ganga, and Kufri Neelkanth were used for experimental trials. The experiment was laid out in a randomized block design with three replications. Healthy, uniform sized tubers were planted at a spacing of 60 x 20 cm for this 35 ha-1 potato tuber that was required. 180–80–120 kg/ha of nitrogen, phosphorous, and potassium were provided with urea, diammonium phosphate, and murate of potash. A full quantity of phosphorous, potassium, and half a dose of nitrogen were applied as basal in furrows at the time of planting, while the remaining quantity of nitrogen was applied in two split doses. For all the morphological characters, three plants in each plot were selected randomly and were tagged to record various growth observations at different crop growth stages. The average number of days required for emergence (or 50% emergence) was recorded, while after 30 days of planting, the final emergence of each hybrid/variety was recorded. The number of stems, number of compound leaves, plant height of the main stem from the ground level to the apical bud, average plant vigour (visually), length of compound leaf, and width of compound leaf were measured with the help of a metre scale at 45–50 days after planting. Canopy covered by crop was observed by being covered by a grid method, unit (cm^2) using a grid with 100 squares. For days to senescence, the average number of days required to reach 70% maturity in senescence for each variety was recorded. Yield was recorded from the plots

of each hybrid and variety and converted to per hectare. The data recorded under the study were subjected to statistical analysis as per standard procedure as suggested by Panse and Sukhatme (1967).

RESULT AND DISCUSSION

A. Morphological characters

The data revealed that days to emergence were significantly different among hybrids and varieties. Control K. Lalima (5.50 days) recorded the lowest days to emergence, which was at par with control Kufri Garima, K. Neelkanth (5.67 days), hybrid PS/06-88 (6.00 days), hybrid Columba and Control K. Pukhraj (6.17 days), and the highest was recorded in hybrid P-28 (8.33 days), followed by control K. Pushkar (8.17 days). Similar significant studies also reported in the Gwalior region of central India by Sadawarti *et al*. (2014), concluded that Kufri Sindhuri, Kufri Lauvkar and Kufri Chandramukhi took 11 days for emergence, while Kufri chipsona-1 took 10 days for emergence, which indicates the significant differences in varieties for days to emergence.

For days to 50% plant emergence, control K. Lalit (7.83 days) recorded the lowest days to 50 % plant emergence, which was at par with hybrid PS/06-88 and control K. Lalima (8 days) and hybrid P-12 and control K. Pukhraj (8.17 days) and highest in 3 hybrids, Columba, MC/12-2116, J/7-37, and control K. Bahar (10.50 days). This is in concurrence with reports by (Agrawal *et al*. (2016), that differences in emergence and flowering between varieties and hybrids may be due to genetic differences (Bradshaw, 2007). This confirms that the present results are in accordance with those reported by the above authors, where variation was reported among hybrids and varieties.

For final emergence (%), there were significant differences between different varieties and hybrids. Significantly higher final emergence was recorded in 5 hybrids and 1 control over hybrid P-28 (91.11%), and the highest was recorded in MS/12-2116 and MS/8-1148 (99.33%). This indicates the varietal difference in emergence. The difference in behaviour of potato varieties with respect to morphological characters can be explained solely by the variation in their genetic makeup and adaptability to soil and climatic conditions, *i.e*., (G*E) interaction. Kumar (2011); Patel *et al.* (2013) also reported the significant difference in the morphology traits that were positively correlated with the genotypes. The present investigation is also supported by the findings of Sati *et al.* (2018).

For the number of stems per plant, a significant maximum number of stems per plant were recorded in control K. Pushkar (8.00) followed by hybrid Columba (7.06) and control K Neelkanth, K. Garima (6.33), while the minimum number of stem per plant recorded in hybrid PS/6-39 (4.17) followed by two hybrids MS/10-1529 and P-28 (4.28). A similar and significant study was reported by Kumar *et al*. (2008). Variety affected the number of stems per plant. The number of stems relates to numbers of branches and numbers of leaves the which contribute to photosynthesis potential. An increase in the absorption of solar radiation can ensure a higher photosynthesis potential and promote the synthesis and accumulation of reserve carbohydrates in the potato tuber, which has a positive effect on the final tuber yield (White *et al.,* 2007).

Significantly maximum number of compound leaves per plant was recorded in control K. Pushakar (79.17) which was at par with control K.Lalit (73.12), hybrid MS/12-2116 (72.69), control K. Khyati (71.94), hybrid P-12 (70.16), control K. Pukhraj (69.05) hybrid PS/06-88 (68.44), control variety K. Lalima (67.66), control K. Garima (64.95), hybrid Columba while minimum number of compound leaves per plant recorded in hybrid MS/8-1148 (49.72) followed by control K. Bahar (54.50), and hybrid MC/12-2116 (57.10). The varietal differences amongst these growth analysis parameters are attributed to the variability in the genetic inheritance among the varieties. This has been supported by Patel *et al.* (2000). Similar to the present, findings were also recorded by Preetham *et al.* (2018)

B. Growth analysis parameters

It is revealed from the data that the significant maximum leaf length recorded in the control variety Neelkanth (30.17 cm), which was at par with hybrid PS/6-39 (28.39 cm). While is the minimum leaf length in control K. Bahar, (19.49 cm), followed by control variety K. Mohan (20.48 cm), and hybrid Columba (22.00 cm). Variation in their genetic makeup and adaptability to soil and climate, *i.e*., GxE interaction, was reported by Kumar (2011); Patel *et al*. (2013). The present findings are supported by the findings of Agrawal *et al.* (2016).

For leaf width, a significant maximum leaf width was recorded in control variety K. Khyati (17.47 cm), which was at par with one control variety, K. Pukhraj (16.11 cm). While the minimum leaf width was recorded in the hybrid variety, PS/06-88 (13.44 cm), followed by two hybrids, PS/6-39 and MC/12-2116 (13.61 and 13.83 cm). The variation in their genetic makeup and adaptability to soil and climatic conditions *i.e.* (GxE) interaction, was reported by Kumar (2011); this is in concurrence with reports by Kajal Raj *et al.* (2016).

For plant height, a significantly higher maximum plant height was recorded in hybrid MS/12-2116 (71.70 cm), which was at par with hybrid P-28 (70.28 cm). While the minimum plant height recorded in hybrid Columba (44.56 cm), followed by variety C-6 (45.56 cm), is hybrid MS/8-1148 (46.33 cm). The variation in plant height was due to the inherent genetic makeup of the plant. Similar findings were reported by Kumar (2011).

Similar and significant observations were reported by Patel *et al.* (2013); Zheng *et al.* (2012).

For plant vigour (scale 1-5), significantly maximum plant vigour was recorded in hybrid MS/12-2116, PS/06-88, P-12, P-28, and control variety K. Lalima, K. Neelkanth (5.0), which was at par with hybrid P-52, MS/8-1148, and control variety K. Khyati, K. Pushkar (4.83), hybrid variety J/7-37, and control variety K. Bahar, K. Ganga, (4.67), while minimum plant vigour was recorded in hybrid MS/10-1529 (4.33), followed by hybrid PS/6-39, MS/9-2196, and control Variety K, lalit, K, Garima, K. Mohan (4.50). The present findings are supported by the findings of Silva *et al.* (2019).

The diameter of stem was significantly maximum in hybrid P-12 (10.75 cm), which was at par with two hybrid variety P-28 (10.39 cm), PS/6-39 (10.26 cm), while the minimum diameter of stem hybrid Columba (5.94 cm), followed by Hybrid MC/12-2116 (6.88 cm). The differential behavior of potato varieties with respect to morphological characters could be explained solely by the variation in their genetic makeup and adaptability to soil and climatic conditions, *i.e*., (G×E) interaction. (Kumar, 2011). Similar and significant observations were reported by Zheng *et al.* (2012).

For days to 70 percent maturity, significantly minimum days to 70 % maturity were recorded in hybrid P-12 (98.50 days), which was followed by control K. Pushkar (99.50 days), control K. Khyati (99.67 days), while maximum days to maturity were recorded in control Neelkanth (104.17 days), followed by hybrid MC/12-2116 (103.17 days). Similar studies also supported by each experimental unit consisted of 12 plants in which plants reached physiological maturity (based on condition of vines) and days to senescence were counted (Mustefa *et al.* 2017). The present study is supported by Preetham *et al.* (2018).

The data of canopy cover for 90 days showed a significant difference between hybrids and varieties; the highest was recorded in K. Khyati and K. Lalima (1466.67 cm2), and the lowest was recorded in K. Ganga (1466.67 cm^2). The canopy cover increases up to 75-80 DAP; thereafter, it starts decreasing due to ageing and senescence. The present findings are in accordance with Kajal Raj *et al*. (2016); Luthra *et al*. (2017).

C. Yield attributing characters

The maximum total tuber yield at 75 DAP was recorded in control K. Neelkanth (42.38 t/ha), followed by hybrid J/7-37 (38.74 t/ha), hybrid MC/12-2116 (38.18 t/ha), and hybrid MS/12-2116 (36.24 t/ha), while the lowest total tuber yield (t/ha) was recorded in hybrid Columba (25.66 t/ha), which was followed by control Kufri Mohan (29.38 t/ha). At 90 DAP, a higher total tuber yield was recorded in control Kufri Lalit (49.13 t/ha), which was followed by control K. Neelkanth (47.55 t/ha) and control Kufri Garima (46.84 t/ha), while the lowest total tuber yield was recorded in hybrid P-12 (34.58 t/ha), followed by hybrid Columba (36.07 t/ha). At senescence, the maximum total tuber yield was recorded in hybrid P-28 (70.03 t/ha), which was followed by MS/12-2116 (67.59 t/ha) and control K. Lalima (66.49 t/ha), while the lowest total tuber yield was recorded in hybrid MS/10-1529 (44.74 t/ha), followed by hybrid Columba (50.48 t/ha). The higher yield attributes in Kufri Lalit may be due to the maximum increase in growth parameters as well as growth analysis parameters. The probable reason for enhanced tubers per plant may be due to better germination, genetic makeup, and environmental interactions. These findings are in agreement with Singh *et al.* (2007); Kaushik *et al*. (2006). The results are in agreement with other researchers who investigated that tuber yield varies significantly with potato varieties and hybrids, location and genotypes × environment interaction. The present findings on varietal differences are in consequence with those of Alam *et al*. (2003); Ullah and Saikia (2008); Rashid *et al*. (2008),

The marketable tuber (>20 g) yield at 75 DAP was recorded in control K. Neelkanth (38.55 t/ha), followed by hybrid MC/12-2116 (35.05 t/ha), while the lowest marketable tuber yield (t/ha) was recorded in hybrid P-12 (31.96 t/ha), followed by control K. Mohan (26.64 t/ha). At 90 DAP, a higher marketable tuber (>20 g) yield was recorded in control K Lalit (46.15 t/ha), which was at par with control Neelkanth (45.40 t/ha). Garima (44.43 t/ha), hybrid J/7-37 (36.01 t/ha), and control K. Khyati (42.13 t/ha), while the minimum marketable tuber yield was recorded in hybrid Columba (33.15 t/ha), followed by hybrid P-12 (32.67 t/ha). At senescence, a higher marketable tuber yield was recorded in hybrid P-28 (65.95 t/ha), which was followed by hybrid MS/12-2116 (65.20 t/ha), control K. Lalima (63.48 t/ha), control K. Ganga (62.89 t/ha), and hybrid PS/6-39 (59.62 t/ha), while the least marketable tuber yield was recorded in hybrid MS/10-1529 (42.92 t/ha), followed by Columba (48.07 t/ha). The variations in the marketable yield of potato genotypes may be due to genotypic and varietal factors. Similar results were reported by Marwaha *et al.* (2007); Khan *et al.* (2013); Luitel *et al.* (2015); Amarananjundeswara *et al*. (2018); Luthra *et al.* (2017).

D. Economics

Among the potato hybrids and varieties on the market, tubers yield the most. At 75 DAP, which was recorded in control, K. Neelkanth brought about the maximum net income (180420 Rs/ha) with a B:C ratio (2.08). This was followed by hybrid MC/12-2116 (155355 Rs/ha) with B: C ratio (1.95).

Table 1: Morphology characters and growth analysis parameters of different varieties and hybrids of potato.

Treatment	Days to emergence	Days to 50% plant emergence	Emergence % 30 DAP	No. of stems/plant at 45-50 DAP	No. of compound leaves/ plant 45-50DAP	Plant height (cm)/ at 45-50 DAP	Leaf length (cm) 45-50 DAP	Leaf width (cm) 45-50 DAP	Plant vigour (1-5 scale) at 45-50 DAP	Diameter of stem (mm) at 45-50 DAP	Canopy cover (cm^2) at 90 DAP	Days to senescence (70%maturity)
Columba	6.17	10.50	91.33	7.06	64.94	44.56	22.00	14.72	4.50	5.94	1341.67	100.83
MCIP/12-185	7.50	10.50	91.56	5.33	57.10	48.75	24.44	13.83	4.83	6.88	1358.33	103.17
MS/12-2116	6.83	8.50	99.33	5.83	72.69	71.70	27.37	15.58	5.00	7.83	1366.67	102.17
MS/10-1529	6.67	9.33	94.44	4.28	59.72	47.76	24.72	13.94	4.33	8.83	1350.00	101.67
PS/06-88	6.00	8.00	98.22	5.44	68.44	57.39	25.47	13.44	5.00	8.39	1375.00	99.00
P-12	7.67	8.17	97.11	4.05	70.16	58.00	24.50	13.94	5.00	10.75	1391.67	98.50
MS/8-1148	6.33	9.33	99.33	5.00	49.72	46.33	26.11	15.18	4.83	9.05	1391.67	103.83
PS/6-39	6.67	8.67	91.33	4.17	59.55	49.22	28.39	13.61	4.50	10.26	1425.00	102.67
P-28	8.33	9.50	91.11	4.28	58.05	70.28	25.81	14.23	5.00	10.39	1416.67	103.67
MS/9-2196	6.83	8.67	93.78	4.66	57.78	51.37	24.08	14.28	4.50	8.28	1400.00	102.17
J/7-37	6.33	10.50	98.44	6.22	58.05	49.56	26.00	14.58	4.67	7.22	1441.67	102.17
K. Bahar	7.67	10.50	96.00	4.39	54.50	45.66	19.49	13.86	4.67	7.66	1416.67	100.83
K. Khyati	6.50	8.50	95.11	5.11	71.94	51.11	24.13	17.47	4.83	8.50	1466.67	99.67
K. Lalima	5.50	8.00	92.44	5.78	67.66	63.28	22.68	14.88	5.00	8.78	1466.67	101.17
K. Pukhraj	6.17	8.17	94.89	4.72	69.05	53.16	22.18	16.11	4.83	8.72	1350.00	100.50
K. Pushakr	8.17	10.00	94.22	8.00	73.83	54.61	23.39	15.28	4.83	9.00	1400.00	99.50
K.Lalit	6.33	7.83	94.22	5.11	73.12	48.11	25.75	14.29	4.50	8.83	1375.00	100.33
K.Garima	5.67	8.83	98.89	6.33	64.95	53.11	26.61	14.03	4.50	8.50	1366.67	102.83
K. Mohan	6.83	8.50	95.56	5.00	62.72	50.77	20.48	14.41	4.50	8.39	1383.33	101.17
K. Ganga	7.50	9.83	92.22	5.33	57.11	52.53	25.30	15.13	4.67	9.38	1341.67	100.00
K. Neelkanth	5.67	8.00	95.78	6.72	61.55	52.08	30.17	14.52	5.00	8.16	1350.00	104.17
SE(m)	**0.26**	**0.22**	**1.96**	**0.33**	**3.49**	**1.59**	**1.090**	**0.511**	**0.136**	**0.34**	**21.69**	**0.39**
CD (5%)	**0.72**	**0.61**	**5.51**	**0.92**	**9.84**	**4.48**	**3.069**	**1.439**	**0.383**	**0.94**	**61.05**	**1.10**

Table 2: Yield attributes and economics of different hybrids and varieties of potato.

Treatment	Total tuber yield t/ha 75 DAP	Total tuber yield t/ha 90 DAP	Total tuber yield t/ha senescence	Marketable tuber Yield 75 DAP t/ha	Marketable tuber Yield 90 DAP t/ha	Marketable tuber Yield Senescence t/ha	Net income 75 DAP (Rs. ha)	B:C ratio 75 DAP	Net income 90 DAP (Rs. ha)	B:C ratio 90 DAP	Net income Senescence (Rs. ha)	B:C ratio Senescence
Columba	25.66	36.07	50.48	22.95	33.15	48.07	68452	**1.48**	141637	**1.90**	248864	**2.35**
MCIP/12-185	38.18	41.18	59.42	35.05	38.68	56.25	155355	**1.95**	181389	**2.07**	307541	**2.51**
MS/12-2116	36.24	43.63	67.59	33.44	40.98	65.20	143756	**1.90**	197872	**2.15**	371856	**2.73**
MS/10-1529	33.13	42.66	44.74	30.05	39.90	42.92	108969	**1.72**	190115	**2.12**	248966	**2.43**
PS/06-88	30.50	39.66	57.06	27.79	36.82	53.10	103177	**1.68**	168031	**2.03**	284990	**2.47**
P-12	35.61	34.58	52.46	31.96	32.67	48.09	133342	**1.85**	138226	**1.88**	248972	**2.35**
MS/8-1148	33.05	40.83	61.29	28.46	38.30	57.43	107989	**1.72**	178696	**2.07**	316016	**2.56**
PS/6-39	31.74	39.52	63.65	27.64	37.38	59.62	102100	**1.67**	172089	**2.05**	331780	**2.62**
P-28	30.95	43.27	70.03	27.21	41.58	65.95	90813	**1.55**	202253	**2.17**	377278	**2.74**
MS/9-2196	34.03	42.90	59.86	29.65	39.98	55.86	116572	**1.74**	190762	**2.13**	304776	**2.54**
J/7-37	38.74	39.53	57.19	34.06	36.01	54.05	148244	**1.92**	162214	**1.97**	291777	**2.50**
K. Bahar	31.90	37.75	59.53	28.56	33.88	56.41	108708	**1.73**	146916	**1.93**	308690	**2.53**
K. Khyati	33.75	44.96	61.57	30.88	42.13	57.95	125549	**1.80**	206203	**2.19**	319787	**2.58**
K. Lalima	33.53	40.70	66.49	28.71	37.73	63.48	109785	**1.73**	174566	**2.05**	359467	**2.67**
K. Pukhraj	31.14	39.43	59.74	27.63	36.85	56.52	101992	**1.69**	168210	**2.03**	309480	**2.55**
K. Pushakr	32.51	41.14	60.19	28.26	38.95	56.06	106589	**1.67**	183293	**2.09**	306213	**2.54**
K.Lalit	33.00	49.13	54.77	29.72	46.15	50.92	117003	**1.74**	235039	**2.30**	269261	**2.38**
K.Garima	33.96	46.84	58.80	32.44	44.43	55.76	136574	**1.87**	222650	**2.25**	304058	**2.53**
K. Mohan	29.38	40.30	60.39	26.64	37.59	57.95	94882	**1.63**	173597	**2.05**	319822	**2.58**
K. Ganga	32.53	46.43	66.47	28.55	43.08	62.89	108600	**1.72**	213026	**2.22**	356379	**2.69**
K. Neelkanth	42.38	47.55	58.19	38.55	45.40	55.16	180420	**2.08**	229688	**2.28**	299749	**2.52**
SE(m)	**1.13**	**1.46**	**2.33**	**1.22**	**1.44**	**2.26**						
CD (5%)	**3.18**	**4.10**	**6.55**	**3.44**	**4.05**	**6.37**						

The lowest net income (68452 Rs./ha) and B: C ratio (1.48) was obtained from hybrid Columba. At 90 DAP, higher marketable tuber yield was recorded in control Kufri Lalit, brought the maximum net income (235039 Rs./ha) with a B: C ratio (2.30). In hybrid, P-28 gave the maximum net return (20, 2253 Rs./ha) and B:C ratio (2.17). The lowest net income (141637 Rs./ha) and B:C ratio (1.90), were obtained from hybrid Columba At

senescence, higher marketable tuber yield net income was recorded in hybrid P-28 (377 278 Rs./ha) with a B:C ratio (2.74) and in control K. Lalima (359 467 Rs./ha) with a B:C ratio (2.67). The lowest net income (248864 Rs./ha) and B: C ratio (2.35) were obtained in hybrid Columba. The net economic gain was secured in accordance with the per hectare yield of the varieties and thereby gross income. Similar findings were reported by Hosea *et al.* (2012).

CONCLUSION

The result of the current study revealed that potato varieties and hybrids significantly affected all the treatments, which clearly indicates hybrid MC/12-2116, control K. Neelkanth, for 75 days, hybrid P-28 and control Kufri Lalit for 90 days, and hybrid P-28 and K. Lalima at senescence were most suitable for higher yield and net income. The cultivation of these hybrids and varieties will meet the requirements of potatoes located in this region, which will bring a remunerative return to the farmers.

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Conflict of Interest. None.

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