



Performance Evaluation of Potato (*Solanum tuberosum* L.) varieties under Northern Plains of India

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ABSTRACT

A field experiment was conducted at Allahabad in order to evaluate the performance of different Potato (*Solanum tuberosum* L.) varieties under the climatic conditions of Northern Plains of India. The experiment was carried out for two consecutive years i.e., during 2015-16 and 2016-17 to assess the morphology, physiological behaviour of these potato varieties/strains under a similar set of agro-climatic conditions. All the potato varieties/strains viz. E-4486, JI-5857, JI-1804, JI-1808, JG-224, JG-657, JE-808, JF-110, JF-27, JF-547, JG-1134, Fr/B-10, JH-222, EM/H-1601, JF-4864, JF-5106, JF-4915, JH-49, JH-516, JI-5871, FR-B-4, FR-B-4, FR/B-21, FR-B-105, G-2524, Kufri Sheetman, Kufri Chandramukhi, Kufri Bahar, Kufri Lalima, Kufri Badshah, Kufri Jyoti, Kufri Alankar and Kufri Sinduri were replicated thrice under randomized block design. Important information on different aspects like tuber sprouting, plant growth and development and yield was gathered in all the treatments. Potato variety JH-222 was the best performer followed by JG-224, E-4486, JF-547, Kufri Bahar, FR/B-10, Kufri Badshah, JF-110, Kufri Chandramukhi, EM/H-1601, Kufri Alankar, JF-27, JG-1334 and JE-808.

KEYWORDS

Potato, Variety, Vegetative attributes and yield.

INTRODUCTION

Potato has occupied a central place on tables due to its inbuilt abilities to provide all essential ingredients of a balanced diet such as starch, protein, minerals and vitamins (Singh, 1959). Presently the potato consumption per capita per annum in our country is very limited as compared to 75 to 175 kg per annum in European and American countries (Singhet *et al.*, 1985). It is a wholesome food for the diet of human beings. It can easily be converted into several dried and processed products across the world. Besides, it is a useful raw material for several industrial products (Leela, 1993). These especial qualities of potato make it deserve an honorable place in Indian agriculture and it further needs a rapid extension in terms of area and cultivation. Since per capita consumption of potato in our country is much lower than many developed countries, therefore, it would be advantageous to pay special attention to its diversified use for food purposes (Agrawal and Tiwari, 2004).

Our country has witnessed an expansion of area and production of potato during the last couple of decades. It is produced to the tune of 51.3 m tons from 2.14 m hectare land with 23.9 t/ha yield. Some of the Indian potato varieties namely Kufri Chandramukhi, Kufri Sheetman and Kufri Lauvkar are found suitable for export and can earn foreign exchange in substantial amount (Pushkarnath, 1964; Minhas *et al.*, 2018). At present, a large number of high yielding varieties and several hybrids have been developed by Central Potato Research Institute, Shimla and are available for commercial cultivation in the country. However, considerable controversy exists about potato varieties/strains regarding yield and several qualitative characters which are influenced by soil and environmental factors to a considerable extent. At this stage, little is known about the morphological and physiological factors which allow one variety to out-yield the other when both are grown under the similar set of agro-climatic conditions (Tiwari and Tiwari, 1975). In fact, yield and qualitative characters are the products of many physiological processes occurring in various plant parts (Moorly, 1978). They are also affected by environmental and agronomical factors (Pandita, 1971). Different inherent yield ability could arise from any one or more of the physiological processes, like net assimilation rate, translocation and utilization of photosynthates (Palkar, 1956). Identification and utilization of these characters might help considerably in the selection of suitable variety/strain/culture (Gupta and Saxena, 1976).

It is established fact that yield and dry matter are controlled by photosynthesis, while photosynthesis is affected by number of factors including leaf area, leaf area index, leaf area ratio, chlorophyll content and other environmental factors (Pandita 1971). Potato tuber yield is directly related to growth parameters and the longevity of the leaves present during the tuber growth (Davis, 1969). Increase in yield and yield contributing attributes depend upon the performance of photosynthetic activities going in the plant system. Hence, factors related to photosynthesis are responsible for this increase or decrease in yield (Accatino and Malagamba, 1982).

The present investigation was carried out with thirty three potato varieties/strains/cultures with an idea to identify or classify them based on these attributes rather than to evaluate the yield potential of the material for various purposes.

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Table 1: Variations in vegetative attributes of different varieties of potato

Variety	Potato Seed tuber sprouting (%)		Number of shoots/plant		Plant Height (cm)	
	2015-2016	2016-2017	2015-2016	2016-2017	2015-2016	2016-2017
E-4486	58.00	71.67	5.00	4.50	76.13	79.07
Jl-5857	71.00	66.00	5.03	4.90	78.43	76.83
Jl1804	53.00	59.33	5.70	5.37	71.40	75.43
Jl1808	73.33	68.57	5.70	5.63	48.23	51.70
JG-224	66.67	64.00	5.67	5.47	45.50	49.60
JG-657	72.00	66.00	6.27	6.47	44.57	56.30
JE-808	66.33	70.67	6.23	6.37	53.00	52.30
JF-110	71.67	71.67	6.83	7.23	72.07	74.90
JF-27	54.33	60.67	4.73	5.70	73.73	72.03
JF-547	75.00	73.67	5.30	5.30	74.37	79.30
JG1334	71.67	73.00	5.40	5.10	77.87	80.17
FR/B-10	70.67	75.00	7.23	7.00	68.00	72.80
JH-222	68.33	74.67	7.17	6.67	75.00	80.30
EM/H-1601	69.67	72.67	6.13	6.23	74.30	72.83
JF-4864	66.00	73.33	6.50	6.43	51.43	76.70
JF-5106	46.33	72.33	6.97	6.27	74.77	74.90
JF-4915	62.33	72.67	7.23	6.97	49.50	47.20
JH-49	65.00	56.33	7.87	7.33	73.43	73.60
JH-516	65.67	49.00	6.97	6.63	74.40	73.47
Jl-5871	71.00	62.33	6.57	6.17	61.90	79.03
FR-B-4	72.33	72.67	5.50	5.93	44.37	73.90
FR/B-21	60.00	64.67	5.13	5.47	51.23	59.67
FR/B-105	77.67	64.67	5.93	6.13	74.23	54.90
G-2524	66.67	66.67	6.27	6.47	72.03	74.50
K.Sheetman	73.33	69.33	6.00	6.17	74.23	80.30
K.Chandramukhi	74.00	71.67	6.90	6.50	69.07	79.27
K.Bahar	70.67	71.67	8.40	8.30	74.20	70.60
K.Lalima	67.67	67.67	8.37	8.60	75.37	76.80
K.Badshah	69.00	70.00	8.40	8.43	74.37	54.87
K.Jyoti	69.00	70.00	7.73	7.37	48.73	53.70
K.Alankar	72.00	69.00	6.30	6.50	69.53	78.03
K.Sinduri	69.00	69.33	7.30	7.27	62.57	75.40
C.D at 5%	12.72	16.11	0.64	0.58	2.80	5.11

MATERIALS AND METHOD

Present investigation was carried out at Bioved Research Institute of Agriculture and Technology, Allahabad Uttar Pradesh during *Rabi* 2015-16 and 2016-17. The field was situated at 20° 28' N (latitude) and 80°24' E (longitude) and about 135 meters above mean sea level. The climate is sub-tropical, semi-arid with hot dry summer and severe cold winters. Experiments were laid out in a randomized block design with three replication under field conditions.

Table 2: Variations in vegetative attributes of different varieties of potato

Variety	Number of leaves/plant		Length of leaf (cm)		Width of leaf (cm)	
	2015-2016	2016-2017	2015-2016	2016-2017	2015-2016	2016-2017
E-4486	78.00	76.00	20.27	19.29	10.53	10.60
Jl-5857	75.00	77.33	19.90	19.33	12.83	12.83
Jl1804	74.00	77.33	21.51	21.33	14.40	14.30
Jl1808	70.00	70.67	22.27	22.23	13.97	14.60
JG-224	72.00	68.33	23.20	23.19	14.53	14.83
JG-657	70.33	71.67	22.13	21.80	14.97	14.97
JE-808	72.33	72.67	22.77	22.83	15.23	14.20
JF-110	74.33	71.00	21.71	21.27	14.40	14.47
JF-27	72.67	71.33	24.31	23.03	15.37	15.40
JF-547	75.67	72.00	21.63	21.33	15.97	14.67
JG1334	76.00	73.67	22.43	22.17	12.60	12.23
FR/B-10	76.00	76.83	20.43	19.80	12.73	12.83
JH-222	75.67	78.00	23.51	23.77	12.13	12.10
EM/H-1601	82.67	81.67	21.17	21.31	11.60	11.73
JF-4864	79.00	79.67	23.27	22.37	11.30	12.30
JF-5106	76.33	81.00	22.83	23.77	10.90	11.10
JF-4915	67.33	71.67	21.53	22.03	12.14	12.30
JH-49	70.00	67.00	23.63	23.77	14.53	14.70
JH-516	74.00	73.67	22.20	21.53	13.13	13.31
Jl-5871	74.33	80.33	18.37	17.97	11.30	11.41
FR-B-4	72.67	73.00	20.27	19.67	11.38	11.58
FR/B-21	70.33	70.33	19.89	19.56	12.65	12.36
FR/B-105	74.67	85.33	22.22	22.43	12.26	12.17
G-2524	79.00	84.00	21.50	22.12	22.10	22.47
K.Sheetman	77.00	80.33	23.73	23.76	13.32	13.64
K.Chandramukhi	70.33	69.33	22.16	22.43	12.73	12.53
K.Bahar	88.33	90.33	21.23	21.41	12.65	12.33
K.Lalima	86.00	90.33	18.32	18.76	11.72	11.55
K.Badshah	89.00	88.33	23.23	23.15	13.17	12.79
K.Jyoti	81.67	85.67	22.53	21.63	12.25	12.52
K.Alankar	79.00	80.00	21.35	22.11	12.14	12.14
K.Sinduri	88.67	80.00	18.37	18.85	11.26	11.28
C.D at 5%	5.85	4.47	0.96	0.93	0.54	0.54

Recommended package of practices was adopted for growing a good crop. The crop was fertilized with 120 kg Nitrogen, 80 kg P₂O₅ and 80 kg K₂O per hectare basis. Total thirty three varieties/strains namely E-4486, Jl-585, Jl-1804, Jl-1808, JG-224, JG-657, JE-808, JF-110, JF-27, JF-547, JG-1134, Fr/B-10, JH-222, EM/H-1601, JF-4864, JF-5106, JF-4915, JH-49, JH-516, Jl-5871, FR-B-4, FR/B-21, FR/B-105, G-2524, Kufri Sheetman, Kufri Chandramukhi, Kufri Bhar, Kufri Lalima, Kufri Badashah, Kufri Jyoti, Kufri Alankar and Kufri Sinduri were used for evaluation purposes. Vegetative attributes like plant height, leaf number, leaf width, leaf length, stolon length, days to bud

Table 3: Variation in yield attributes and yield of potato varieties

Variety	Number of stolons/plant		Stolon length (cm)		No. of days required for bud growth		No. of days for first bud opening (days)	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
E-4486	17.33	16.00	13.53	11.73	97.33	100.00	93.00	93.07
Jl-5857	18.00	18.00	9.00	9.43	100.20	104.10	113.37	115.63
Jl1804	19.00	20.00	9.99	9.83	97.13	99.71	112.23	112.77
Jl1808	17.33	19.00	10.40	9.77	105.50	107.93	115.67	114.27
JG-224	18.00	18.00	9.63	9.97	107.13	105.13	113.23	116.67
JG-657	20.00	20.67	10.00	9.77	103.67	103.53	111.53	112.73
JE-808	21.00	20.67	9.43	9.53	100.03	100.13	103.27	104.83
JF-110	21.67	22.67	9.20	9.63	103.43	103.33	111.57	113.43
JF-27	22.00	22.00	10.67	10.10	102.90	103.13	110.07	114.00
JF-547	21.00	19.33	9.57	9.40	103.43	101.53	110.83	110.27
JG1334	20.67	20.00	9.80	9.20	100.00	99.53	105.60	107.27
FR/B-10	18.67	18.67	8.60	8.70	99.23	99.33	104.87	106.23
JH-222	18.00	20.00	7.60	7.00	93.11	93.47	99.90	101.03
EM/H-1601	22.00	21.00	8.47	7.63	100.41	100.70	104.23	104.00
JF-4864	21.33	19.67	9.40	8.90	101.70	100.10	115.07	119.33
JF-5106	19.83	20.00	9.47	9.04	110.23	107.21	117.50	120.30
JF-4915	21.00	18.00	8.80	8.53	107.51	105.73	116.63	110.47
JH-49	18.67	18.00	9.07	9.07	104.40	103.53	115.23	115.10
JH-516	20.00	20.00	10.07	10.63	104.53	100.21	115.50	115.47
Jl-5871	19.33	18.67	10.47	9.73	107.27	100.77	114.27	115.13
FR-B-4	20.33	21.00	9.70	10.07	100.12	105.47	100.23	102.75
FR/B-21	23.00	22.00	9.50	9.40	104.53	106.18	104.86	105.13
FR/B-105	22.00	22.00	10.13	10.07	110.72	109.28	107.65	106.43
G-2524	21.00	21.00	9.57	10.83	107.36	110.76	110.29	109.74
K.Sheetman	20.00	19.33	10.80	9.70	110.82	110.36	112.33	111.65
K.Chandramukhi	19.33	20.00	9.80	9.90	103.63	101.46	115.25	113.19
K.Bahar	20.67	20.00	11.10	11.13	102.35	105.26	110.76	109.28
K.Lalima	18.00	20.67	12.00	13.37	104.51	106.83	107.65	110.62
K.Badshah	19.00	20.00	12.10	11.20	107.45	103.28	108.74	109.73
K.Jyoti	20.33	20.67	11.27	11.10	101.58	103.12	112.57	114.35
K.Alankar	21.00	20.67	10.17	9.33	104.27	103.31	113.25	110.28
K.Sinduri	24.00	26.00	10.40	11.10	105.62	103.86	110.43	109.87
C.D at 5%	2.04	2.16	1.06	0.99	1.25	1.58	2.32	2.10

initiation, opening and yield attributes. Total monthly distribution of rainfall, temperature and relative humidity during the period of investigations for both years was observed.

RESULTS AND DISCUSSION

Results obtained were pooled and data of two years related to this study is presented here in tables under suitable subheads. The perusal of [Table 1](#) revealed that a considerable range of variation was found in all traits. Tuber sprouting per cent ranged from 74.34 (JF-547) to 56.17 (Jl1804). A significant difference was also shown by Jl1808, JF110, JG1334, FR/B10, JH-222, EM/H-1601, FR/B-4, FR/B105, K. Sheetman and K. Bahar. The number of shoots ranged from 4.75 to 8.49. Majority of the varieties gave the maximum number of shoots while few strains viz. E-4486, Jl5857, JF27, JF547,

JG1334 and FR/B21 recorded less number of shoots. The plant height ranged from 47.55 cm to 79.02 cm. five varieties found of short height including Kufri Jyoti among varieties used.

The number of leaves per plant ranged from 68.50 leaves per plant to 89.33 leaves per plant. Out of 33 varieties, only ten varieties recorded significantly less number of leaves. The length of leaf varied from 18.17 cm to 23.75 cm while width of leaf varied from 10.57 to 22.29cm., K Lalima, Kufri Sindhuri and Jl5871 recorded short length of leaves. However, E4486 and JF5106 recorded less width among the varieties ([Table 2](#)).

So far yield and yield attributes are concerned; these traits also showed considerable variation among varieties ([Table 3](#) and

Table 4: Variation in yield attributes and yield of potato varieties

Variety	Number of tubers/plant		No. of days for tuber maturity		Yield in q/ha		Dry matter content (%)	
	2015-16	2016-17	2015 -16	2016-17	2015-16	2016-17	2015-16	2016 -17
E-4486	7.30	7.93	103.63	113.33	340.57	326.50	15.00	15.03
JI-5857	10.40	10.13	111.23	112.00	315.10	242.40	13.93	14.23
JI1804	10.37	10.37	104.33	100.33	349.77	255.77	14.57	14.63
JI1808	9.93	9.90	113.30	113.30	370.17	244.77	14.37	14.77
JG-224	13.73	12.90	112.40	112.10	413.90	258.57	14.93	15.30
JG-657	14.80	14.64	110.50	111.73	325.57	254.63	14.57	14.97
JE-808	15.27	14.83	103.51	100.43	322.93	308.83	14.50	14.73
JF-110	14.80	14.93	100.37	107.90	332.87	312.60	14.80	14.80
JF-27	14.40	14.80	104.33	100.20	324.00	311.07	14.47	16.00
JF-547	14.17	13.83	107.11	110.10	330.90	327.73	15.07	14.60
JG1334	13.93	14.60	114.57	109.17	318.17	316.37	14.37	13.87
FR/B -10	14.13	14.07	95.23	98.20	337.43	316.80	14.87	14.07
JH-222	14.50	13.83	99.53	93.93	350.40	331.99	13.73	13.80
EM/H -1601	14.40	13.68	107.33	100.93	309.27	328.90	14.57	14.67
JF-4864	14.50	13.83	103.03	107.00	187.43	218.73	14.70	14.00
JF-5106	14.60	13.23	114.50	114.27	289.40	244.93	14.23	14.57
JF-4915	12.03	12.70	112.63	112.17	290.17	217.43	14.03	14.77
JH-49	12.90	13.73	110.80	110.23	235.80	214.80	14.80	15.33
JH-516	14.37	13.77	113.27	114.30	248.17	248.40	15.10	15.17
JI-5871	14.80	13.90	114.67	114.60	267.63	219.60	14.53	14.73
FR-B-4	12.77	13.13	109.86	110.24	245.10	226.37	14.67	15.27
FR/B -21	13.57	13.63	110.25	110.86	232.50	214.47	15.63	15.23
FR/B -105	14.57	12.77	107.35	109.85	277.93	241.27	15.10	14.97
G-2524	10.80	11.00	95.27	98.61	240.43	239.97	14.90	15.07
K.Sheetman	10.53	10.27	109.31	104.66	343.50	268.47	14.97	14.93
K.Chandramukhi	9.83	10.40	103.63	104.34	375.57	284.20	15.10	14.53
K.Bahar	11.07	11.07	112.35	112.48	336.47	245.38	14.80	15.00
K.Lalima	11.40	10.90	110.22	110.78	363.47	241.70	15.30	15.07
K.Badshah	10.73	10.20	112.65	112.31	345.47	239.27	15.83	15.73

4). The stolon length ranged from 7.30 cm to 12.69 cm. Only two varieties JH222 and EM/H1601 recorded a short length of stolon. The number of days required for bud growth ranged from 93.29 to 110.59 days. JH222 recorded minimum days of bud growth requirement among all the varieties. The number of days of first bud opening ranged from 93.04 to 118.9 days and it was E4486 to the least and JF5106 the most number of days required for first bud opening.

The number of tubers per plant ranged from 7.62 to 15.64 tubers with the least number of tubers in E4486 and Kufri Sindhuri with the greatest number of tubers per plant. The

tuber maturity days ranged from 96.72 to 114.64. FR/B10, JH222 and G2524 recorded the least number of days required for tuber maturity. The yield ranged from 203.8 to 341.20 q/ha. Variety JH222 gave maximum yield while JF4864 gave the minimum yield. The dry matter content in tubers ranged from 13.77 to 15.78 percent. JI5857, JG1334 and JH222 gave the minimum dry matter content. Rest varieties were significantly superior over these varieties for dry matter content. In potato crop, yield contributing factors were found mainly plant growth parameters along with nutrition applied to the crop, Plant height, shoot growth, leaves growth, development and production for a normal yield of tubers.

Different aspects were found to have a positive role towards proper growth and development of potato crop.

CONCLUSION

It is concluded that important information on different aspects of vegetative and yield attributing attributes like plant growth and development parameters were gathered from thirty three varieties/strains/cultures used under the study. All these varieties/strains/cultures grown were found to express normal characters and recorded observations would prove helpful to the farmers for selection of varieties.

REFERENCES

- Accatino P and P Malagamba.1982.Potato production from True Seed.*Int. Potato Central Lime Peru*, pp: 20.
- Agrawal A and Tiwari RS.2004.Genetic variability in Garlic (*Allium sativum*L.).*Indian J. Agri. Sci.* **74**: 164-165.
- Davis HT.1969.The influence of stem thinning on tuber size.*Amer. Potato J.***46**: 287-290.
- Gupta A and Saxena MC. 1976. Dry matter and nitrogen accumulation in different plant parts of potato in relation to soil fertility. *Indian J. Agric. Sci.***46**: 41-45.
- Leela D.1993. Present status and future scenario of weed control in Horticultural crops. Golden Jubilee Symposium Horticulture Research A Chaning Scenario. Bangalore (May, 24-26).
- Minhas JS, Kumar P, Kumar D, Dua V K and Gupta Y K. 2018. Responese of potato to elevated CO₂ under short days growth physiological parameters and tuber yield. **70** (1): 82-86.
- Moorly J.1978.The physiology of growth and tuber yield. In Harris, P.M. ed. The potato crop.The scientific basis for improvement.*London Chappman and Hall*, pp: 153-194
- MurlidharanVK and Amalraj NA. 1991. Potato on underutilized tuber for the tropics. *Indian Hort.***36** (1): 31-37.
- Treatment Kufri Badshah, JH-222, FR/B-10, JG1334, JF547, JF110, JE808, K. Chandramukhi, K. Lalimaand K. Badshah were found promising. Treatments JH222, JG224, E4486, Kufri Chandramukhi, Kufri Bahar, Kufri Sheetman, EM/H1601, Kufri Badshah and Kufri Sindhuri were found promising and suitable for these areas. Varieties with high tuber yield were having comparatively less dry matter and should be cultivated for table purposes only. It was JH-222 which was the best performer followed by JG-224, E-4486, JF-547, Kufri Bahar, FR/B-10, Kufri Badshah, JF-110, Kufri Chandramukhi, EM/H-1601, Kufri Alankar, JF-27, JG-1334 and JE-808.
- Madalageri BB, Hosamani RM, Dharmalli RD and Kulkarni S.1990.Germplasm evaluation for yield and disease resistance in potato. *Abst. Int. Sem. New Frontiers Hort.* held at Bangalore, pp: 191
- Palkar S I.1956. Age differences in content of phenotypic components and their distribution in the organs of potato plants.*DeklodyAkadNauk SSAR IIT PP*: 1375-1377.
- Pandita ML. 1971. A varietal evaluation and selection potato.*Ann. Report H.A.U., Hissar*:42-44.
- Pushkarnath.1964. Potato in India : varieties. *Indian Council of Agricultural Research, New Delhi*, pp: 493.
- Rai M and Dhankar D C.1988.Effect of zinc application and mulching on potato production mid upland of Tripura.*Lalbagh J. Mysore***18**: 15-18.
- Singh RP, Pandey VPand Tatoo H N.1985. Studies on the performance of potato varieties in Tarai.*Ann. Report. G.B. Pan Univ. of Agric. & Tech., Pantnagar, Nainital*, pp: 181-183.
- Singh K. 1959. Quality in potato, Kanpur.*Agric. Coll. J.* **28** (1-2): 31-34.
- Tiwari DK and TiwariJP.1975. Ecophysiological adoptability of new potato varieties at Jabalpur.*Rez.J.* **9**: 44-49.

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