PERFORMANCE OF POTATO VARIETIES FOR GROWTH, YIELD AND YIELD ATTRIBUTING IN SOUTH EASTERN RAJASTHAN

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ABSTRACT

Present study was conducted to evaluate the growth performance of ten (10) different potato varieties viz. Kufri Jyoti, Kufri Bahar, Kufri Badshah, Kufri Gaurav, Kufri Garima, Kufri Pushkar, Kufri Surya, Kufri Khyati, Kufri Pukhraj and Kufri Lauvkar under natural epiphytotic conditions of Kota, Rajasthan. Results of study revealed that maximum marketable yield and total tuber yield were recorded from K. Jyoti, K. Khyati, K. Garima and K. Bahar, while maximum tuber dry matter were recorded with K. Surya, K. Bahar, K. Jyoti, K. Pukhraj and K. Pushkar. Further, in case of vigour characteristics, maximum plant vigour and minimum disease incidence (Leaf spot and Viral) was noticed in K. Jyoti and K. Khyati. Overall it can be conclude that K. Jyoti and K. Khyati is most adaptable species under epiphytotic conditions of Rajasthan.

KEYWORDS

Potato varieties
Dry matter
Plant vigour
 Marketable and total tuber yield

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1 Introduction

Potato (Solanum tuberosum L.) popularly known as ‘The king of vegetables’. It is the third most common globally consumed crop behind rice and wheat (IPC, 2013). Potato plays a vital role in food security for ever increasing world population (Thiele et al., 2010; Scott & Sourez, 2012). In 2018, total worldwide potato cultivation area is 19.3 m.ha and total production is 388 mt. In India, total area under potato cultivation is 2.1m.ha and production is 52.59 mt in 2018 (DACFW, 2019). The major potato producing states of India are Uttar Pradesh, West Bengal, Bihar, Gujarat, Madhya Pradesh, Punjab, Haryana, Assam, Jharkhand and Chhattisgarh. In Rajasthan, total area under vegetables cultivation is 166235.8 ha and production is 1699584 MT. In Rajasthan, total area under potato cultivation is 13819 ha, production is 278519 MT and productivity is 201.6 q/ha. The major potato producing districts of Rajasthan are Dholpur, Bharatpur, Hanumangarh, Kota, Sirohi, Sri gangangar and Jalore (DOHGI, 2019). Freshly harvested potatoes contain about 75-80% water, 16-20% carbohydrates, 2.5-3.2% crude protein, 0.8-1.2% minerals, 0.1-0.2% crude fats, 0.6% crude fiber and some vitamins (Yadav & Srivastava, 2015). One prior condition for high and stable yields is the choice of the most suitable potato varieties in compliance to the region’s climate and soil particularities. Beyond the high yield potential, the chosen varieties must be resistant to various environmental stresses and must have high quality potential. Potato plants are sensitive to several climatic factors, such as temperature, rainfall, humidity and photoperiod which exert a considerable influence on its growth and tuber development (Kumar et al. 2011). Good crop growth is observed when days are sunny and nights are cool (Ghosh et al., 2000). Low temperature, high light intensity and short days are conducive for early initiation of tuberization and subsequent tuber development (Das et al., 2014). Minimum of 70-90 days of favorable cool season is required to obtain an economical potato yield (Mehta et al., 2018). The optimum planting date for potatoes in Indo-Gangetic plains is the middle of October and harvesting in February/March (Kumar et al., 2007a). Climate change and its variability are posing the major challenges influencing the performance of agriculture including annual and perennial horticulture crops (Malhotra & Srivastva, 2017). Therefore, current field study was conducted at Agriculture Research Station Ummedganj, Kota, Rajasthan to evaluate the growth performance of ten available potato varieties which can yield higher, having good quality so that farmers can generate higher income.

2 Materials and Methods

Field trials was conducted with ten Indian Varieties under AICRP on Potato centre at Agricultural Research Station, Kota during 2015-2016 to 2016-2017 for finding out the yield potentiality and diseases resistance. Selected verities viz. Kufri Jyoti, Kufri Bahar, Kufri Badshah, Kufri Gaurav, Kufri Garima, Kufri Pushkar, Kufri Surya, Kufri Khyati, Kufri Pukhraj and Kufri Lauvkar were evaluated under natural epiphytotic conditions of Kota, Rajasthan. The varieties were planted in a randomized block design in the first week of November of every year, the planting condition were 60x20 spacing in 3x2.4 meter plots (60 plants/plot), each treatment replicated three times. The recommended dosage of NPK187.5:125:125 kg/ha was incorporated and 50 per cent of nitrogen applied at sowing and remaining 50 per cent of nitrogen after 30 days of sowing at earthing-up operation (Sharifi et al., 2007). The package of practices of AICRP on Potato, ARS, Kota was followed during different stages of crop growth and harvesting was done at 90 days after sowing.

2.2 Vegetative growth attributes

The observations related to vegetative growth attributes, yield attributes and disease scoring were recorded as suggested by Bhuwneshwari et al. (2013).

2.2.1 Plant Emergence

Plant emergence (%) at 30 days after sowing was calculated as given below

\[
\text{Plant emergence} \% = \frac{\text{Total number of tubers germinated}}{\text{Total number of tubers sown}} \times 100
\]

2.2.2 Plant vigour

The plant vigour was measured on the visual observation in (1-5 scale) at 60 DAP (Amarananjundeswara et al., 2018).

2.3 Yield attributes

2.3.1 Marketable tuber yield (t/ha)

Out of total tubers obtained from plants, the tubers were sorted and excluding small tubers all other grades were considered as marketable and weight was recorded and this data were used for estimate marketable tuber yield per ha.

2.3.2 Total tuber yield (t/ha)

Total tuber yield was calculated by using following formula

\[
\text{Total tuber yield} (t/ha) = \text{Marketable tuber yield} (t/ha) + \text{small tuber yield} (<20 g)
\]

2.3.3 Rottage (t/ha)

Weight of rotten tubers were recorded and by using this data for rottage per hectare (tonnes) was calculated.
2.3.4 Disease scoring

Per cent Leaf spot and viral diseases were observed and calculated by using the following formula scale.

Virus disease incidence (%) = \( \frac{\text{No. of Infected Plants}}{\text{Total No. of Plants}} \times 100 \)

Leaf spot disease Intensity (%) = (Sum of Individual Ratings / Total No. of Plants) x (100 / Max. Scale).

3 Results and Discussion

The observations on percentage of plant emergence, plant vigour, marketable tuber yield, total tuber yield and tuber rottage were recorded for two consecutive years. All shown varieties have significant difference in their growth performance, yield potentiality and disease tolerance capability. Maximum marketable yield and total tuber yield were recorded from K. Jyoti, K. Khyati, K. Garima and K. Bahar, while maximum tuber dry matter were recorded with K. Surya, K. Bahar, K. Jyoti, K. Pukhraj and K. Pushkar. However, K. Badshah, K. Gaurav and K. Lauvkar were found inferior as compare to other tested varieties. The growth parameters indicated that, all the tested varieties have higher percentage of plant emergence i.e. ranged from 88 to 95% at 30 days after sowing (Table 1). Maximum plant vigour at 60 days after planting was noticed in K. Jyoti and K. Khyati. Further, the minimum disease intensity of leaf spot and viral disease was recorded in K. Jyoti and K.Khyati (Table 2). The better performance of these varieties might be due to its genetic make-up and its better adoptability to prevailing environmental conditions (Gobana, 2002). These results are in agreement with other researchers who investigated that marketable tuber yield was significantly varied with variety, location and genotypes and genotype X environment interaction (Pandey et al., 2004; Kumar et al., 2007b; Elfinesh, 2008, Gebreselassie et al., 2016; Mehta et al., 2018).

### Table 1 Performance of various varieties on various growth attributes and tuber yields characteristics (Pooled Data)

| Hybrid/Variety | Mean emergence at 30DAP (%) | Plant vigour at 60DAP (at 1-5 Scale) | Tuber rottage at harvest (t/ha) | Foliage senescence at dehaulming (%) | Marketable yield>20g, size | Total yield | Tuber dry matter (%) |
|----------------|-----------------------------|-------------------------------------|---------------------------------|--------------------------------------|---------------------------|-------------|---------------------|
| K. Jyoti       | 94.62                       | 4.67                                | 2.56                            | 85.00                                | 19.96                     | 22.33       | 21.33               |
| K. Bahar       | 91.89                       | 4.00                                | 2.15                            | 89.00                                | 17.33                     | 19.55       | 22.13               |
| K. Badshah     | 88.70                       | 4.00                                | 1.85                            | 90.00                                | 13.37                     | 15.56       | 19.00               |
| K. Gaurav      | 91.59                       | 4.17                                | 1.78                            | 90.00                                | 13.70                     | 15.78       | 19.40               |
| K. Garima      | 94.63                       | 4.33                                | 2.29                            | 83.33                                | 18.22                     | 20.18       | 19.50               |
| K. Pushkar     | 93.41                       | 4.17                                | 2.44                            | 88.33                                | 16.55                     | 18.88       | 20.30               |
| K. Surya       | 92.00                       | 4.00                                | 2.18                            | 90.00                                | 13.89                     | 16.00       | 22.43               |
| K. Khyati      | 94.22                       | 4.67                                | 2.30                            | 85.00                                | 18.96                     | 21.07       | 20.57               |
| K. Pukhraj     | 94.07                       | 4.33                                | 2.04                            | 86.67                                | 15.11                     | 17.03       | 20.60               |
| K. Lauvkar     | 89.00                       | 4.00                                | 2.29                            | 90.67                                | 13.07                     | 15.45       | 19.93               |
| F-Test         | SIG                         | SIG                                 | SIG                             | SIG                                  | SIG                       | SIG         | SIG                 |
| CD 5%          | 2.94                        | 0.40                                | 0.36                            | 4.06                                 | 1.18                      | 1.20        | 1.06                |
| SE             | 1.39                        | 0.19                                | 0.17                            | 1.92                                 | 0.56                      | 0.57        | 0.50                |
| CV %           | 1.84                        | 5.55                                | 9.58                            | 2.68                                 | 4.27                      | 3.83        | 2.98                |

### Table 2 Disease incidence at 90-105 days of sowing

| Hybrid/Variety | Late blight (%) | Leaf spot disease (%) | Viral diseases (%) |
|----------------|-----------------|-----------------------|--------------------|
| K. Jyoti       | 0               | 11.50                 | 9.00               |
| K. Bahar       | 0               | 34.50                 | 27.50              |
| K. Badshah     | 0               | 39.00                 | 21.50              |
| K. Gaurav      | 0               | 24.00                 | 15.00              |
| K. Garima      | 0               | 24.50                 | 13.00              |
| K. Pushkar     | 0               | 15.50                 | 15.50              |
| K. Surya       | 0               | 20.00                 | 18.00              |
| K. Khyati      | 0               | 12.50                 | 12.50              |
| K. Pukhraj     | 0               | 35.50                 | 13.00              |
| K. Lauvkar     | 0               | 34.00                 | 17.00              |
Conclusion

Among the tested varieties, variety K. Jyoti, K. Khyati, K. Garima and K. Bahar were the best varieties while K. Surya, K. Pukhraj, K. Pushkar and K. Guarav were found next in terms of total and marketable tuber production under Kota, Rajasthan climatic conditions. However, maximum tuber dry matter was recorded from K. Surya, K. Bahar, K. Jyoti and K. Khyati while the minimum disease intensity of leaf spot and viral disease was recorded in K. Jyoti and K. Khyati.

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Conflict of Interest

Authors would hereby like to declare that there is no conflict of interests that could possibly arise.

References

Amarananjuswara H, Prasad PS, Shetty S, Sandhya GC (2018) Evaluation of Promising Potato Varieties for Yield Potentiality and Late Blight Disease Tolerance in Southern Dry Zone of Karnataka, India. International Journal of Current Microbiology and Applied Sciences 7: 341-350.

Bhunweshwari, Verma S, Narayan KK, Paikra MS (2013) Evaluation of processing potato genotypes for growth, yield and yield attributes under Chhattisgarh condition. The Asian Journal of Horticulture 8 : 241-245.

Das B, Sarkar KK, Priya B, Dudhane AS, Pradhan AM, Das A (2014) Evaluation of Early and Late Harvested Potatoes for Yield, Quality and Storability. International Journal of Bio-resource and Stress Management 5:22-30.

Department of Agriculture, Cooperation & Farmers Welfare (2019) Directorate of Horticulture Government of India report available on http://agricoop.gov.in/sites/default/files/Monthly_Report_on_Potato_for_July_2019.PDF access on 25th July, 2019.

DOHGI (2019) Directorate of Horticulture Government of India report available on http://agricoop.gov.in/sites/default/files/Monthly_Report_on_Potato_for_July_2019.PDF access on 25th July, 2019.

Elfinesh F (2008) Processing quality of improved potato (Solanum tuberosum L.) varieties as influenced by growing environment, genotype and blanching. M. Sc. Thesis submitted to the School of Graduate Studies of Haramaya University, Ethiopia.

Gebreselassie H, Mohamed W, Shimelis B (2016) Evaluation of potato (Solanum tuberosum L.) varieties for yield and yield components in Eastern Ethiopia. Journal of Biology, Agriculture and Healthcare 6:146-154.

Ghosh SC, Asanuma K, Kusutani A, Toyota M (2000) Effect of temperature at different growth stages on nonstructural carbohydrate, nitrate reductase activity and yield of potato (Solanum tuberosum L.). Journal of Environment Control in Biology 38:197-206.

Gobana DR (2002) Genetic variability, heritability and path coefficient studies in Potato (Solanum tuberosum L.). M.Sc Thesis submitted to the University of Agricultural Sciences Dharwad, Karnataka (India), Pp.166.

International Potato Center (2013) Potato Facts and Figures. Retrieved December 2014, from http://cipotato.org/potato/facts/.

Kumar P, Pandey SK, Singh SV, Kumar D (2007a) Irrigation requirements of potato for growing potato cultivars under west-central Indian plains. Potato Journal 34:193-98

Kumar S, Khade HD, Dhokane VS, Bethere AG, Sharma A (2007b) Irradiation in combination with higher storage temperatures maintains chip-making quality of potato. Journal of Food Science 72: 402-406.

Kumar V, Luthra SK, Jai Gopal, Singh BP (2011) CPRI Technical Bulletin No78, Pp. 56.

Malhotra SK, Srivastva AK (2014) Climate smart horticulture for addressing food, Nutritional security and climate challenges. In: Srivastava AK (Ed.) ShodhChintan, ASM Foundation, New Delhi, India, Pp. 83-97.

Mehta A, Raigon P, SomDutt, Kumar V, Singh B (2018) Effect of maturity dates on processing attributes of potato varieties under North-Western Indian plains. Potato Journal 45: 59-69.

Pandey SK, Singh SV, Kumar P, Manivel P (2004) Sustaining potato chipping Industry from western and central Uttar Pradesh: Adoption of suitable varieties. Potato Journal 31: 119-127.

Scott GI, Suarez V (2012) The rise of Asia as the centre of global potato production and some implications for industry. Potato Journal 39 : 1-22

Sharifi M, Bernie JZ, Coleman W (2007) Screening for nitrogen-use efficiency in potato with a recirculating hydroponic system. Communications in Soil Science and Plant Analysis 38: 359-70

Thiele G, Theisen K, Bonierbale M, Walker T (2010) Targeting the poor and hungry with potato science. Potato Journal 37: 75-86

Yadav SK, Srivastava AK (2015) Effect of integrated nutrient management on production of seed tubers from true potato (Solanum tuberosum) seed. International Journal of Applied and Pure Science and Agriculture 1: 26-34.