International Journal of Advanced Biochemistry Research 2025; 9(6): 499-502

International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(6): 499-502
www.biochemjournal.com
Received: 17-04-2025
Accepted: 22-05-2025

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Analysing the red skinned potato (*Solanum tuberosum* L.) hybrids for dry matter content, total starch and total sugars

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DOI: https://www.doi.org/10.33545/26174693.2025.v9.i6f.4590

Abstract
The present investigation was carried out during *kharif*, 2020-21 to study the growth, yield and nutritional value among eight red skinned potatoes (*Solanum tuberosum* L.) hybrids. The present investigation was carried out during *kharif*, 2020-21 to study the yield and its nutritional value of red skinned potato (*Solanum tuberosum* L.) hybrids. The experiment was laid out in Randomized Block Design with four replications at Department of Horticulture, Main Agricultural Research Station, UAS, Dharwad, Karnataka. Analysis of variance showed highly significant differences for all the twenty traits of red skinned potato hybrids. Among all red skinned potato hybrids evaluated for nutritional value, hybrid Kufri Mohan had highest dry matter content, Kufri Pukhraj observed maximum starch content. Total soluble solids were recorded maximum in P-46 and total polyphenols were maximum in hybrid Kufri Manik. Red skinned potato hybrid Kufri Lalima had found more total sugar content and hybrid P-53 recorded maximum reducing sugar content.

Keywords: Yield, *Solanum tuberosum* L., growth and red potato tubers

Introduction

Potato (*Solanum tuberosum* L.) is one of the largest vegetable tuber crop, staple food of many countries and grown all over the world next to wheat and rice. It is used as a vegetable, stock feed and also in industries for starch, beverages and processed products (Raturi *et al*., 2014) [15]. It belongs to Solanaceae family and native to Peru (South America).

The solanum genus comprises of 2000 species, among which 170 species are bearing the tubers. Among these, *Solanum tuberosum* is cultivated at large scale in worldwide and exploited commercially throughout the world.

India stands second in area with 2161 million hectares and production of 52589 million tonnes after China (Kang *et al*., 2001) [5]. In India potatoes are grown more in north plains during the winter days covering an area of 85-90%. Among these plains, West central plain and North-Western plain comprises more potato producing areas which accounts 45-50% of total area and production of potato in the country. Uttar Pradesh ranks first in area and production followed by West Bengal and Bihar in India. In Karnataka state, it occupies an area of 28.00 thousand hectares with production of 345 thousand MT and with productivity of 13.38 tonnes per hectare (Anon., 2019) [3].

Potato tuber colour is an important factor that influences consumer preferences. Eastern plain region of India contributes about 50% of total potato area and production. Consumers in this region generally prefer red skinned varieties. Growing awareness for nutrient rich food can create a niche market for nutritious potatoes. Potato is crop of choice for mineral bio-fortification owing to better mineral bioavailability due to its high ascorbic acid and minimal phytate content. Iron and zinc are the essentially required minerals for good health. Traditionally red skinned potato hybrids have more demand in Eastern India and also now in North Western plains and West central plains. (Luthra *et al*., 2006) [7]. Red skinned potato varieties from Punjab are regularly sent to Kashmir predominantly for cooking with meat. In India, the west-central and eastern plains accounts for nearly 75 per cent of the countries potato production. Two red skinned potato hybrids, Kufri Lalima and Kufri Sindhuri are released in 1960's but failed to continue to grow these hybrids because of late blight susceptibility, but now red skinned potato hybrids have more demand in the market because of their nutritional value. Red skinned potatoes are less in starch and more in sugar content, good source of potassium and vitamin B_6. It lowers the cholesterol, protects against the heart diseases and regulate the blood pressure. Because of these important traits the present study is planned to screen the red skinned potato hybrids for yield and nutritional value.

Potato is a versatile and nourishing food. Freshly harvested potatoes contains 80 per cent of water and 20 per cent of dry matter content. Among 20 per cent of dry matter 60-80 per cent is starch. It is rich source of vitamin-C and vitamin $B_{1,}$ B_3, B_6, minerals and also trace elements with less amount of fat. One can eat potatoes alone to live hence it is a "Wholesome food".

Growth and yield of potato depends on different agro climatic conditions. Different varieties adaptable in different type of soil and climatic requirement for better growth performance. Though India is a vast country one single variety is not suitable for different agro climatic conditions. Hence different varieties need to be evaluated in different locations to increase the production of potato.

In view of this, the present study with eight red skinned potato hybrids are screened for growth, yield and quality attributes in Northern zone of Karnataka.

Materials and Methods

The present investigation on "Screening of red skinned potato (*Solanum tuberosum* L.) hybrids for yield and its nutritional value" was conducted under All India Co-ordinated Research Project on Potato, Department of Horticulture, MARS, UAS, Dharwad during *kharif* 2020-21. Eight red skinned potato hybrids were collected from CPRI-Modipuram and evaluated using randomized block design (RBD) with four replications. The row to row spacing was 60 cm and plant to plant spacing was 20 cm. The recommended package of practices was followed. Five plants were selected randomly from each replication and data were recorded for the characters *viz.*, Plant height (cm), number of primary shoots per plant, number of compound leaves per plant, fresh weight of shoots per plant (g plant^{-1}), dry weight of shoot per plant (g plant^{-1}), circumference of tuber (cm), length of tubers (cm), number of tubers per plant, weight of peel (g), weight of tuber after peeling (g), average weight of tuber (g), total tuber yield per plot (kg plot^{-1}) and Total tuber yield per hectare (t ha^{-1}) and the quality parameters *viz*, dry matter content, total starch content, total soluble solids (TSS), total polyphenols, total sugars, reducing sugars and non-reducing sugars.

The differences between all genotypes for different characters were tested for significance by using analysis of variance as par the procedures given by Panse and Sukhatme (1961) [12].

Results and Discussion

Mean performance of eight red skinned potato hybrids for chemical constituents *viz*., dry matter content (%), total starch content (%), total soluble solids (^{0} Brix), total polyphenols (mg/100 g), total sugars (mg/100 g), reducing sugars (mg/100 g) and non-reducing sugars (mg/100 g) were noticed in Table 1 and 2 and promising red skinned potato hybrids for nutritional value were shown in Plate 1.

1. **Dry matter content (%):** Significant variation among eight red skinned potato hybrids was recorded for dry matter content (%). Dry matter content of potato hybrids ranged from 16.07 to 21.25 per cent with average mean of 18.69 per cent. Red skinned potato hybrid Kufri Mohan recorded maximum dry matter content (21.25%), which was on par with red skinned potato hybrid P-53 (20.75%), Kufri Lalith (19.9%) and Kufri Lalima (19.75%). Whereas potato hybrid Kufri Pukhraj recorded lowest dry matter content (16.07%). All the red skinned potato hybrids had significant and maximum dry matter content significantly than Kufri Pukhraj (16.07%) and values are depicted in Table 1.

   It is one of the most important trait in potato production. Potato cultivars with high dry matter content are most suitable for processing in to French fries, chips and other value added products. In the present investigation highly significant variation is observed among eight red skinned potato hybrids for dry matter content are presented in Table 1. The increased dry matter content in potato varieties may be due to cell division and cell elongation in various tissues. Sharma *et al*. (1990) [16] observed that in potato cultivar, senescence started earlier produces less dry matter content with declining its photosynthetic activity in leaves with senescence. Similar results were obtained by findings of Marawaha (1998) [9], Manivel *et al*. (2003) [8], Paul *et al*. (2005) [14], Pandey *et al*. (2005) [10], Habung (2011) [4] and Krashi *et al*. (2020) [6]. Abbas *et al*. (2011) [1] reported that potato genotype NARC 1-2006/1 had found highest dry matter content (27.36%) and potato genotype NARC 1-2006/2 had lowest dry matter content (13.76%).
2. **Total starch content (%):** Total starch content for eight red skinned potato hybrids showed significant difference. Starch content ranged from 59.99 to 81.98 per cent with its general mean of 69.39 per cent (Table 7a). Highest starch content (81.98%) was noticed in check potato hybrid Kufri Pukhraj. Red potato hybrid P-45 had lower starch content (59.99%). All the red skinned potato hybrids significantly showed lower starch content than check variety Kufri Pukhraj (81.98%) and values are shown in Table 1.

   Increase in starch content may be due increase in photosynthetic activity. This is in conformity with the findings of earlier authors Abbas *et al*. (2011) [1], Zaman and Ali *et al*. (2020) [20]. Habung (2011) [4] reported that variety Kufri Jyothi (86.39 g per 100 g) had found highest starch content.
3. **Total sugars (mg/100 g):** Total sugar content for eight red skinned potato hybrids showed significant variation. Sugar content in red skinned potato hybrids ranged from 320.52 to 685.87 mg/100 g with common mean of 522.66 mg/100 g. Among the test potato hybrids, Kufri Lalima recorded highest total sugars (685.87 mg/100 g) and check hybrid Kufri Pukhraj recorded lowest total sugars (320.52 mg/100 g). All the red skinned potato hybrids exhibited highest total sugar content than check variety Kufri Pukhraj (320.52 mg/100 g) and presented significantly in Table 2.

   The variation in sugar content may be due to residual sugars after synthesis of starch, which is later become active and lead to increase in total sugar. Habung (2011) [4] reported that variety Kufri Jyothi obtained maximum total sugar content (253.67 mg/100 g).
4. **Reducing sugars (mg/100 g):** Significant differences were observed for reducing sugars in eight red skinned

potato hybrids. Reducing sugar content ranged from 60.40 to 212.37 mg/100 g with general mean of 104.63 mg/100 g (Table 7b). Hybrid P-53 had highest reducing sugars (212.37 mg/100 g) and whereas, check hybrid Kufri Pukhraj possessed lowest reducing sugars content (60.40 mg/100 g). All the red skinned potato hybrids recorded high significantly more reducing sugars compared to check variety Kufri Pukhraj (60.40 mg/100 g) and values are shown in Table 2.

Increase in reducing sugar may be due to increase in phenols accumulation after the synthesis of starch. Similar results were obtained by Uppal and Khurana (2003), Paul *et al*. (2005) [14], Habung (2011) [4], Patil *et al*. (1990) [13] and Abbas *et al*. (2011) [1]. Pandey *et al*. (2009) [11] reported that Kufri Chipsona-1 and Kufri Chipsona-2 had found highest reducing sugar content (0.1%) and found less suitable for frying and more suitable for other processing methods.

Non-reducing sugars (mg/100 g)

Non reducing sugars content showed significant differences among eight red skinned potato hybrids. It ranged from 260.24 to 596.45 mg/100 g with mean value of 417.77 mg/100 g (Table 7b). Among all red skinned potato hybrids, Kufri Manik recorded maximum non reducing sugars (596.45 mg/100 g) and Kufri Pukhraj recorded minimum non reducing sugar (260.24 mg/100 g). Significantly all red skinned potato hybrids possessed high non reducing sugars content than check variety Kufri Pukhraj (260.24 mg/100 g) and shown in Table 2.

Habung. (2011) [4] reported that potato variety Kufri Jyothi observed highest non-reducing sugar content (139.88 g/100 g).

Table 1: Performance of different potato hybrids for dry matter content and nutritional value

Sl. No.	Hybrids	Dry matter content (%)	Total starch content (%)
1	Kufri Mohan	21.25	73.16
2	Kufri Lalima	19.75	70.00
3	Kufri Lalith	19.90	70.17
4	Kufri Manik	17.17	62.81
5	P-45	18.17	59.99
6	P-46	16.50	62.84
7	P-53	20.75	74.17
8	Kufri Pukhraj	16.07	81.98
Mean		18.69	69.39
S.Em ±		0.79	0.43
C. D. @ 5%		2.33	1.43
C.V%		8.44	1.39

Table 2: Performance of potato hybrids for sugar content

Sl. No.	Hybrids	Total sugars (mg/100 g)	Reducing sugar (mg/100 g)	Non - reducing sugar (mg/100 g)
1	Kufri Mohan	398.42	92.47	305.4
2	Kufri Lalima	670.75	104.52	565.37
3	Kufri Lalith	481.32	75.62	404.42
4	Kufri Manik	685.87	89.55	596.45
5	P-45	548.55	90.65	457.32
6	P-46	532.35	111.45	421.5
7	P-53	543.52	212.37	331.42
8	Kufri Pukhraj	320.52	60.40	260.24
Mean		522.66	104.63	417.77
S.Em ±		0.34	0.21	0.16
C. D. @ 5%		1.02	0.64	0.48
C.V%		0.13	0.41	0.07

Kufri Manik

P-53

Plate 1: Promising red skinned potato hybrids for nutritional value

Conclusion

Based on the present investigation it is concluded that most promising potato hybrids namely P-46, Kufri Mohan and P-53 were high yielding hybrids. Red skinned potato hybrids, Kufri Manik and Kufri Lalith were most promising for chemical constituents in potato.

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