Annals of Plant and Soil Research 24(4):592-595 (2022)
https://doi.org/10.47815/apsr.2022.10213

Morpho-physiological and productivity characteristics of two leader cultivars of Karonda trees (*Carissa carandas* L.)

VIJAY KUMAR*, RAKESH KUMAR, BALBIR DHOTRA[1], SHALINI KHAJURIA[2] AND ROHIT KUMAR ARORA[3]

Rainfed Research Sub-station for Sub-tropical fruits, Raya, Sher-e- Kashmir University of Agricultural Sciences & Technology, Jammu-181 143, India

Received: November, 2021; Revised accepted, August, 2022

ABSTRACT

The present investigation was carried out to study the morpho-physiological and productivity characteristics of two genotypes of Karonda (Carissa carandasL) trees grown under rainfed condition of Jammu.The two leading cultivars of karonda viz. green and pink were used in study at Rainfed Research Sub-station for Sub-tropical fruits, Rayaduring 2020-21. The leaf morphological characteristics were maximum in green cultivar of karonda i.e. leaf length,leaf breadth, leaf fresh weight and leaf dry weight. The green cultivar of karonda had maximum leaf total water content (34.11 %), relative water content (39.25 %) and total chlorophyll (43.68) as compared to pink. The leaf scherophylly was higher in green cultivars of karonda viz. leaf area (30.30 cm^2), specific leaf area (197.6 cm^2/g) and density of foliar tissue (37.0 g kg^{-1}) than pink. The fruit yield (8.11 kg/plant), fruit weight (4.42 g) and fruit acidity (2.25 %) was maximum in green cultivar of karonda where as TSS (13.65^{0}Brix) was maximum in pink cultivar.Thus, green cultivar of Karonda performed better in morpho-physiological and fruit productivitycharacterizations than pink.

Key words: Chlorophyll, leaf water, fruit yield, fruit quality, rainfed conditions

INTRODUCTION

Karonda is widely utilized in making pickles, jams and preserves. This succulent bounty also confers immense health benefits, such as preventing heart disease, relieving digestive trouble and curing fever. Karonda (Carissa carandas L.; 2n=2x=22) belongs to family Apocynaceae which comprises of more than 25 species in the genus Carissa, of which five species are indigenous to India, (Patil *et al.*, 2017). Karonda is a hardy, drought-tolerant species which does well in a wide range of soil conditions. This crop is well adapted for arid tropics and sub-tropics since it can withstand high temperatures thrive well as a rainfed crop, and gives yield with the less management. It is grown for its attractive colored edible fruits and also used as live fencing around the orchards due to the presence of spines which provide protection against stray and wild animals.Karonda is an immense wealth based on variable morphological and biochemical qualities which warrants for appropriate addressing and documentation of the germplasm. Karonda fruit contains fair amount of vitamin C and minerals. The ripe fruits contains high amount of pectin. The fruits have anti-microbial and antifungal properties and its juice used to clean old wounds which have become infected. The fruit have an analgesic action as well as an anti- inflammatory one (Das *et al.*, 2013). Fruits are generally harvested at immature stage for vegetable purpose, fully ripen fruits are consumed fresh or processed. The unripe fruits yield milky white latex which can be used in preparing chewing gum and rubber. Improvement in productivity will definitely boost the crop expansion in non-traditional areas of India and other ancillary industries. One of the simple approaches to improve production of any crop is to boost up productivity through utilization of existing genetic resource. A large germplasm resource is always favoured in plant breeding program as many desirable traits may obviously remain in the population, which may exploit breeding program. The analysis of genetic diversity and relatedness among genotypes becomes very useful. The present study was undertaken to demonstrate the usefulness of morphological, physiological, fruit yield and quality attributes the variability of Karonda cultivars of Jammu and Kashmir, India.

*Corresponding author e-mail: vijaykumar.1144@yahoo.com
[1]Organic farming Research Centre Chatha,[2]KVK Samba,[3]Division of Soil Science and Agricultural Chemistry,SKUAST, Jammu

MATERIALS AND METHODS

The present study was conducted at Rainfed Research Sub-Station for Sub-tropical fruits Raya, Jammu, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. The research station is situated at an elevation of 332 m above mean sea level and lies between 32º39" North latitude and 74 53" East longitude. The climate of this site is sub-tropical with hot and dry in summer season, hot and humid in rainy season and cold in the winter months. The maximum temperature rises up to 45ºC during summer and minimum temperature falls to 3.16ºC during winter. Rainfall of 1100 mm occurs annually but about 70 to 80 per cent from July to September and with a very high intensity and frequency distribution. The soil is sandy loam low in fertility and water holding capacity, with soil pH 6.50, electrical conductivity 0.06dSm^{-1} organic carbon: 2.70 g kg^{-1} , available N: 127 kg ha^{-1}, available P: 11.7 kg ha^{-1} and available K: 128.5 kg ha^{-1}.The two cultivars (green and pink)were selected and marked with metal tags for recording observation for morphological and physiological adaptations.The leaf parameters: leaf fresh weight (FW) and dry weight (DW) per leaf were recorded during 2021. The leaves were weighed immediately after harvest to determine their fresh weight. Then these leaves were oven dried at 70^{0}Cfor 48 hours and their dry weight was then determined. Several indices of leaf physiological parameters (specific leaf area, specific leaf weight and density of foliar tissue and succulency)were calculated by the formulas suggested by Ennajeh *et al.* (2010).Total chlorophyll content was measured by using chlorophyll meter SPAD-502. The randomly selected 10 in fresh leaves in a plant and calculate the average value.For formative relative water content (RLWC) and leaf water content (LWC were estimated following the procedures suggested by Bowman (1989): The leaf areawas calculated according to the equation proposed by Ahmed and Morsy (1999).The fruit size (length and diameter) was measured by digital vernier. Total soluble solids (TSS) was determined by a hand refractometer. The acidity was estimated by adopting the standard procedureby Ranganna (2001). The data were analyzed with SPSS version 16.0. All the means were compared by Independent samples T test at p= 0.01 to evaluate the differences between the two cultivars.

RESULTS AND DISCUSSION

Most of the leaf morphological characteristics were significantly different between the two cultivars of Karonda plants. Green cultivarexhibited significantly greater leaf length, leaf breadth, leaf fresh weight andleaf dry weight ($P < 0.01$) than pink cultivar (Table 1). However, the number of seeds per fruit was maximum (5.47) in pink cultivar as compared to green cultivar and number of seed per fruit and leaf length were not significantly affected by the cultivars. This might be due to higher carbohydrate demand of green cultivar in August due to later maturity as compared to pink cultivar. Therefore, green fruits have comparatively greater sink ability and require faster carbohydrate accumulation until later August.

Table 1: Leaf morphological characteristics of green and pink cultivars of Karonda

Karonda cultivars	No of seed per fruit	Leaf length (cm)	Leaf breadth (cm)	Leaf fresh weight (g)	Leaf Dry weight (g)
Green	5.14 ±0.165	6.45±0.021	3.55±0.019	0.478±0.011	0.168±0.022
Pink	5.47±0.133	6.43±0.014	3.48±0.007	0.418±0.007	0.154±0.017
Significance	NS	NS	**	**	**

*Data are mean values standard error (n=15) ** significance differences at P<0.01; NS Non- significance difference at p> 0.01 (Independent samples T test)*

The leaves of green cultivar had significantly higher total chlorophyll content, total water content (TWC) and relative water (RLWC) contents per unit of fresh leaf weight compared to those in pink leaves (Table 2). The SPAD reading indicated that green cultivar leaves had higher leaf absorbance than pink. The green cultivars of Karonda contained high total water content (TWC) and relative water content (RWC) in leaves. The total chlorophyll content of green cultivar of karonda could be due to water availability as it increased total chlorophyll content. Hence, chlorophyll pigments might be higher due to resistant to dehydration of leaves

of this cultivar (Luvaha *et al.*,2007). The adaptationof the pigment in leaves could be due toinfluence of the rate of photosynthesis and leaf gas exchange of plants.

Table 2: Leaf water content and chlorophyll of green and pink cultivars of Karonda

Karonda cultivars	Leaf TWC (%)	Leaf RLWC (%)	Total chlorophyll (SPAD)
Green	34.11±0.034	39.25±0.071	43.68±0.056
Pink	32.45±0.081	37.45±0.050	40.75±0.045
Significance	**	**	**

The leaf sclerophylly of green cultivar had significantly higher (Table 3) leaf area (30.30cm^2/leaf), specific leaf area (197.6 cm^2/g), and density of foliar tissue (37.00 g kg^{-1}) which were significantly higher over pink cultivar. However, specific leaf weight (0.0056 cm^2/g) and succulency (0.0103 mgH_2O/cm^2) were higher in pink cultivar than green cultivar.The increased values in the leaf sclerophylly characteristics were also evident from the growth data recorded on plant height and plant spread (Kumar*et al.*,2020).The green cultivar received higher photosynthetically active radiations (PAR), but had lowest specific leaf productivity and better in resource rich environments due to better photosynthesis. Singh and Singh (2007) reported an increase in photosynthesis in green cultivarindicating better adaptation under resource poor environment.

Table 3: Leaf sclerophylly in green and pink cultivars of Karonda

Karonda cultivars	Leaf area (cm^2)	Specific leaf area (cm^2/g)	Specific leaf weight (cm^2/g)	Density of foliar tissue (g/kg)	Succulency (mgH_2O/cm^2)
Green	30.30±0.065	197.6±2.100	0.0051±0.00005	37.00±0.991	0.0087±0.00026
Pink	30.03±0.031	179.4±2.340	0.0056±0.00008	35.43±1.084	0.0103±0.00040
Significance	**	**	**	**	**

The poor yield and low quality fruits are largely due to poor photosynthetic efficiency, poor distribution of light, coupled with other compounding factors (Singh and Singh, 2007). The fruit yield and fruit quality parameters of green cultivars weresignificantly higher as compared to pink cultivars.The green cultivars showed the maximum fruit yield (8.11 kg /plant), fruit weight (4.42 g), fruit length (21.56 mm), and fruit diameter(17.64 mm) as compared to pink cultivars (Table 4).

Table 4: Fruit yield and quality attributes of green and pink cultivars of Karonda

Karonda cultivars	Fruit Yield (kg /plant)	Fruit weight (g)	Length (mm)	Diameter (mm)	TSS (^{0}Brix)	Acidity (%)
Green	8.11±0.22	4.42±0.090	21.56±0.173	17.64± 0.18	10.02±0.12	2.25±0.043
Pink	7.11±0.11	3.84±0.091	20.28±0.21	16.44±0.22	13.65±0.14	1.52±0.072
Significance	**	**	**	**	**	**

The fruit quality attributes were significantly higher of green cultivar than pink karonda. The lower yield and poor fruit quality attributes might be due to meager photosynthetic effectiveness, deprived distribution of light, joined with supplementary compounding factors (Singh and Singh, 2007). The fruit TSS (13.65^0 Brix) was higher in pink than green cultivars, where as fruitacidity was maximum in green (2.25%) cultivar.Though,green cultivar contained lesser TSS(10.02^0 Brix), but had highest acidity (2.25%) due to photosynthesis and rich resources in environments (Yulin *et al.*, 2005).

The present study indicated new information about the physiology and fruit yield and quality of two leading Karonda cultivars (green and pink) and showed a clear difference in morphological, physiological, and fruit yield quality between the two cultivars under well-

rainfed conditions. The green leaves were characterized by larger leaf area, greater SLA, and higher chlorophyll contents as compared to pink. The fruit yield and acidity was higher in green cultivar and TSS was higher in pink cultivar. The superior physiological, morphological characteristics and fruit yield were recorded in green cultivar of karonda.

REFERENCES

Ahmed, F.F. and Morsy, M.H. (1999) A new method for measuring leaf area in different fruit species. *Minia Journal of Agricultural Research and Development***19**: 97-105.

Bowman, W.D. (1989) The relationship between leaf water status, gas exchange, and spectral reflectance in cotton leaves. *Remote Sensing of Environment***30**: 249–255.

Das, S.C., Prakashm, J. Deb, A.K. and Biswas, T. (2013) Medicinal value of underutilized fruits in hilly Tripura.*Acta Horticulturae* **972:** 135–41.

Kumar, S., Awasthi, O.P., Singh, A., Sharma, R. R. and Singh, K. (2020) Physiological alteration in Kinnow developed through physical and chemical mutagen. *Indian Journal of Horticulture* **77**(2): 267-272.

Luvaha, E, Netondo, G. W. and Ouma G. (2007) Physiological responses of mango (*Mangifera indica* L.*)* rootstock seedlings to water stress. *American Journal of Plant Physiology* **3**(1): 1–15.

Patil, U.S., Athani, S.I., Naik, N.H., Jagadeesh, R.C., Allolli, T.B. and Gopali, J.B. (2017) Quality and yield characterization of Karonda. *International Journal of Pure and Applied Bioscience***5**: 374−378.

Ranganna, R. (2001) Handbook of Analysis and Quality Control for Fruit and Vegetable products, second ed. Tata McGraw Hill, New Delhi.

Singh, V.K. and Singh G. (2007) Photosynthetic efficiency, canopy micro climate and yield of rejuvenated guava trees. *Acta Horticulturae* **735:** 249–57.

Yulin, L, Johanson, D. A., Yongzhong, S. U., Jianyuan, C.U.I. and Zhang, T. (2005) Specific leaf area and leaf dry matter content of plants growing in sand dunes. *Botanical Bulletin of Academia* **46:** 127–34.