

Research Article

Impact of agro-climatic conditions of Faisalabad on growth performance of *Portulaca* genotypes

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Abstract

Portulaca oleracea L. is a warm-climate, herbaceous succulent annual plant with a cosmopolitan distribution belonging to the Portulacaceae family. The majority of *Portulaca* genotypes are succulents that do well in drought and desert gardens. This characteristic of *Portulaca* genotypes formulates them as the main candidate for gardens and landscape in the region with water scarcity and saline soils. The selection of exotic genotypes in the novel atmosphere is not an easy task. Present research was designed to evaluate the growth performance of various *Portulaca grandiflora* genotypes. The variability among the *Portulaca* genotypes was observed to find out the best performer under the agro-climatic conditions of Faisalabad, Pakistan. Five *Portulaca grandiflora* genotypes were grown in the Institute of Horticultural Sciences' research field, University of Agriculture Faisalabad, and data was recorded for morphological traits. The conducted experiment was laid out in Randomized Complete Block Design with three replications. The data on eight morphological traits i.e. height of the plant, number of shoots, shoot length, number of leaves per branch, number of leaves on the plant, number of days to flower emergence, and flower size were recorded and analyzed. Amongst the five genotypes, significant variation was seen for different yield and growth-related parameters. Main parameters that were analyzed during the study include the height of the plant, number of shoots, shoot length, number of leaves per branch, number of leaves on the plant, number of days to flower emergence and flower size. Out results suggested that “*Portulaca* long time bloom” performed best in vegetative and flowering traits followed by “*Portulaca* Yubi Pink” in agro-climatic conditions of Faisalabad.

Keywords: agro-climatic conditions; morphological traits; performance evaluation; *Portulaca* genotypes;

Introduction

Portulaca grandiflora is known by several different names like sun plant, rose moss, moss rose as well as portulaca. It is

extensively cultivated in tropical and subtropical regions. It grows well in sunny, dry locations and rock gardens. It is grown as an edging plant and intercropping in bulk

on beds. It belongs to the family Portulacaceae, order Caryophyllales. Based on life span, it is grouped into two types, annual and perennial. Portulaca has up to 100 plant species. Warm tropical flowers are appearing in temperate climates. The annual *P. grandiflora*, a succulent herb, has many single and double-flowered varieties in various colors. The perennial type of Potulaca is a hardy herbaceous plant that produces only double flowered varieties and is likely to have limited color shade compared to the annual. Portulaca flower is ephemeral and open almost simultaneously early morning. However the time of flower wilting is significantly affected by weather conditions. Flowers often wilt during the dry and hot days whereas most do not wilt until evening [1]. Purslane is a quite common Portulaca and is an integral member of the Portulacaceae family. It is pervasive as a wild plant and had been ranked at 8th position nearly all common flora on the earth [2]. Portulaca flowers have many different styles and textures, but the majority of varieties are succulents (fleshy plants with their own water storage for dry conditions) that do well in drought-tolerant and desert gardening. Portulaca grows eagerly in media that could be dry and salty. Consequently, it is planned as halophyte in the Halophyte database. [3] Taking into accounts its forbearance particularly to the chlorine saline condition Portulaca is recommended as a capable aspirant for use of sewerage water reutilization scheme. Portulaca is not merely important for its survival tendency and low water consumption but on the other hand also important for its utility as a vegetable and oil extraction crop. The exceptional nutritive eminence of portulaca and its excellent forbearance towards Cl salinity give this class a capable halophyte candidate for saline gardening. Nevertheless, be short of scientific studies on the biological,

physiological, and biochemical mechanisms reinforcing it as salt tolerant, another scientific research elaborated the reticence effects of salinity on sapling growth of Portulaca [4].

Introduction of foreign cultivars in new agro-climate is difficult as their performance is affected by prevailing climatic factors. The quality production of Portulaca could be achieved by using of suitable environmental conditions, which are desired by the plant. The development of cultivars or varieties, which can be adapted to a wide range of diversified environments, is the ultimate goal of plant breeders in crop improvement programs. The adaptability of a variety over diverse environments is usually tested by the degree of its interactions with different environments under which cultivar is planted. A genotype is measured as adapted or established if that genotype has a high average yield. Less degree of stability is observed in cultivars' yielding aptitude when cultivars are raised in different environmental conditions. *Zinnia elegans* had a prominent effect on its growth and flowering traits under other climatic conditions [5]. It is commonly observed that at any place where environment is hot and arid, Portulaca is planted for its vibrant and colorful flowers. Portulaca is also used for plantation in rock landscape, in masses and as ground cover.

The research proposed in this manuscript provides a simplest solution that well adopted and efficient genotype can perfume better with nominal applications of fertilizer and pesticide. Considering the socio-economic condition of Country, small scale floriculture industries with minimal inputs in agricultural domain can be benefited from this cost effective simple genotype evaluation and selection. Various genotype of Portulaca in varied climatic situation performed in an unlike way. Portulaca genotype has high temperature requisite and

high temperature is a trait of Faisalabad climate. Therefore this research was designed for the assessment of Portulaca genotypes for variability regarding the growth and flowering indices. Variability and performance of available genotypes of Portulaca was studied to identify the best performing genotype in local climate conditions of Faisalabad, Pakistan.

Materials and Methods

Site of the experiment

The current research trial was carried out in Pakistan, University of Agriculture Faisalabad, Institute of Horticultural

Sciences, Horticulture Research Area during spring 2018.

Geography and meteorology of site

Faisalabad is situated in the slight slopes and even plains north-east of Punjab and sandwiched between longitude 73^o- 06' East, latitude 31^o- 26' North, at an altitude of 184 m (604 ft.) above ocean level. Weather data presented in (Table 1) was collected and composed by Agricultural Meteorology Cell, Crop Physiology Department, University of Agriculture Faisalabad.

Table 1. Weather conditions

Month	Temperature			Moisture	Precipitation	Day length
	Max	Min.	Avg.			
	°C	°C	°C	%	mm	Hours
March	26.37	13.15	19.76	59.84	6.8	8.43
April	32.02	17.22	24.84	46.95	20.9	9.337
May	40.65	24.855	32.75	42.98	14.6	10.4
June	38.57	26.017	32.29	54.95	78.3	9.38

Plant material

Seed was obtained by a limited seed business company Chanan Din Lahore. Seeds of all genotype were sown discretely in pots for nursery growing and after that were shifted to the 12" pots each comprising one plant in each pot. Seeds were sown on the 18th of March, 2018, in the afternoon. It took about 4 days to germinate and they were transplanted after 26 days. The well-rotted leaf compost was used only on time of pot filling. No chemical fertilizer or chemical treatment was used.

Genotypes

Genotypes used were Portulaca long time blooming, Portulaca F-1 Sundial peach, Portulaca extra double large-flowered, Portulaca Sunnyboy Flame, and Portulaca Yubi Pink.

Treatments

Homogeneous horticultural practices were applied to all the saplings under research. Throughout the tenure of the trial, all further

cultural practices like weeding, sapling protection procedures, earthen up, staking, etc. were kept alike for every entry. Five different cultivars were used with three replications.

Growth indices

Following morphological characters were observed during the study like germination %age, number of leaves per branch, number of leaves per plant, leaf length (cm), number of shoots, number of flowers per plant and flower diameter.

Statistical analysis

Data were subject to statistical analysis for significant differences by means of analysis of variance technique [6]. Evaluation of means was interpreted according to LSD Test at 5 % level of significance.

Results and Discussion

The quality production of Portulaca plants can be achieved by using suitable genotype under favorable environmental conditions. To attain this objective, different genotype

were grown and some important morphological traits were studied to conclude the performance of *Portulaca* genotype under the agro-climatic conditions of Faisalabad city. The mean of five *Portulaca* cultivars for the 8 morphological

traits has been analyzed and given in (Table 2). Analysis of means revealed the significant differences among the *Portulaca* genotypes for most of the morphological traits.

Table 2. Table of mean values of morphological parameter

Cultivars	Germination %age	Plant height (cm)	Number of leave /branch	Number of leaves / plant	Number of shoots/plant	Leaf length (cm)	Number of flower/ plant	Flower diameter
Portulaca long time blooming	95.00a	13.60b	28.18a	427.00a	13.13a	1.45a	28.00a	12.93 b
Portulaca F-1 Sundial peach	88.33b	15.42b	25.20c	338.44b	13.52a	1.52a	16.67b	12.93 b
Portulaca extra double large flowered	81.67c	19.55a	29.17a	305.00b	12.81a	1.45a	24.67ab	14.10 a
Portulaca Sunnyboy Flame,	78.67c	15.00b	28.34a	356.33b	9.89b	1.57a	26.67a	12.87b
Portulaca Yubi Pink,	93.33a	8.92 a	25.19c	433.00a	12.25a	1.55a	27.67a	12.71 b

Germination %age

The mean values presented in (Fig.1) revealed that there was a significant difference among the cultivars regarding germination percentage. “Portulaca long time bloom” showed significant difference as compared with genotype “Portulaca extra double large flowered”, “Portulaca F-1 Sundial peach” and “Portulaca Sunnyboy Flame”. The cultivars “Portulaca long time blooming” showed highest germination i.e. (95%) and least germination (78%) was obtained by genotype “Portulaca Sunny boy Flame”.

This variation in results may be due to the fact that seed germination of different genotypes is exaggerated by the environmental conditions existing in the surroundings and genotype of *Portulaca*. This trait is dependent of enormous climatic prevailing conditions such as temperature, light, media, and moisture contents. It is

accepted theory that certain species of seed have different responses to temperature according to variety and location. These responses are adaptive success or failure and this is also reasonable to believe [7]. *Portulaca* seeds that germinated in sporadic temperatures varied from 24-14 °C to 34-24 °C, representing that *Portulaca* species might germinate throughout the annum on less high elevation in the area of tropics. Light, though, seems to be supplementary significant for germination than temperature as merely a minute percentage of seeds germinated in shadows or darkness at a few warmth between 14-24 °C and 24-34 °C, whereas in light, numerous seeds germinated irrespective of the given temperature. A similar retort for *P. oleracea* was described from [8].

Plant height (cm)

The means presented in (Fig. 2) exhibit that there was a significant difference among the

cultivars with respect to plant height. The genotype “Portulaca extra double large-flowered” gained significantly more average plant height (19.78 cm) than other cultivars followed by genotype “Portulaca F-1 Sundial peach” that was (15.25 cm) and least average plant height (8.84 cm) was observed in genotype “Portulaca Yubi Pink”.

Enhancement in plant tallness is the main evident sign of plant growth that is in a straight line affected by hereditary makeup of cultivar and agro-climatic conditions. The difference in the plant heights among

different cultivars of *Zinnia elegans* was also reported by [5, 22] give a statement that manifold genes influence the plant height in the *Zinnia elegans* species. . She divided in her exertion the classified *Z. violacea* plants into six categories typical, dw 1 to dw 5 typical plants were the tallest and 40 cm in height, trailed by dw 1 30-40 cm. [9] Reported variation in leaf production per plant. [10] Accomplished the gerbera-grown underneath the naturally ventilated green house, which result in maximum produced plant height, plant canopy, spread and number of leaves.

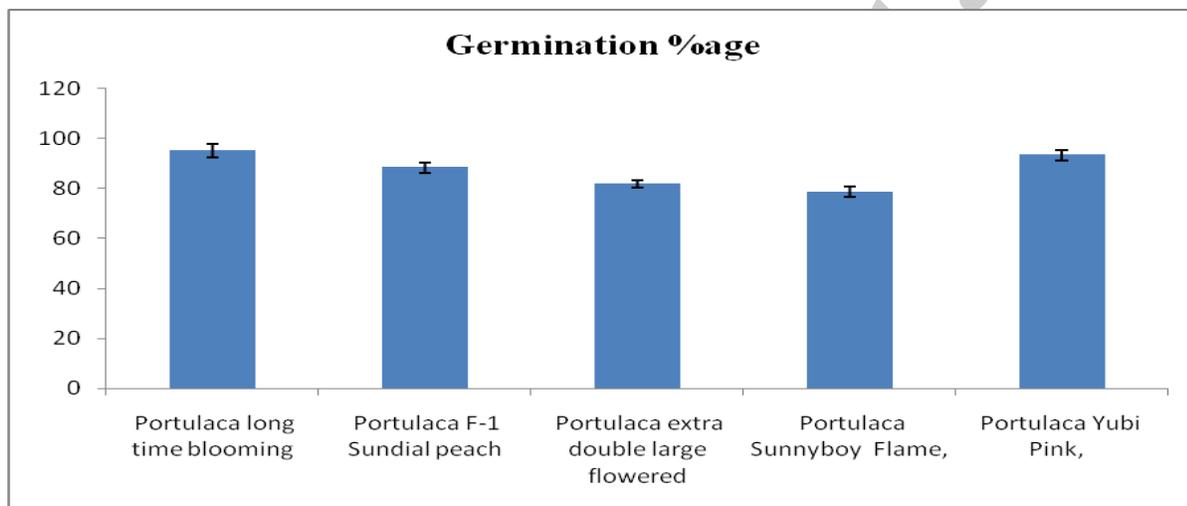


Figure 1. Germination %age

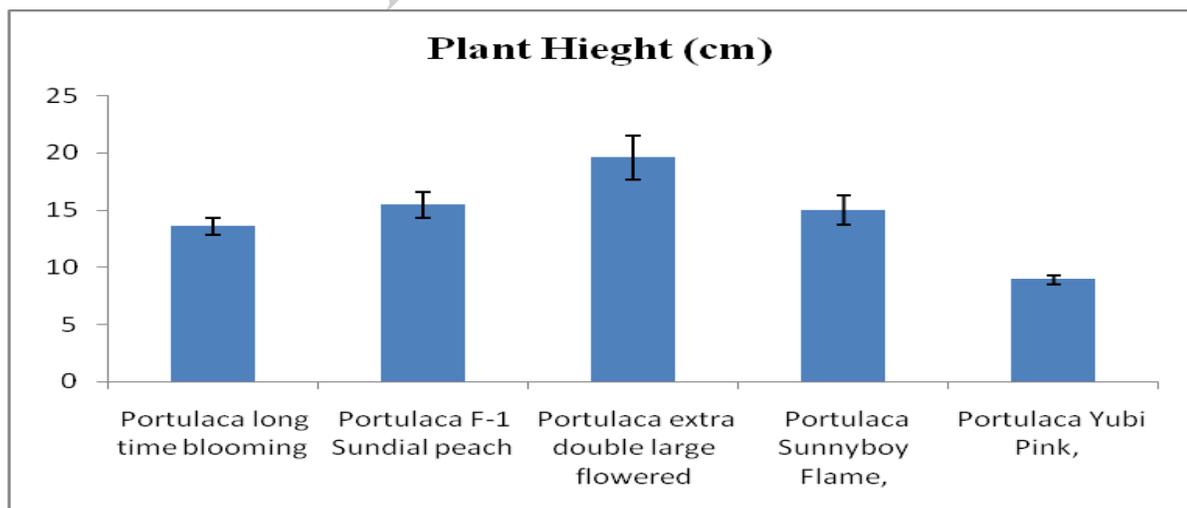


Figure 1. Plant height (cm)

Number of leaves per branch

The mean values given in (Fig. 3) revealed that there was a significant difference among the cultivars regarding number of leaves per branch. The genotype “Portulaca extra double large-flowered” with more number of leaves per plant (29) showed significant difference with genotype “Portulaca F-1 Sundial peach” and “Portulaca Yubi Pink”. The fewest number of leaves on plant (25) was observed in genotype “Portulaca F-1 Sundial peach”.

Production of leaves of any species settled the spread and texture of the plant. They are also called the food factory of plant. Leaves are the principally significant functional units of photosynthesis that greatly influence the escalation of growth and flower yield. Deviation in leaf manufacture per plant has been also elaborated by [10, 11] in gerbera. Our results were also evident by [13]. He premeditated the vegetative characters of 9 Gerbera varieties at the time of 1 year age of crop growth under naturally ventilated lath house.

Number of leaves per plant

The mean values obtained in (Fig. 4) interpret that there were considerable differences amongst the portulaca cultivars about leaves numbers per plant. It is evident from the results that genotype “Portulaca Yubi Pink” significantly produce more number of leaves per plant (430) than other cultivars “Portulaca sunny boy Flame”, “Portulaca F-1 Sundial peach” and Portulaca extra double large-flowered. The minimum number of leaves (292) was found in genotype “Portulaca extra double large flowered”.

Variation in leaf production per plant could be due to the fact that under given environmental conditions, a cultivar with different genetic makeup performs differently. This was also reported by [10, 11, 13]. They calculated the foliage traits in gerbera elaborated that the utmost plant vigor in Versace while Khaiser resulted in least amount of plant spread. The highest leaves numbers on plant were formed by AVP.07 after that number came of Versace while Yellow Queen generated minimum leaves numbers.

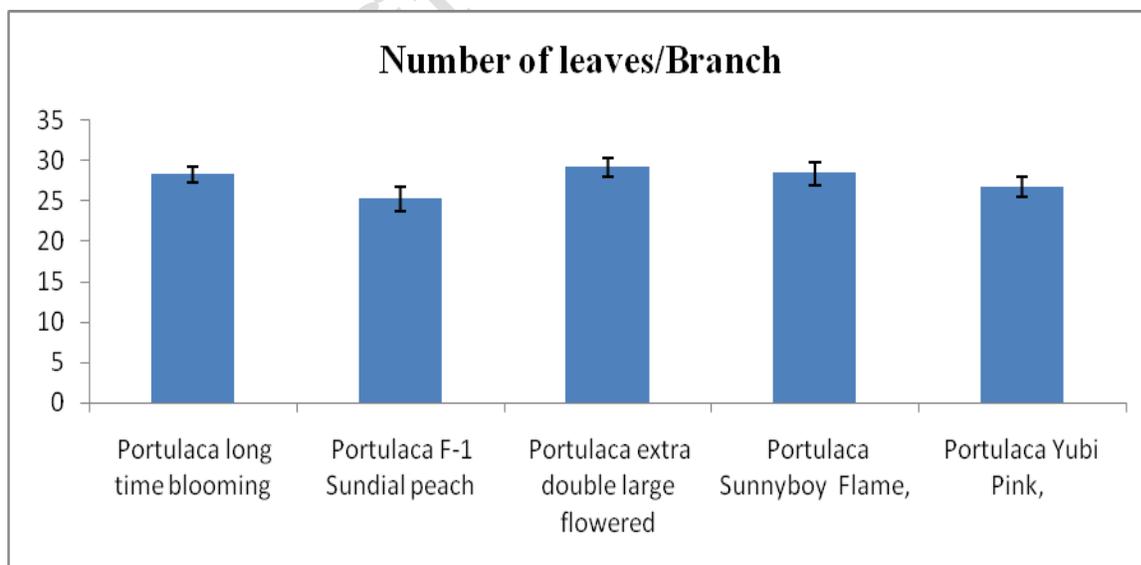


Figure 2. Number of leaves per branch

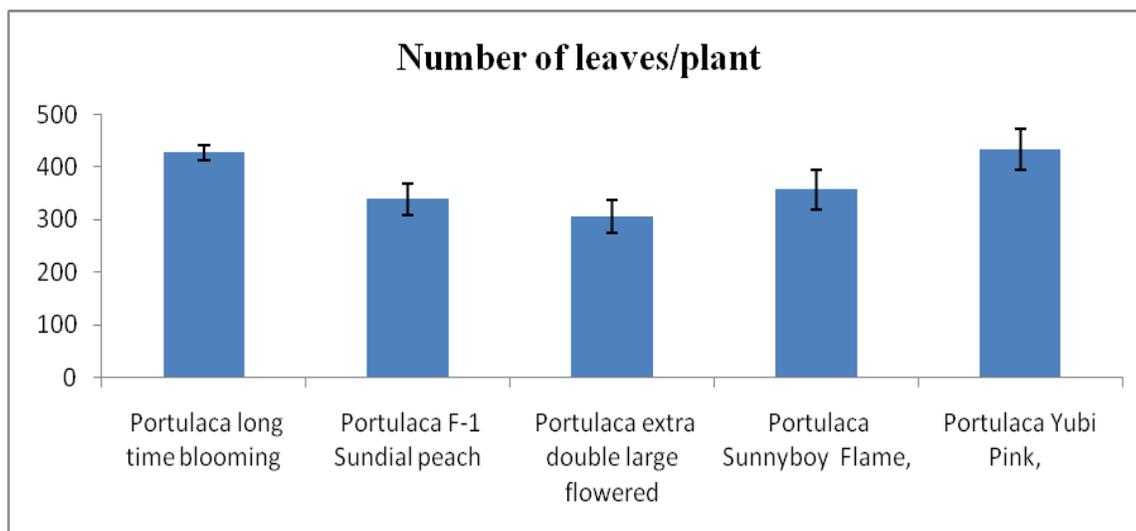


Figure 4. Number of leaves per plant

Number of shoots per plant

The skeletal structure and shape of the plant is intricate by the branches. They were influenced by high significance by means of the changeable environmental conditions and genetic makeup of cultivars. The mean values given in Fig. 5 exhibit that there was a significant difference among the cultivars regarding number of shoots per plant. As shown in (Fig. 5), the significant difference was found in genotype "Portulaca long time blooming" that produce maximum average number of shoots as compared with minimum average number of shoots (10) producing genotype "Portulaca Sunnyboy Flame".

Our findings were being strengthened by the result of [14] who deliberated the morphological and floral characteristics of annual Zinnia cv. Dahlia giant produced flower beneath natural agro-climatic conditions of city Faisalabad. He found the largest vegetative growth pace, lateral branches number for each plant, lateral branches size, and leaf area. Likewise, study was taken by [15] who noted that height of plant, leaves number for each plant, side branches number, days taken to first flower

appearance and flowers number per plant were exaggerated significantly when plants were cultured in manure of leaf mix. It has been reported by [16] that the plants grown in comparatively different environment produced differently leaves and branches on top of the prime axis. The occurrence of escalating number of leaf on shoots in more hot soil tended plants to initial spread for getting settled by absorbing and receiving plenty of light and carbon dioxide.

Leaf length (cm)

The mean values elaborated in (Fig. 6) revealed no significant difference among the cultivars regarding leaf length. Graph shown in Fig. 6 revealed that "Portulaca Yubi Pink" genotype produced leaves with more average leaf length (1.57cm) followed by Portulaca long-time blooming gained leaf length of about (1.548cm). Average smallest leaves were produced by genotype "Portulaca F-1 Sundial peach" i.e. 1.446 cm in length.

The shape and size of leaves is an example of conciliation between leaf energy exchange, leaf temperature, respiration, transpiration and photosynthesis. The utmost amplification in nutrient absorption and

reason to this factor, more photosynthesis might have resulted in more chlorophyll formation with a greater than before leaf size by [17] Findings are in step with [5]

who observed small variation in leaf area of different cultivars of *Zinnia elegans* under natural agro-climate conditions of Faisalabad.

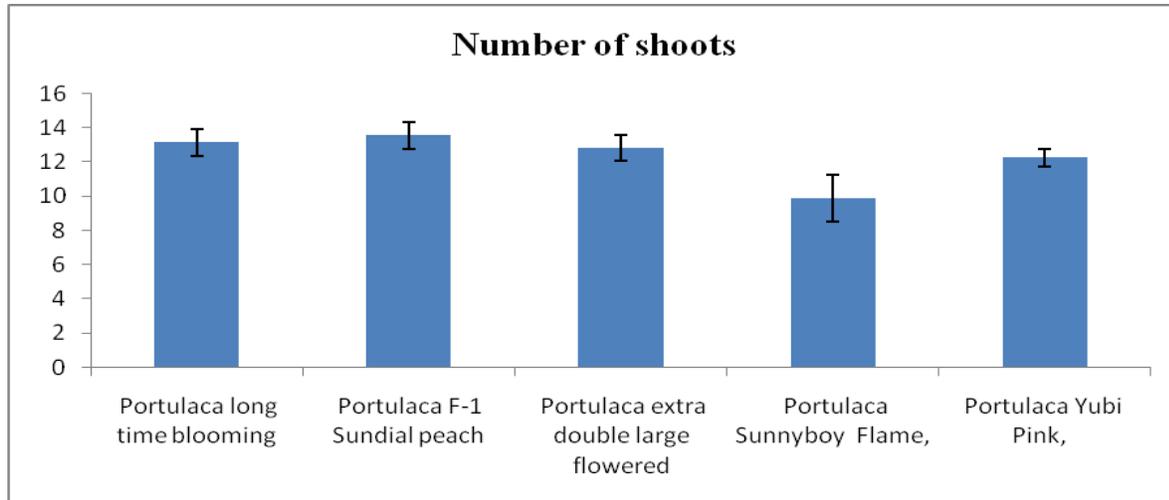


Figure 5. Number of shoots per plant

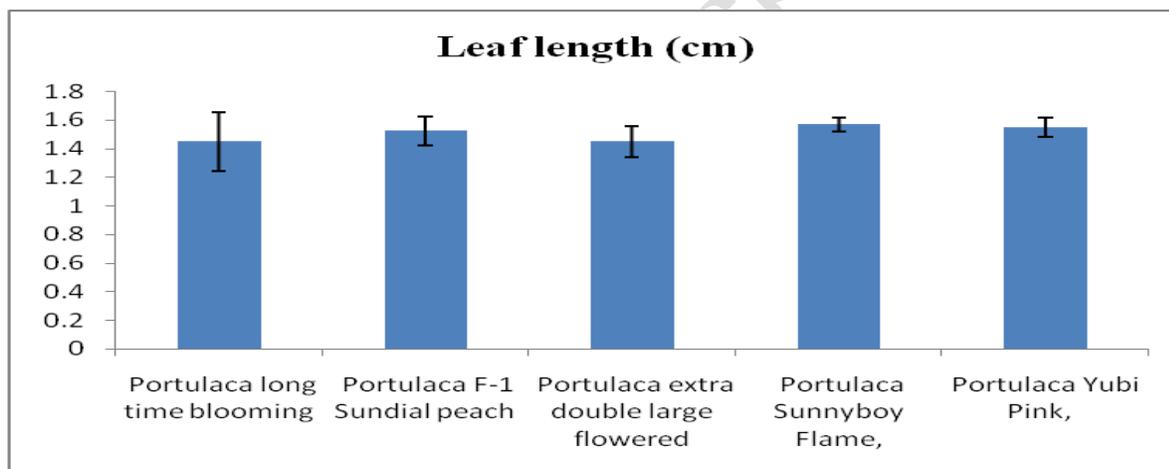


Figure 6. Leaf length (cm)

The number of flowers per plant

The mean values given in (Fig. 7) exhibit a significant difference amongst portulaca cultivars regarding the number of flowers per plant. The data showed significant variation between the genotype “Portulaca long time blooming” and “Portulaca F-1 Sundial peach” and more number of flower (28) was recorded in genotype “Portulaca long time blooming” whereas least number

of flower were found in genotype “Portulaca F-1 Sundial peach” that produced 16.66 flowers. No significant difference was found in the mean values of other cultivars regarding the number of flower per plant.

Yield of flowering by Portulaca is moreover an imperative attributing trait toward landscape and floriculture. Our outcomes are in corresponding with [18] that calculated that executed performance of every gerbera genotype diverse with regard to flowers

numbers each plant, length of the stalk and diameter of flower because of several factors similar to genetic makeup, climatic factors, prevailing growing conditions, land and inputs. Our findings are in line with [19] he gained the maximum Zinnia number of flowers from 20 x 20 cm line spacing subsequent to 3 years experiment. [20] Assessed performance of twenty gerbera varieties of solitary, twofold and semi double for its yield and excellence. The maximum flower production noted in cultivar 'Jayce' and the lowest in Cv. Sujan. [5] Studied eleven cultivars of *Zinnia elegance* showed similar result regarding number of flower per plant. He observed that Zinnia double supper yoga 3F1 Mixed produced averagely 10 flowers and was at top position regarding the number of flowers.

Flower Diameter (cm)

Flower size is a very important trait of seasonal plants in a landscape perspective. The mean values presented in (Fig. 8) revealed that there was significant difference among the cultivars regarding flower diameter. In Fig. 8 it was obvious that "Portulaca extra double large flower" showed significant difference regarding flowers diameter and produce a flower of size (14.103cm) and showed significant variation to the other cultivars of followed

by "Portulaca long time bloom" and "Portulaca Yubi Pink". The least size flowers were recorded in Portulaca Sunnyboy Flame.

Our results were parallel with [5] who observed that flower size greatly varies with respect to subjected environment and type of cultivars. He found that among the eleven cultivars of Zinnia, maximum flower diameter was shown by *Zinnia elegans* twofold giant dahlia flower followed by Zinnia dreamland F1 hybrid and lowest flower size was exhibited by Zinnia giant new lime. [18] Who observed that the execution performance of every gerbera cultivar changed with esteem to flowers numbers each plant, length of stalk and diameter of flower because of more than a few factors like genetic makeup, climatic factors, prevailing culturing conditions, and land in addition to inputs [21] denoted difference in eminence traits such as diameter of flower, diameter of stem and vase life of solitary, semi twofold and twofold cultivars. [12] evaluate 9 gerbera cultivars for production and eminence of cut flower along with they concluded that by means of quality respect of flowers, the largest flower diameter was noted in Sunset, flower length, length of the stalk in Twiggy while the smallest in Whit Sun.

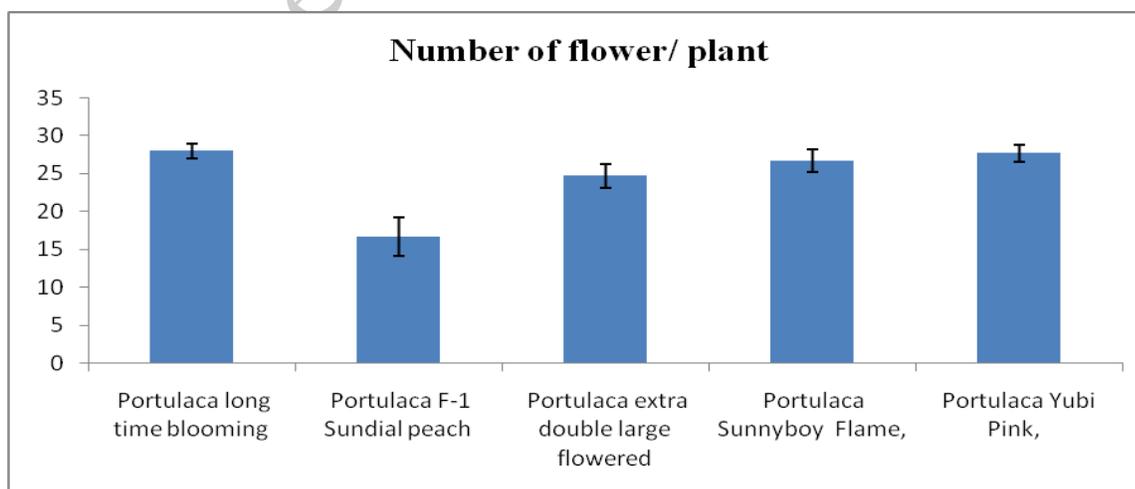
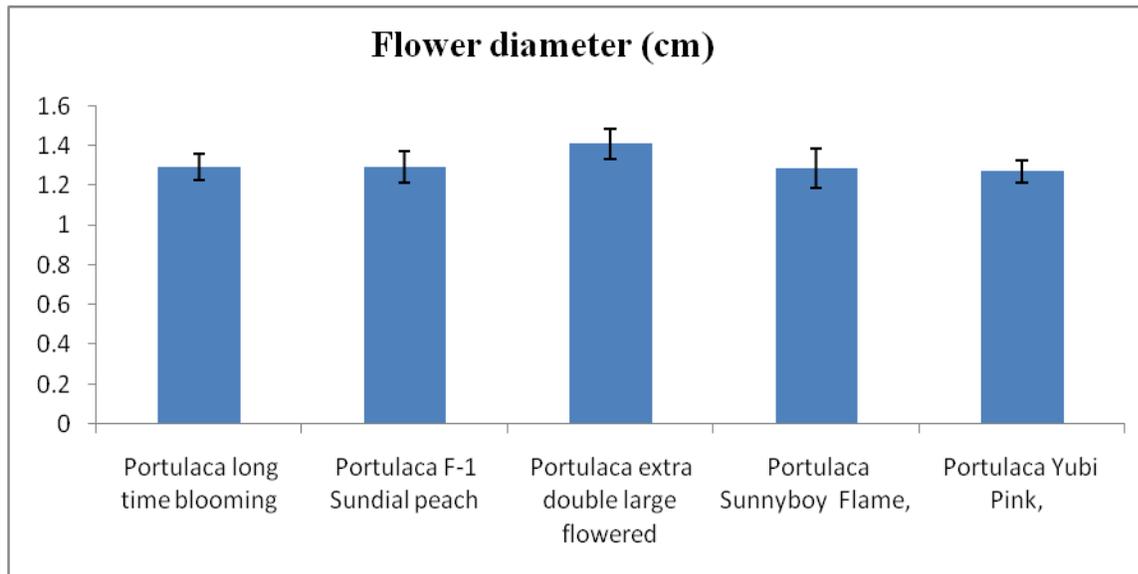


Figure 7. The number of flowers per plant**Figure 8. Flower diameter (cm)****Conclusion**

Morphological traits regarding growth and flowering were assessed by means of appropriate statistical analysis. The trial findings revealed that a substantial significant deviation was found in different yield and quality parameters amongst the five genotypes studied. The Extraordinary performance was demonstrated by genotype “Portulaca long time bloom” followed by “Portulaca Yubi Pink” regarding Plant height (cm), shoot number, shoot length, leave numbers on each branch, number of leaves on each plant, days to 1st flower emergence and size of flowers (cm) in natural agro-climatic conditions of Faisalabad, Pakistan.

Authors' contributions

Conceived and designed the experiment: MFK Pasha, Performed experiment: MFK Pasha, Analyzed Data: MFK Pasha & A Ahmed, Contribute to material and analysis tools: MFK Pasha & S Ali, Wrote the paper: MFK Pasha.

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