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Evaluation of growth and yield performance of five cucumbers (*Cucumis sativus* L.) genotypes; Case study Kunduz province, Afghanistan

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Abstract
This study was carried out to evaluate, five different cucumber (*Cucumis sativus* L.) genotypes namely Beit Alpha, Soheil, Super Zagross, Liza, and Mehran, for their growth and yield performance under the agro-climatic condition of north-eastern, Afghanistan. The experiment was carried out at the research farm of the agriculture faculty of Kunduz University, Afghanistan. The experiment design was Randomized Complete Block Design (RBCD) with 4 replications and five cucumber genotypes made up treatments. Three middle plants were selected randomly from each plot, tagged and used as sample plants for data collection. Data on vegetative growth and yield parameters were collected and analyzed using Analysis of Variance (ANOVA) for Randomize Complete Block Design (RCBD). The treatment means were separated using Critical difference (CD) at (p<0.05%) probability level. The results obtained from the present study indicated that the genotype Liza performed better with respect to various growth and yield characters such as number of branches, Vine length, number of flower per plant, fruit length, number of fruit per plant, average fresh fruit weight, fresh fruit weight per plant, fruit yield per m^2 and hectare. However, genotype Mehran showed superiority in days to first flower initiation, days to first fruit maturity and highest fruit diameter. whereas the genotype Soheil shows that the best in number of leaves. Similarly, Super Zagross was only superior in number of fruits per kilogram. But genotype, Beit Alpha is insignificant with respect to most of the characters evaluated in Kunduz agro-climatic condition. Thus, Liza genotype could be recommended to the farmers for better cucumber production in Kunduz agro-climatic region, North-Eastern Afghanistan.

Keywords: cucumber, genotype, growth, yield, evaluation, kunduz

1. Introduction

Cucumber (*Cucumis sativus* L.), is monoecious annual crops, belongs to the cucurbitaceae family. It is one of the oldest vegetables cultivated by man with historical records dating back 3,000 years (Eifediyi and Remison, 2010) [4]**.** Cucumber is believed to have been domesticated in India for 3000 years and in Eastern Iran and China probably for 2000 years (Golabadi *et al*., 2012) [8]**,** and it reportedly much appreciated by ancient Greeks and Romans, now it is grown all around the world (Adinde. J.O. *et al*., 2016) [13]**.** It is comprising of 70 genera's and 750 species (Dijkhuizen *et al*., 1996)**.** Generally, cucumber is day neutral annual crop, produces male and female flowers separately on the same individual plant, though some may produce bisexual flowers (Elsheikh and Ahmed, 2005) [5]**.** This implies that sex expression in the plant is subject to regulation by a number of environmental factors such as photoperiod, temperature and plant hormones (Renner *et al*., 2007) [16]**.** The crop is the fourth most important vegetable after tomato, cabbage and onion in Asia (Eifediyi and Remison, 2010) [4]**.** It is grown for its tender fruits, which are consumed either raw as salad, cooked as vegetable or as pickling in its immature stage (Khan *et al*., 2015) [9]**.** Cucumber fruit is rich in two of the most basic elements needed for healthy digestion; water and fiber (Elsheikh and Ahmed, 2005) [5], but it is very low in calories (16 calories per cup) (Nwofia *et al*., 2015) [15]. It is a rich source of vitamin B and C, carbohydrates, Ca and P (Kumar *et al*., 2015) and as well a quantity of phyto-nutrients (Carotene-B, Xanthein-B and lutein) which add and enrich the dietary of human being (Nwofia *et al*., 2015; Elsheikh and Ahmed, 2005) [15, 5]. The nutritional composition of cucumber fruit per 100 gr edible portion is carbohydrate (3%), protein (1 %), total fat (0.5% and dietary fibre (1%) (Nwofia *et al*., 2015) [15]**.** The fresh cucumber seeds are source of vitamin C, vitamin K, and potassium, also providing dietary fiber, vitamin A, vitamin B6 and thiamin (Umeh, 2018**;** Adinde. J.O. *et al*., 2016) [19, 13]**.** It also contains fiber in the skin, cucumber oil typically used for cosmetic purposes (Elsheikh and Ahmed, 2005) [5]**.**

Cucumber is warm season vegetable crop and grown in almost all climate ranging from tropical to semi-temperate zone of the world (Pal, et. al., 2017; Elsheikh and Ahmed, 2005)) [5]. Its-requires a steady warm temperature of between 18 and 24 ^{0}C for suitable yield (Elsheikh and Ahmed, 2005) [5] and it frost-susceptible horticultural crop usually cultivated in fields during spring-summer period or in greenhouse in different seasons (Enujeke, E.C and Emuh, 2015; Khan *et al*., 2015) [9]**.** Lower light intensity gives rise to more female flowers where as high light intensity causes more male flowers (Elsheikh and Ahmed, 2005) [5]**.**

Cucumber can grow on a wide range of soil but can do best on deep well drained sandy loam soils with a pH of 5.5-6.7 and high content of organic matter (Ranjian, *et al*., 2015) [15]. The plant requires fertile soil, infertile soil results, bitter taste and misshapen fruits that are rejected by consumers (Elsheikh and Ahmed, 2005) [5]. Cucumber rarely grows luxuriantly in infertile soils, hence, its level of susceptibility to poor soil fertility manifests in the form of low fruit yield, bitter and malformed fruits that have little marketability value. However, the nutrient requirements of the crop vary depending on soil type, native fertility, previous cropping and cultural practices but it responds positively to organic, inorganic or combined nutrient applications for optimum growth and productivity (Nwofia G.E. et. al. 2016; Ranjian, *et al*., 2015) [15]. Cucumber varieties should fulfill some basic requirements like high yield even taste qualities, diseases resistance and durability in preserving (Dimov et. al. 2016) [3]. Breeding for disease resistance, use of amended cultural practices tend to stimulate the production of pistil late flowers and increase cucumber yields, (Nwofia et al., 2015) [15]**.** Great attention is paid to the indexes that characterize the varieties suitability for the separate directions of consumption and their productivity, but there is no official information for their climate adaptation to the situations in Afghanistan. Some authors studied the cultural practices, influence of varieties and the way of growth of cucumbers. (Dimov et. al. 2016) [3].

Kunduz with total land area of 8,081 square kilometers, represent 1.24 percent of the total land area of Afghanistan territory (FAO, 2007) [7]**.** The climate in this area is considered to be a local steppe climate and is rain deficient, with an average annual mmaximum temperature of 30.7 °C and minimum 2.8 °C (Belda *et al*., 2014) [1]. Total cultivated land area is 193983 hectares (25.11% of total area), and grew 35 different crops (FAO, 2007; USAID, 2010) [7, 18]. It is famous for producing melons and cotton, which are considered as being some of the best quality in Afghanistan. The total crop production of Kunduz in 2008 was estimated at 793,502 metric tons (MT), consisting of grains (51%), fruits and nuts (27%), vegetables (19%) including cucumber and fodder/industrial crops (3%) (USAID, 2008) [20]**.** However, at present no genotype of cucumber has been identified as best adapted or most suitable for Kunduz agro-climatic region, north-Eastern Afghanistan. So, the objective of present study focuses to identify best adapted or must suitable genotype with most effective performance for increased yield in Kunduz agro-climatic region, to recommend for farmers, for enhanced cucumber production in Kunduz agro-climatic region, North-Eastern Afghanistan.

2. Material and method

2.1 Profile of study area

The focus of the present study was on central parts of Kunduz Province, Afghanistan (Figure 1), which covers about 1.24 percent of the total land area of Afghanistan territory (FAO, 2007) [7]. The climate in this area is considered to be a local steppe climate and is rain deficient, with an average annual mmaximum temperature of 30.7 °C and minimum 2.8 °C (Belda *et al*., 2014) [1]. Total cultivated land area is 193983 hectares (25.11% of total area), and grew 35 different crops. Cultivated area is mostly concentrated in the north and southeastern districts in the low land near Kunduz and Amu River (USAID, 2008) [20]**.** 74% of cultivated land is concentrated in 4 of its 9 districts. The rest are suitable for raising livestock due to the mountainous terrain (FAO, 2007) [7]. The total crop production in 2008 was estimated at 793,502 metric tons (MT), consisting of grains (51%), fruits and nuts (27%), vegetables (19%) including cucumber and fodder/industrial crops (3%) (USAID, 2010; FAO, 2007) [18, 7]. Approximately 77.3 percent of the all Kunduz vegetables are grown in 3 districts (Aliabad, Khan Abad and Kunduz Center), (USAID, 2008) [20]**.** The Experiment was led at the Kunduz University Research Farm, located at N 36°42'41" and E 68.5°48'.35" with a mean altitude of 406 m above mean sea level (AMSL). It was carried out for one season during the period of March –June, 2019.

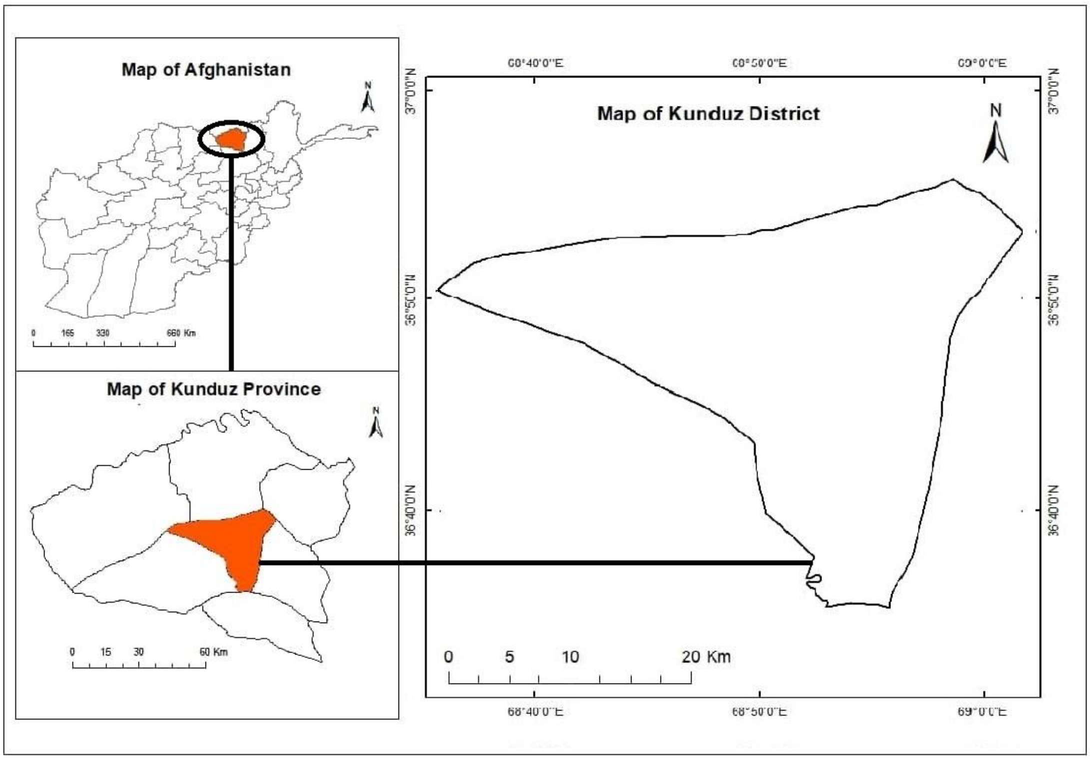

Fig 1: Map of Study Area (Kunduz District)

2.2 Seed sowing and raising seedling

Seeds of five cucumber genotypes were collected from Anwar Agriculture Seed Company, located in Kunduz central city. Seeds were socked in normal water (20 ^{0}C) for 24 hours for pre germination. one seed of every genotype were sown in black polythene bags of 10 cm length and 12 cm width filled with mixture of soil: sand: Verme-compost (2:1:1) on 18 March and cultural practices were followed for raising healthy seedling in greenhouse. On 21 April seedling were transplanted to open field from greenhouse.

2.3 Experimental design

The experiment design was laid out in Randomized Complete Block Design (RBCD) with 4 replications. Five cucumber genotypes (*cucumis satives* L.) were sown as a treatment. The treatments were: T1) Liza; T2) Beit Alpha; T3) Soheil; T4) Super Zagrass and T5) Mehran.

2.4 Field operation

The experimental field size of 142 m^2 was marked using measuring tape, rope and peg. Land clearing was done using cutlass. The debris was packed using rake. The soil was ploughed to fine tilth. The field was demarcated into 4 blocks each block containing 5 plots. 20 plots of 2m x 2m each was prepared using hoe. 1 m rows separated adjacent blocks and 0.6m alleys plots respectively. Poultry manures at the rate of 14 tons/ha (dry weight), and 150 kg N (75kg/ha sued in pre flowering phase) 125 kg DAP/ha was integrated into the soil. Five cucumber cultivars (treatments) seedling were transplanted from polythene bag to the field using spacing of 0.45m between every plant and 1m between every rows. A total of 10 seedlings were transplanted in each plot giving a plant population of 14084 plants per hectare. Steady weeding was done at every two-week interval using hoe.

2.5 Data collection and analysis

Three middle plants from each plot were selected randomly, tagged, used as sample plants upon which data collection was made. Data were collected for number of leaves, number of branches, vine length, days to first female flower initiation, number of flowers per plant, days to first fruit maturity, number of fruits per plant, weight of fresh fruit, fresh fruit weight per plant, fresh fruit yield per m^2, fresh fruit yield per hectare, fruit length, fruit diameter and number of fruits per kilogram (Table 1). The data was analyzed through Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD) using SPSS (22) software (2011) and means were separated using, Duncan Multiple Test Range (DMRT) at (p<0.05%) probability level.

Table 1: Interpretation of the various growth and yield Parameters

Parameter	Equation	Description
Number of leave per plant	$= \frac{\text{Total no. of leaves on sample plants}}{\text{No. of sample plants}}$	Determined by direct counting of the leaves per plant
Number of branches	$= \frac{\text{Total no. of branches on sample plants}}{\text{No. of sample plants}}$	Determined by direct counting of the branches
Number of flower per plant	$= \frac{\text{Total no. of flower on sample plants}}{\text{No. of sample plants}}$	Number of female flower per plant was computed by counting of the flower per plant
Number of fruits per plant	$= \frac{\text{Total no. of fruits harvested(sample plants)}}{\text{No. of sample plants}}$	Determined by direct counting of the number of harvested fruits from the sample plants
Weight of a fresh fruit (kg)	$= \frac{\text{Total weight of fresh fruits weighted}}{\text{Total no. of fresh fruits weighted}}$	Measured using weighing scale to get the total weight of the harvested fruits
Fresh fruit weight per plant (kg)	$= \text{No. of fruit per plant X weight of a fresh fruit}$	Determined using the number of fruits per plant and weight of a fresh fruit.
Fresh fruit yield per meter square (kg)	$= \text{Fresh fruit weight per plan X plant desnsit per } m^2$	Calculated using fresh fruit weight per plant and plant density per meter square.
Fresh fruit yield per hectare (ton)	$= \text{fresh fruit weight per plant X plant desnsity(14000 stand per hectare)}$	Computed using fresh fruit weight per plant and plant density per hectare.

* Whereas the other parameters such as vine length, fruit length and fruit diameter were measured in cm. Phenology of first female flower initiation and first fruit maturity was noted days from the sowing.

3. Result and discussion

3.1 Number of branches per plant

The present study observed that there was significant difference (p<0.05) among the five cucumber genotypes and the average number of branches per plant ranged from 1.37 to 3.15 (Table 2. Figure 2). The genotype, Liza had highest number of branches per plant (3.15) whereas, it was minimum (1.37) in Super Zagross. In overall, Liza genotypes had more number of branches per plant as compared to the rest 4 genotypes fallowed by Mehran (2.35), Soheil (2.0) and Beit Alpha (1.96). Highest number of branches tends to increase the femaleness of cucurbits and thereby results increased yield. Similar estimations for this character in different cucumber genotypes were reported (Pal, et. al., 2017; Ranjian *et al*. 2015) [15].

3.2 Number of leaves per plant

Significant difference (p<0.05) among the five cucumber genotypes were revealed for number of leaves, the average values for number of leaves, ranged from 54.75 to 93.25. Maximum leaves number (93.25) was recorded in genotype Soheil and minimum was recorded in Mehran (54.75), Soheil genotype was statistically superior compare to four genotypes in this character (Table 2. Figure 2). Supper

Zagross genotype had the second highest average value of (86.5), but was statistically at par with Beit Alpha (82.25) and Liza (70.75). The significantly higher values obtained in Soheil, over the other cucumber genotypes tested could be attributed to superiority in its genetic make-up with respect to vegetative growth and suitability of the genotype to the agro-climatic status of the study area. Generally, more number of leaves per plant, more is the yield in cucumber. The result was against to the findings of (Pal, et. al., 2017; Adinde.J.O. *et al*., 2016; Ranjian *et al*. 2015) [13, 15].

3.3 Vine length (cm)

The result showed that there was significant difference ($p<0.05$) among the five cucumber genotypes in vine length, the mean value for this character ranged from 142.16 cm to 187.5 cm (Table 2. Figure 2). Highest vine length with a mean value of (187.5 cm) was recorded in Liza which was statistically at par with Soheil, while Mehran had minimum vine length with mean value of (142.16 cm). Beit Alpha genotype had the second highest mean value of 152.91cm but was statistically at par with Supper Zagross. Generally, more vigorous the vine, more is the yield in cucumber. Similar assessments were also reported earlier (Pal, et. al., 2017; Veena *et al*. 2012; Shukla *et al*. 2010) [21, 17].

3.4 Days to first female flower initiation

The observation recorded for, days to first female flower initiation, showed significant difference ($p<0.05$) among the cucumber genotypes studied. The less mean days to first female flower initiation (46 days) was observed with genotype Mehran and the highest mean days was observed in genotype Soheil (62.5 days) which was statistically in harmony with Super Zagross (60.5 days) Table 2. Figure 2. However, there was non-significant difference ($p>0.05$) between Liza (54.5 days) and Beit Alpha (58.75 days) genotypes. The mean values for different genotypes revealed that genotype Mehran was earliest (46 days), and Soheil (62.5 days) was latest cultivar in case of first female flower initiation. The variation in the number of days to first female flower initiation might be due to genetic nature of the different genotypes, as the environmental conditions were same for all the cucumber genotypes. Similar estimation was reported by (Adinde. J. O. *et al*., 2016) [13].

3.5 Days to first fruit maturity

Significant variations ($p<0.05$) were observed among all the cucumber genotypes, for days to edible maturity and the mean value for this character varied from 53.5 to 72.5 days and the general mean for this character was 65.35 days (Table 2. Figure 2). two genotypes were earlier in maturity than population mean. The genotype Mehran was earliest in maturity (53.5 days) and followed by Liza (62.5 days). Genotype Soheil had maximum mean value of (72.5 days), which was statistically at par with that of Beit Alpha (70.75 days), Supper Zagross (67.5 days), there was less significant difference among these three genotypes. Whereas, minimum days to edible maturity (53.5 days) was recorded in Mehran. Our results agreed with those of (Pal, et. al., 2017; Khan *et al*., 2015) [9]. who also stated that great variability is present in days to edible maturity due to the genetic differences, as the environmental conditions were similar for all the cucumber genotypes.

3.6 Number of flower per plant

The data recorded for, the numbers of flower per plan showed non-significant variability ($p>0.05$) among three genotypes. The highest mean value (84) of flower per plant was present in genotype Liza which was statistically at par with that of Mehran (79) and Soheil (74), Beit Alpha genotype has second maximum mean value of (67) as shown in (Table 2. Figure 2). While the minimum (59) of flower per plant was present in genotypes Supper Zagross which showed Significant variability ($p<0.05$) with rest four genotypes. This variability may due to genetic variation at same environmental conditions (Pal, et. al., 2017; Khan *et al*., 2015; Ranjian *et al*. 2015) [9, 13] also reported that number of flower per plant varied significantly among the accessions due to genetic variation.

Table 2. Growth parameters of five genotypes of cucumber (*Cucumis sativus* L.)

Varieties	No. of branches /plant	No. of leaves/ plant	Vine length(cm)	Days to first female flower initiation	Days to first fruit maturity	No. of flower/ plant
Liza	3.15^{a}	70.75^{bc}	187.5^{a}	54.5^{b}	62.5^{b}	84^{a}
Beit Alpha	1.96^{b}	82.25b	152.91^{bc}	58.75^{bc}	70.75^{c}	67^{ab}
Soheil	2.00^{b}	93.25a	175.25^{ab}	62.5^{c}	72.5^{c}	74^{ab}
Super Zagross	1.37^{c}	86.5b	150.16^{c}	60.5^{bc}	67.5^{bc}	59^{c}
Mehran	2.35^{b}	54.75^{c}	142.16^{c}	46^{a}	53.5^{a}	79^{a}
Mean	2.16	77.5	161.6	56.45	65.35	72.6
F taste	*	*	*	*	*	*
Sem	0.26	10.44	9.09	2.62	2.94	8.02
CD (0.05) %	0.89	34.92	30.41	8.76	9.859	26.83

Note: *= (Critical difference); sem = Standard error mean; CD: (Critical difference).
Mean values within each column with the same alphabet are not significantly different ($p>0.05$ %).

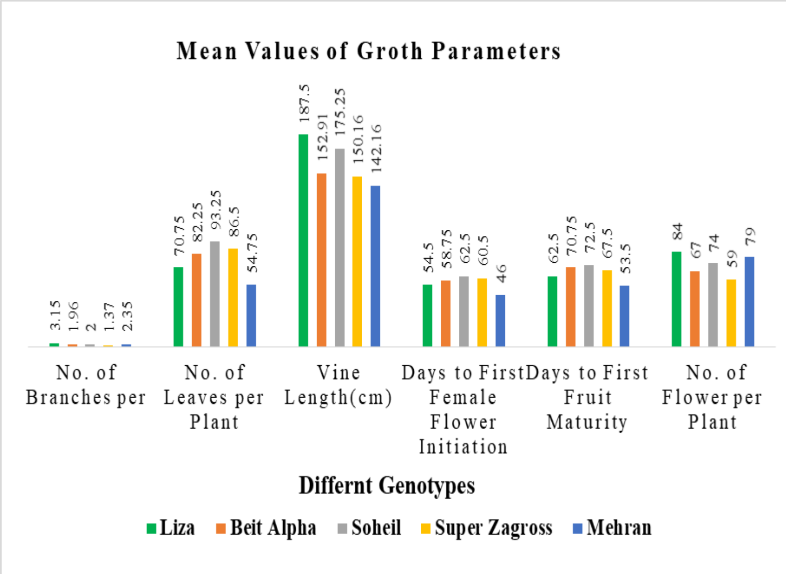

Fig 2: Average values of growth performance of different cucumber genotypes

3.7 Fruit length

In present study fruit length displayed greater variation ($p<0.05$) among Liza and rest three genotypes evaluated but it was statistical at par with Soheil. Genotype Liza recorded the highest length (22cm) of fruit and genotypes Beit Alpha (15cm) and Supper Zagross and Mehran recorded the lowest length (14.5cm) of fruit as shown in Table 3. Figure 3. There was non-significant variation among genotype, Beit Alpha, Supper Zagross and Mehran. Longer fruits generally have greater contributions to the final yield. These result are agreed to that obtained by (Khan *et al*., 2015; Mukhtar and Kayani, 2019) [9, 11].

3.8 Fruit diameter

Significant variations ($p<0.05$) were absorbed among the all cucumber genotypes evaluated for Fruit diameter, the mean values for this character, laid from 2.5cm to 4.5cm (Table 3. Figure 3). Fruits of genotype Mehran had maximum average fruit diameter (4.5cm), which was statistically at par with that of Beit Alpha and Super Zagross, however, minimum fruit diameter (2.5cm) was recorded in genotype Liza. In the present study, three genotypes had more fruit diameter than Liza (2.5cm) and there was non-significant difference among them, whereas, genotype Soheil had the second fruit diameter (3cm). While, fruit diameter has a positive role to yield, but fruits with more fruit diameter have a tendency of separation of placenta, lead to unfavorable cavity formation and reduce the quality of the fruits. Similar result for this trait were also found earlier (Adinde. J. O. *et al*., 2016; Kumar *et al*. 2017; Khan *et al*., 2015) [13, 9].

3.9 Number of fruit per plant

Number of fruit per plant differed significantly ($p<0.05$) among the five genotypes studied. The highest mean value (15) of fruits per plant was recorded in genotype Liza, followed by Mehran (12.75), Soheil (10.25) and Beit Alpha (8.25), while the lowest number (6.5) of fruits per plant was noted in genotypes Super Zagross as shown in Table 3. Figure 3. (Adinde.J.O. *et al*., 2016; Mukhtar and Kayani, 2019) [13, 11]. also reported that number of fruit per plant varied significantly among the cultivars. This variability may due to the unsuitable climatic conditions or may be the genetic variation. Total number of fruit per plant showed positive significant relationship with vine length and number of flower per plan.

3.10 Average fresh fruit weight (gr)

Variability of data ($p<0.05$) recorded for this trait, ranged between 143gr to 166.5gr (Table 3. Figure 3). Comparison of data exposed that the genotype Liza had highest average fruit weight (166.5 gr), it was statistically similar with Beit Alpha (165.75gr) and Mehran (161.5gr), there was non-significant difference among these three genotype, whereas, Supper Zagross (143 gr) had lowest mean value for this trait. In overall, 3 genotypes had higher average fruit weight than the Supper Zagross (143gr). The fresh fruit weight showed positive significant relationship with vine length, fruit diameter, fruit length, number of female flower per plant. For this trait, similar result was also reported by (Adinde.J.O. *et al*., 2016; Kumar *et al*. 2017) [13].

3.11 Fresh fruit weight per plant (gr)

The observations recorded for fresh fruit weight per plant reveals significance variation ($p<0.05$) among all genotypes. The data laid between 978.75 gr to 2250 gr (Table 3. Figure 3). The genotype, Liza produced maximum fresh fruit weight per plant (2250gr), whereas, minimum fresh fruit weight per plant (978.75gr) were produced in Super Zagross. Mehran cultivar had second highest mean value (1680gr). In overall, Liza genotypes recorded more fresh fruit weight per plant than the Mehran (1680gr), Beit Alpha (1402.5gr) and Soheil (1435gr) whereas Supper Zagross has lowest mean value (978.75gr) of fresh fruit weigh per plant. Number of fruits per plant, fruit diameter and fruit length, plays vital role in fresh fruit weight per plant and on overall yield per hectare. Earlier, almost similar estimations for this trait was recorded by (Adinde.J.O. *et al*., 2016; Shukla *et al*.2010; Pal, et. al., 2017) [13, 17].

3.12 Fresh fruit yield per meter square

The results of the analysis for, fresh fruit yield per m^2 of five cucumber genotype studied were presented in (Table 3. Figure 3) varied significantly ($p<0.05$) in all the genotypes. The observations relating to this character ranged from 1.37. to 3.15. Liza genotype gave higher yield per m^2 (3.15kg), whereas, it was lowest yield per m^2 in Supper Zagross

(1.37kg) than other genotypes. Mehran cultivar gave second highest yield per m2 (2.35kg) which was statistically at par with Sohil (2.00kg) and Beit Alpha (1.96kg). These results are also in harmony with the finding of Mukhtar and Kayani, 2019**;** Khan *et al*., 2015**;** Kumar *et al*. 2017) [9, 11]. who also represented similar results, that this variation is due to genetic diversity of genotypes, differences in environmental and edaphic conditions and potentials to transport photosynthetic materials within plants.

3.12 Fresh fruit yield ton per hectare

The results showed critical variations ($p<0.05$) among all genotypes studied for fresh fruit yield ton per hectare, it ranged from 13.70 ton/ha to 31.5 ton/ ha (Table 3. Figure 3). Maximum fresh fruit yield per hectare (31.5 ton) was recorded in Liza, whereas, it was minimum in Supper Zagross (13.70 ton). However, genotype Mehran had second highest yield (23.52 ton), but it shows non critical variations with genotypes Soheil (20.09 ton) and Beit Alpha (19.63 ton) they were statistically at par. For this character, Liza genotypes had excelled performance over the rest four genotypes (31.5ton) cultivated. Similar results were also described earlier (Adinde.J.O. *et al*., 2016; Khan *et al*., 2015) [13, 9].

3.13 Number of fruit per kilogram

There was no critical variability ($p> 0.05$) in number of fruit per kilogram among all genotypes cultivated. Our findings show, the highest mean values (6.99) of fruits per kilogram was shown in genotype Soheil while the lowest mean values (6.03) of fruits per kilogram were recorded in both genotypes Liza and Beit Alpha as shown in Table 3 Figure 3. This similarity shows positive significant relationship with fruit diameter and fruit length. These results are Against with (Mukhtar and Kayani, 2019; Adinde.J.O. *et al*., 2016; Khan *et al*., 2015) [11, 13, 9].

Table 3: Yield parameters of five genotypes of cucumber (*Cucumis sativus* L.).

Varieties	Fruit length (cm)	Fruit diameter (cm)	No. of fruits /plant	Average fresh fruit weight (gr)	Fresh fruit weight/plant(gr)	Fresh fruit yield (kg/m^2)	Fresh fruit yield/ha (Ton)	No. fruits /kg
Liza	22a	2.5b	15a	166.5a	2250a	3.15a	31.5a	6.03b
Beit Alpha	15b	4a	8.5^{cd}	165.75a	1402.5c	1.96^{b}	19.635^{b}	6.03^{b}
Soheil	17ab	3b	10.25^{bc}	150.75b	1435c	2.00^{b}	20.09^{b}	$6.64a^{b}$
Super Zagross	14.5b	4a	6.75^{d}	143c	978.75d	1.37^{c}	13.70^{c}	6.99^{a}
Mehran	14.5b	4.5a	12.75^{ab}	161.5a	1680b	2.35^{b}	23.52^{b}	6.20^{b}
Mean	16.6	3.6	10.65	157.5	1549.25	2.16	21.68	6.38
F taste	*	*	*	*	*	*	*	*
Sem	1.48	0.37	1.24	4.89	191.64	0.26	2.68	0.19
CD (0.05)%	4.976	1.26	4.16	16.35	640.88	0.89	8.97	0.64

Note: *= Critical difference; sem = Standard error mean; CD: Critical difference; Mean values within each column with the same alphabet are not significantly different (p>0.05 %).

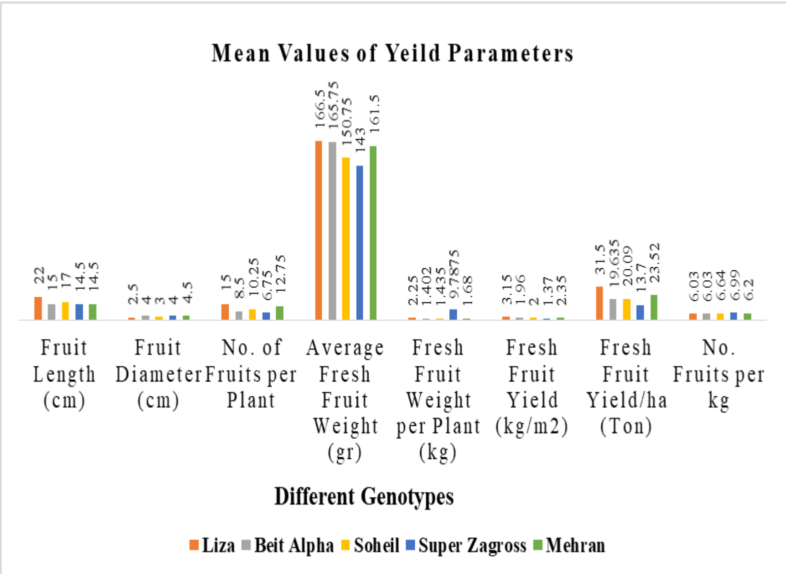

Fig 3: Average values of yield parameters of different cucumber genotypes

4. Conclusion

The results obtained from the present study indicated that the genotype Liza performed better with respect to various growth and yield characters such as number of branches, Vine length, number of flower per plant, fruit length, number of fruit per plant, average fresh fruit weight, fresh fruit weight per plant, fruit yield per m^2 and hectare. However, genotype Mehran showed superiority in days to first flower initiation, days to first fruit maturity and highest fruit diameter. whereas the genotype Soheil shows that the best in number of leaves. Similarly, Super Zagross was only superior in number of fruits per kilogram. But genotype, Beit Alpha is insignificant with respect to most of the characters evaluated in Kunduz agro-climatic condition. Thus, Liza genotype could be recommended to the farmers for better cucumber production in Kunduz agro-climatic region, North-Eastern Afghanistan.

5. Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. Acknowledgments

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