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EVALUATION THE PERFORMANCE OF SOME INTRODUCED CHICKPEA GENOTYPES UNDER RAINFED CONDITIONS

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ABSTRACT

Good chickpea production is depends on the release of new genotypes with improved adaptation. Therefore, a three-year experiment was conducted at Malta Research Center; Duhok Province during growing seasons 2015/16, 2016/17, and 2017/18 to investigate the performance of twenty one newly introduced genotypes of chickpea (FLIP09-73C, FLIP09-78C, FLIP09-83C, FLIP09-117C119C, FLIP09-119C, FLIP09-132C, FLIP09-149C, FLIP09-199C, FLIP09-212C, FLIP09-214C, FLIP09-247C, FLIP09-250C, FLIP09-251C, FLIP09-252C, FLIP09-254C, FLIP09-292C, FLIP09-298C, FLIP09-300C, FLIP09-332C, FLIP09-333C, and FLIP09-345C) from ICARDA under rainfed conditions of Duhok province. Results revealed the superiority of each FLIP09-78C, FLIP09-83C, FLIP09-333C and FLIP09-212C in final grain yield, while each of FLIP09-132C, FLIP09-117C119C and FLIP09-345C were recorded lowest final grain yield, although the genotypes effect was not significant. On the other hand, final grain yield was gradually increased with increasing of the rainfall amount at the end of the seasons. Accordingly, the succeed genotypes are recommended to the farmers in the area and further studies are suggested to ensure the performance of all of these genotypes in comparison to local varieties and in different locations.

KEY WORDS: chickpea, genotypes, rainfed, grain yield

INTRODUCTION

Global climate changes have raised extreme crop yield reductions worldwide and along with the increasing of world population, it threads food security in the future. Legumes considered one of the main sources for feeding both human and animals, as they are rich in many nutrients such as proteins carbohydrates starch, and fibers. (Tewodros *et al*. (2015) and Musallam *et al.* (2004). In addition, grain legumes are able to fix atmospheric nitrogen (N_2) in association with symbiotic *Rhizobium* to a form in which the plant can utilize it (Omer. 2009).

Chickpea crop is mostly sown on residual soil moisture with little rain opportunities, it's grown worldwide in over 54 countries in 12.7 Mha with annual production of 12Mt (Viola and Daniel, 2018). Among numerous factors minimizing the chickpea yield, drought stress associated with high temperatures is the most destructive, which reduces the crop yield to high levels. Nour (1982) stated that in addition to varieties, numerous constraints limiting legume crops yield; these include water requirements, diseases, insect pests, weeds, soil salinity, arid planting, and time of harvesting. Rouphael *et al.* (2011) reported that drought is one of the major factors limiting pulses such broadbean and chickpea production in Mediterranean region with irregular water distribution and moisture level below 500 mm. Leport *et al*., (2006) stated that pod abortion ratio increase significantly with the decreasing of soil moisture (water stress) at pod setting stage; drought tolerance in their conclusion was found to be directly proportional to deep root system and high leaf water potential. On the other hand, Muhammad Yaqoob *et al.*, (2013) recorded significant differences among various chickpea lines and varieties when exposed to drought at pre-flowering stage for 30 days suggesting that moisture stress at pre-flowering has usually a fatal effect on chickpea crop. Also, they reported that Kabuli type of chickpea lines are more sensitive to moisture stress and high temperature and produced lower yields as compared to Desi types.

Viola and Daniel, (2018) reported that drought and temperature stresses are common in most of

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chickpea production regions with different intensities and sequences. Therefore, good chickpea production will depend on the release of new genotypes with improved adaptation to the mentioned factors, recent progress in chickpea breeding has increased the efficiency of assessing genetic diversity in germplasm collections.

In this regards, also Yuceld and Dürdane (2014) recorded significant variations among some Flip chickpea genotypes under drought stress of Mediterranean (Adana, Turkey) conditions. Gunes *et al*. (2006) illustrated that chickpea is one of the most grain legumes drought crops, their resistance is related to the period of drought occurred; as they demonstrated that the drought post anthesis has higher effects on the final grain yield; on the other hand, they concluded that drought tolerant genotypes accumulate higher nutrient (N, P, K, Ca, Zn, Mn and B), The total nutrient uptake efficiency of the cultivars were also very significantly correlated with the growth reduction ration. Similarly, Marjani *et al* (2016) recorded significant differences among different chickpea genotypes exposed to various periods of drought stress at different growth stages and also, they found a positive correlation between number of seeds per plant and above ground biomass with final grain yield.

In Iraqi Kurdistan, chickpea productivity is relatively low in yield as compared to the world standard measurements and this may belong to numerous factors including involving low chickpea varieties into the farming system for most of local farmers along with primitive cultural practices and climate conditions. Therefore, a major objective of any breeding program in this region is to develop or introduce drought tolerant genotypes that are well adapted to a wide range of environments. Accordingly this study was considered to investigate the growth and yield performance of twenty one newly introduced genotypes of chickpea by ICARDA for several growing seasons under rainfed conditions of Duhok province.

MATERIALS AND METHODS

This study was carried out at the fields of Malta research center, Duhok region (36^{o} 50' 49" N; 42^{o} 93' 6" E and 307 asl) during three growing seasons (2016, 2017 and 2018) to investigate the performance of twenty one introduced genotypes of chickpea from International Center for Agricultural Research in the Dry Areas (ICARDA) under different rainfall conditions of Duhok Governorate. The genotypes included in the study were: FLIP09-73C, FLIP09-78C, FLIP09-83C, FLIP09-117C119C, FLIP09-119C, FLIP09-132C, FLIP09-149C, FLIP09-199C, FLIP09-212C, FLIP09-214C, FLIP09-247C, FLIP09-250C, FLIP09-251C, FLIP09-252C, FLIP09-254C, FLIP09-292C, FLIP09-298C, FLIP09-300C, FLIP09-332C, FLIP09-333C, and FLIP09-345C (Table 1).

The treatments (genotypes) were arranged in a simple randomized complete block design (RCBD) with three replications. For all seasons the field was plowed with a disk plow and the soil was shredded a week prior to planting. The experiments were conducted under rainfed conditions without any supplementary irrigation; climatic data were collected from the meteorological station of the experimental site (Table 2); sowing dates were at 1/3, 21/2 and1/3depending on the first expected rainfall in March which were at 3/3, 2/3 and 9/3 for 2016, 2017 and 2018 growing seasons respectively. Soil physical and chemical analysis tests were carried out for the soil samples collected randomly from 0-40 cm depth. All soil properties analysis was conducted at the University of Duhok, College of Agriculture, Central Laboratory (Table 3). Randomized complete block design (RCBD) was applied in three replication in this study. Plot size was 2 m^2 (four rows with 2*0.25 m apart) which match to 200 seeds per meter square; twenty (20) seeds were sowed in each row. 25 $kg.do^{-1}$ of compound fertilizer (DAP; 46%N and 18%P) was applied at the sowing; weeding was conducted manually when required. Ten plants from one of the middle rows were included and then the average per one plant was calculated. One of the middle rows (0.25 m^2) was harvested for the yield measurement within 6, 14 and 27, June for 2016, 2017, and 2018 respectively. The genotypes were divided into two groups (diagram 1); small sized that have lower seed size than 20 ml and large sized having higher than 20 ml which determined via seed displacement method; 100 seeds from each genotype were placed in a scaled cylinder contain 100 ml of water, then the displaced area by milliliters was recorded as the seeds size. The data was analyzed using GenStat version 10 (2011) program. Least significant differences (LSD) test at 0.05 level was used for the mean comparisons.

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Table (1): Code, pedigree, and origin of 21 chickpea genotypes

#	Name and Code	Pedigree	Origin
1	FLIP09-73C	X05TH20/X04TH-139XFLIP02-36C	ICARDA
2	FLIP09-78C	X05TH30/X04TH-150XFLIP02-42C	ICARDA
3	FLIP09-83C	X05TH59/X04TH-18XFLIP00-06	ICARDA
4	FLIP09-117	X05TH122/FLIP99-34XFLIP00-14	ICARDA
5	FLIP09-119C	X05TH124/FLIP00-44XFLIP00-17	ICARDA
6	FLIP09-132C	X05TH135/FLIP00-06XF5LM(5847)	ICARDA
7	FLIP09-149C	X06TH6/X05TH103XFLIP03-120	ICARDA
8	FLIP09-199C	X06TH61/FLIP98-128XFLIP00-65	ICARDA
9	FLIP09-212C	X06TH78/ILWC292XFLIP03-105	ICARDA
10	FLIP09--214C	X06TH80/ILC10766XFLIP03-110	ICARDA
11	FLIP09-247C	S00789(45 KR)-35/	ICARDA
12	FLIP09-250C	S01135(30 KR)-11/	ICARDA
13	FLIP09-251C	S01135(30 KR)- 13/	ICARDA
14	FLIP09-252C	S01135(30 KR)-14/	ICARDA
15	FLIP09-254C	Leb. Market-1(30 kr)-/	ICARDA
16	FLIP09-292C	X04TH147/FLIP00-17XFLIP98-230	ICARDA
17	FLIP09-298C	X04TH151/S01020XFLIP95-68	ICARDA
18	FLIP09-300C	X04TH155/S01203XFLIP97-205	ICARDA
19	FLIP09-332C	X05TH109/FLIP01-18XFLIP00-06	ICARDA
20	FLIP09-333C	X05TH111/FLIP00-39XFLIP98-178	ICARDA
21	FLIP09-345C	X06TH1/X05TH78XFLIP02-47	ICARDA

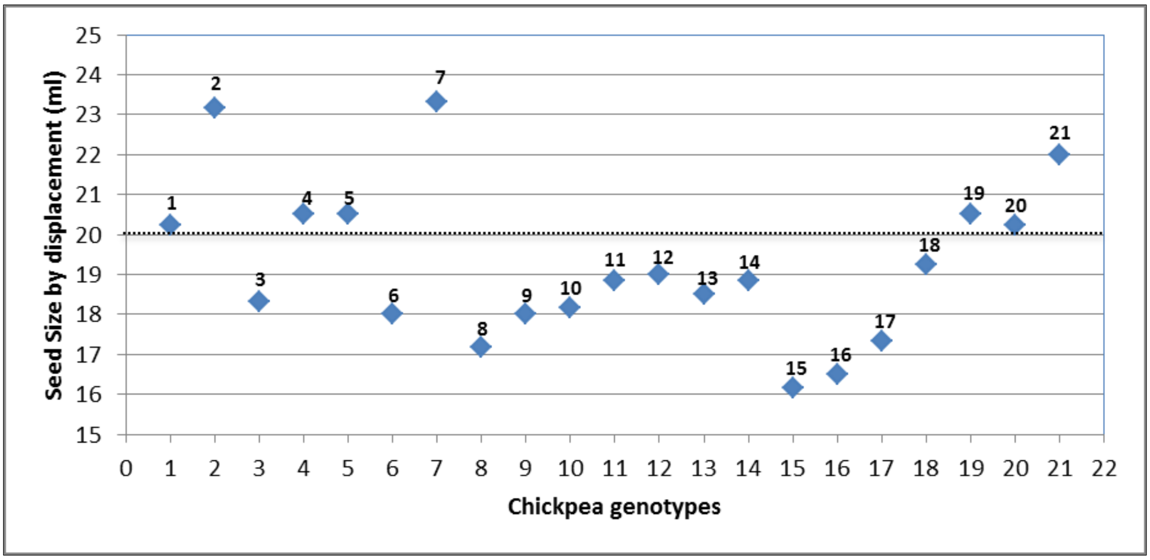

Diagram (1): Seed size of chickpea genotypes determined by displacement (ml)

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Table 2: Rainfall data (rainfall mm) and Max/Min temperatures during growing season 2016, 2017, and 2018*

Growing season	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	Total (mm)
2015/2016	12.5	32.4	70.8	94	116	46	105	70	0.5	0	**547.2**
Max/Min Tem.	-	-	-	-	-	-	17.8/8.7	24.9/13.6	30.2/17.6	36.5/24.1	
2016/2017	0	5	24.5	90.5	41	15	83	64	27	0	**350**
Max/Min Tem.	-	-	-	-	-	-	17.3/8.6	23.1/11.5	30.5/17.4	36.9/22.1	
2017/2018	0	3	30.2	14	93.5	110.5	15	82	90	0	**438.2**
Max/Min Tem.	-	-	-	-	-	-	21.8/10.9	25.2/13.3	29.3/17.5	36.3/22.3	

***** The data were obtained from Malat Research Center meteorological station, Duhok

Table (3): Soil characteristics for the experiment location (Malta R. Center)

Character[1]	value
pH	7.62
$CaCO_3$%	21.03
EC (ds^{-1})	0.278
OM (%)	0.62
Sand (%)	10.62
Silt (%)	45.96
Clay (%)	34.42
Soil type	Silty clay

* OM, Organic material; EC, Electrical conductivity

RESULTS AND DISCUSSION

Table (4) shows the analysis of variance and probability of significance for all the studied traits as infected by the involved factors with the exception of number of sees per pods which was not differed significantly by any treatments or their interaction; chickpea genotypes and seasons as well as their interaction. It's clearly demonstrated that all the studied measurements were significantly influenced by the season of sowing. As for the chickpea genotypes, only weight of 100 seeds was significant while the other studied traits were not significantly infected by genotypes. Regarding the interaction between growing season and chickpea genotypes, all studied traits were not significantly differed with the exception of grain weight.

Table (4): Analysis of variance for the studied traits

Source of variance	Probability of significance						
	Flowering	**maturity**	**plant height (cm)**	**number of pods per plant**	**number of seeds per pod**	**weight of 100 grains (g)**	**grain yield ($t.ha^{-1}$)**
Seasons	<.001	<.001	<.001	<.001	0.948	<.001	<.001
Genotypes	0.509	0.435	0.638	0.984	0.634	<.001	0.230
Sea. x Geno.	0.993	0.804	0.752	0.628	0.742	<.001	0.174

***** Sea; seasons, Geno.; Genotypes

Analysis of variance showed significant differences (P<0.001) between seasons in respect to days to flowering and maturity (Tables 4, 5 and 6). The season 2017 recorded higher days to flowering (43 days) and maturity (73.71 days) compared to 31; 26 and 62; 66 days for each of 2016 and 2018 seasons respectively. A variation of 9 and 16 days for flowering and also 9 and 13 days for days to maturity were found between 2017 season and 2016 and 2018 respectively.

With respect to chickpea genotypes a variation, non-significant differences were observed among genotypes for both traits. As for the interactions between genotypes with in seasons, also there were no effective variations although all genotypes required higher days to flowering and maturity in 2017 compared to the two rest seasons of sowing.

Variation in days to flowering and maturity can be explained by both the genotypes and climatic differences between the locations or seasons, particularly the temperature varied significantly between the test seasons (Table 2), especially at the second half of May. Days to flowering can be an effective trait with respect to drought resistance, since earliness can help the plants to escape adverse circumstances during grain filling. Its observed that in season 2017 lower amount of rainfall was recorded (Table 2) but days to flowering and maturity were increased and this can be returned to adequate distribution of rainfall during the growing season and warmer degrees of temperature during the last periods of plant life as it has more influence on the growing period than amount of rainfall.

Flowering and maturity time are important traits as one of the plant’s strategy to survive dry periods is to avoid damage by completing their life cycle before the stress can harm them. The obtained results are in agreement with Zinn *et al*. (2010) and Farooq *et al*. (2012) whom found that flowering is the most critical stage for any kind of stress, even short periods of stress at this stage, may lead to large damages on yield and its components. Therefore, crops tend to complete their life cycle before stress really damages.

Table (5): effect of growing seasons, chickpea genotypes and their interactions of the days to flowering

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	32	44	25	34
2	FLIP09-78C	31	44	26	34
3	FLIP09-83C	30	43	25	33
4	FLIP09-117C119C	31	43	26	33
5	FLIP09-119C	31	43	26	33
6	FLIP09-132C	31	44	26	33
7	FLIP09-149C	30	44	26	33
8	FLIP09-199C	30	43	26	33
9	FLIP09-212C	31	44	26	33
10	FLIP09--214C	30	43	26	33
11	FLIP09-247C	30	43	25	33
12	FLIP09-250C	33	44	26	34
13	FLIP09-251C	30	42	26	33
14	FLIP09-252C	31	43	26	33
15	FLIP09-254C	31	43	25	33
16	FLIP09-292C	31	43	25	33
17	FLIP09-298C	30	43	26	33
18	FLIP09-300C	30	43	25	33
19	FLIP09-332C	31	43	25	33
20	FLIP09-333C	31	43	25	33
21	FLIP09-345C	31	43	26	33
	Mean of seasons	31	43	26	-

***** LSD values for seasons= 0.4, for genotypes= 1 and for the interaction of seasons with genotypes = 1.8

Table (6): effect of growing seasons, chickpea genotypes and their interactions of the days to maturity

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	64.667	74.00	66.33	68.33
2	FLIP09-78C	64.667	74.00	66.66	68.44
3	FLIP09-83C	64.54	73.67	66.33	68.18
4	FLIP09-117C119C	66.00	74.00	66.33	68.77
5	FLIP09-119C	65.33	74.33	67.00	68.88
6	FLIP09-132C	65.33	74.00	66.67	68.66
7	FLIP09-149C	64.00	74.33	66.66	68.33
8	FLIP09-199C	64.67	74.00	67.00	68.55
9	FLIP09-212C	64.66	74.00	66.00	68.22
10	FLIP09--214C	64.33	73.67	66.66	68.22
11	FLIP09-247C	63.33	74.00	66.67	68.00
12	FLIP09-250C	63.67	74.33	66.66	68.22
13	FLIP09-251C	63.66	73.00	67.00	67.88
14	FLIP09-252C	64.67	74.00	66.66	68.44
15	FLIP09-254C	64.00	73.33	66.33	67.88
16	FLIP09-292C	64.00	73.33	66.67	68.00
17	FLIP09-298C	62.67	73.33	66.66	67.55
18	FLIP09-300C	63.66	74.00	66.00	67.88
19	FLIP09-332C	63.67	73.33	66.66	67.88
20	FLIP09-333C	64.33	73.00	66.33	67.88
21	FLIP09-345C	65.66	73.33	66.67	67.55
	Mean of seasons	64.35	73.76	66.57	-

***** LSD values for seasons= 0.3611, for genotypes= 0.9554 and for the interaction of seasons with genotypes = 1.654

Also for plant height, significant seasonal (environmental) effects were observed (Table 4 and 7). The season 2017 surpassed the two other seasons for recording highest plants (48.21 cm) compared 33.54 and 33.25 cm for 2016 and 2018 seasons respectively. However plant height were not differed significantly among genotypes, the plant height varied between 36.78 cm for FLIP09-214C and 40.44 cm for FLIP09-119C genotypes. With respect to seasons, plant height was associated with the distribution of rainfall recorded for the respective seasons. Plant height is genetically controlled by the genes (Rebetzke *et al*. 2011), but growth conditions such as water availability (rainfall) and temperature can significantly influence plant height.

Table (7): effect of growing seasons, chickpea genotypes and their interactions of the plant height (cm)

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	34.67	46.33	32.67	37.89
2	FLIP09-78C	32.33	49.00	33.67	38.33
3	FLIP09-83C	32.67	51.33	32.67	38.89
4	FLIP09-117C119C	34.33	49.67	32.33	38.78
5	FLIP09-119C	38.33	50.00	33.00	40.44
6	FLIP09-132C	36.00	47.67	33.00	38.89
7	FLIP09-149C	37.00	46.67	33.33	39.00
8	FLIP09-199C	33.33	47.00	33.67	38.00
9	FLIP09-212C	30.00	47.67	33.33	37.00

10	FLIP09--214C	31.00	46.67	32.67	36.78
11	FLIP09-247C	34.67	49.00	34.33	39.33
12	FLIP09-250C	33.33	50.33	34.00	39.22
13	FLIP09-251C	32.00	48.00	33.33	37.78
14	FLIP09-252C	33.00	48.67	33.33	38.33
15	FLIP09-254C	32.33	47.00	33.67	37.67
16	FLIP09-292C	33.00	48.00	33.33	38.11
17	FLIP09-298C	31.00	48.67	33.33	37.67
18	FLIP09-300C	33.00	46.33	33.00	37.44
19	FLIP09-332C	35.67	46.33	33.00	38.33
20	FLIP09-333C	33.00	48.00	33.00	38.00
21	FLIP09-345C	33.67	50.00	33.67	39.11
	Mean of seasons	33.54	48.21	33.25	-

***** LSD values for seasons= 0.981, for genotypes= 2.595 and for the interaction of seasons with genotypes = 4.494

Table (8) shows the effect of studied factors on the number of pods per plant. The number of pods per plant was also significantly influenced by the season of sowing as the 2017 season with 10 pods recorded highest number of pods per plant followed by 9 and 7 pods for each of 2018 and 2016 seasons respectively. Regarding genotypes, number of pods varied between 9 for most of genotypes and 10 pods for both FLIP09-250C and FLIP09-254C genotypes. However this variation was not significant. The genotype by seasonal pattern was also not significant although most genotypes produced higher number of pods during the season 2017.

Table (8): effect of growing seasons, chickpea genotypes and their interactions on the number of pods per plant

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	5	10	10	8
2	FLIP09-78C	7	11	9	9
3	FLIP09-83C	7	10	9	9
4	FLIP09-117C119C	7	9	10	9
5	FLIP09-119C	8	10	9	9
6	FLIP09-132C	9	10	8	9
7	FLIP09-149C	8	10	10	9
8	FLIP09-199C	6	12	8	9
9	FLIP09-212C	7	11	9	9
10	FLIP09--214C	6	10	10	9
11	FLIP09-247C	7	11	9	9
12	FLIP09-250C	7	10	11	10
13	FLIP09-251C	5	12	9	9
14	FLIP09-252C	6	11	9	9
15	FLIP09-254C	7	12	11	10
16	FLIP09-292C	7	11	10	9
17	FLIP09-298C	6	11	10	9
18	FLIP09-300C	4	10	9	8
19	FLIP09-332C	7	10	10	9
20	FLIP09-333C	8	9	10	9
21	FLIP09-345C	8	9	10	9
	Mean of seasons	7	10	9	-

***** LSD values for seasons= 0.7, for genotypes= 1.8 and for the interaction of seasons with genotypes = 3.1

Regarding weight of 100 seeds, as it's shown in the table (4), both studied factors (seasons and genotypes) as well as their interactions were significant on this yield related trait. As shown in diagram (1), the genotypes have grouped into small and large sized, the seed weight ranged between 20.32 for FLIP09-83C and 29.80 g for FLIP09-149C (Table 9). Although the amount of rainfall was lower in the season 2017 (Table 2), it recorded higher seed weight (32.75 g) compared to 17.96 and 27.36 g for 2016 and 2018 seasons respectively. This may due to the better distribution of rainfall during the last days of the season which have great influence of the seed quality. Similarly, most of the genotypes produced higher seed weight during the season 2017 and FLIP09-78C (40.33g) and FLIP09-345C (36.98 g) with higher values. Thereby, grain filling could have taken place at stress conditions which were probably less severe than later on in 2016 and/or 2018, resulting in higher seed weight of the genotypes.

For final grain yield, the analysis of variance revealed significant mean effects for growing seasons and non-significant for each of genotypes and interaction (Table 4). The seasons involved in this experiment significantly influenced on the final grain yield of chickpea genotypes; in contrast to most of the pervious studied traits, final grain yield was gradually increased with increasing of the rainfall amount at the end of the season; 1.445 t in 2016, 0.969 t in 2018 and 0.759 $t.ha^{-1}$ in 2017 (Tables 10 and 2) which demonstrates the specific adaptation of this particular genotypes to water stress. However the effect of genotypes was not significant, both FLIP09-78C and FLIP09-83C surpassed others with 1.336 and 1.331 $t.ha^{-1}$ respectively and FLIP09-345C with lowest yield (0.668 $t.ha^{-1}$).

Table (9): effect of growing seasons, chickpea genotypes and their interactions of the weight of 100 seeds (g)

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	20.86	32.55	28.57	27.33
2	FLIP09-78C	10.23	40.33	32.62	27.73
3	FLIP09-83C	20.70	32.38	25.88	20.32
4	FLIP09-117C119C	16.34	36.50	29.15	27.33
5	FLIP09-119C	19.45	35.06	28.77	27.76
6	FLIP09-132C	19.18	30.00	25.03	24.74
7	FLIP09-149C	19.33	36.98	33.10	29.80
8	FLIP09-199C	17.82	28.37	24.42	23.54
9	FLIP09-212C	19.81	31.06	25.49	25.45
10	FLIP09--214C	25.64	32.51	26.01	28.05
11	FLIP09-247C	19.94	31.22	26.75	25.97
12	FLIP09-250C	20.40	30.74	26.77	25.97
13	FLIP09-251C	12.02	31.39	26.68	23.37
14	FLIP09-252C	17.14	30.23	27.11	24.83
15	FLIP09-254C	20.77	28.74	24.15	24.55
16	FLIP09-292C	23.83	29.16	23.48	25.49
17	FLIP09-298C	11.38	30.85	24.99	22.41
18	FLIP09-300C	20.13	34.40	27.79	27.44
19	FLIP09-332C	19.23	33.17	28.89	27.10
20	FLIP09-333C	22.56	35.35	28.31	28.74
21	FLIP09-345C	18.36	36.76	30.52	28.55
	Mean of seasons	17.96	32.75	27.36	-

***** LSD values for seasons= 1.243, for genotypes= 3.289 and for the interaction of seasons with genotypes = 5.696

Therefore, the succeed genotypes such as FLIP09-78C, FLIP09-83C, FLIP09-333C and FLIP09-212C can be recommended to the farmers in the area and further studies are suggested to ensure the performance of all of these genotypes in comparison to local varieties and in different locations.

Table (10): effect of growing seasons, chickpea genotypes and their interactions on the final grain yield (t.ha^{-1})

#	Genotypes	Seasons			Means of Genotypes
		2016	**2017**	**2018**	
1	FLIP09-73C	1.268	0.572	1.173	1.004
2	FLIP09-78C	2.272	0.832	0.903	1.336
3	FLIP09-83C	2.220	0.676	1.096	1.331
4	FLIP09-117C119C	0.947	0.673	0.809	0.810
5	FLIP09-119C	1.333	0.600	0.832	0.922
6	FLIP09-132C	0.736	0.699	1.092	0.842
7	FLIP09-149C	1.307	0.476	0.936	0.906
8	FLIP09-199C	1.361	0.632	0.855	0.949
9	FLIP09-212C	2.093	0.771	0.981	1.282
10	FLIP09--214C	1.973	0.700	0.825	1.166
11	FLIP09-247C	0.987	0.811	0.869	0.889
12	FLIP09-250C	1.011	0.759	1.028	0.932
13	FLIP09-251C	1.653	0.824	1.161	1.213
14	FLIP09-252C	1.120	1.745	0.941	1.269
15	FLIP09-254C	1.733	0.837	0.831	1.134
16	FLIP09-292C	1.263	0.748	0.949	0.987
17	FLIP09-298C	0.813	0.696	1.048	0.852
18	FLIP09-300C	1.787	0.684	1.135	1.202
19	FLIP09-332C	1.933	0.779	1.003	1.238
20	FLIP09-333C	2.133	0.741	0.977	1.284
21	FLIP09-345C	0.400	0.692	0.912	0.668
	Mean of seasons	1.445	0.759	0.969	

***** LSD values for seasons= 0.189, for genotypes= 0.501 and for the interaction of seasons with genotypes = 0.869

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پوختە

ل دویف ئەنجامێن شروڤەکرنا کومپوستی یێ کو هاتیە بەرهەم ئینان ل کارگەها کواشێ یا گلێشی و تێدا دیاربووی کو رێژا کانزاییێن ب سەنگ لناڤدا یا زێدەبوو ب تایبەتی (**lead, cadmium, copper, nickel, chromium, cobalt and zinc**)، ئەڤ ڤەکولینە هاتە ئەنجامدان لسەر ٣ جورێت زەرزەواتێن بەلگی (جەرجیر وکەرەفس و بەقلی) ژبو دیارکرنا رێژا کانزاییێن ب سەنگ دناڤ بەلگێن واندا. ئەنجامان دیارکر کو دەرئەنجامانێن لسەر رووەکاندا دجیاوازبوون لدویف کارلێکێن هاتینە ب کارئینان دڤێ لێکولینێ دا بو هەر ئێک ژ تێگوهورێن هاتینە بکارئینان. دیاربو کو ئەو رووەکێن هاتینە کارلێک کرن ب پەینێ گیانەوەری دسەرکەفتی بوون لسەر وان رووەکێن کارلێک کرین ب کومپوستی بو زوربەیا تێگوهورا. بەلێ جیاوازیەکا بەرچاڤ (بەرکەفتی) دگەل وان رووەکان دا نەبوو ئەوێن هاتینە کارلێک کرن بـ ٦ و ٩ لیتر/ م**2** یێن کومپوستی. رێژا کانزاییێن ب سەنگ دناڤ هەمی نموونادا لدویف ستاندارتێن یاسایا خوارنێ یا ئەوروپی بوو ژبلی (کرومیوم) چونکی دیاربوو کو یێ ژەهراوی بوو دناڤ ئێک ژ نموونێن کەرەفسێ دا (**0.53** ملغم/ کغم) وب کێر خوارنا مروڤان ناهێت. یا سەرنج راکێش ئەوبوو کو ئەو نموونێت نەهاتینە کارلێک کرن ب کومپوستی دیارکر کو رێژا کانزاییێن ب سەنگ دناڤدا یا نێزیکی وێ رێژێ بوو ئەوا دناڤ وان نموونادا ئەوێت هاتینە کارلێک کرن ب کومپوستی، ئەڤەژی وێ چەندێ دیاردکەت کو ئەڤ رێژا کانزایا دناڤ وان نموونادا دیاربووی ژ ژێدەرەکێ دی هاتیە ژبلی کومپوستی. ئەڤ ڤەکولینە بکارئینانا دروست دوپات دکەت و رێکێ ل بکارئینانا رێژێت زیانبەخش بێن پێشبینیکری د پاشەروژێدا دگریت.

الخلاصة

الانتاج الجيد للحمص تعتمد على ظهور السلالات الجديدة مع تحسين تأقلمها في البئات المختلفة، لذلك اجريت هذة التجربة في ثلاثة مواسم مختلفة في محطة البحوث الزراعية في منطقة دهوك خلال **16/2015**، **17/2016**، **18/2017** لغرض دراسة اداء احدى وعشرون سلالة جديدة من الحمص ادخلت

حديثا عن طريق منظمة ايكاردا وكالاتى **FLIP09-73C, FLIP09-78C, FLIP09-83C, FLIP09-117C119C, FLIP09-119C, FLIP09-132C, FLIP09-149C, FLIP09-199C, FLIP09-212C, FLIP09-214C, FLIP09-247C, FLIP09-250C, FLIP09-251C, FLIP09-252C, FLIP09-254C, FLIP09-292C, FLIP09-298C, FLIP09-300C, FLIP09-332C, FLIP09-333C, and FLIP09-345C)**

تحت الظروف الديمية في محافظة دهوك، اظهرت النتائج تفوق كل من الاصناف **FLIP09-78C, FLIP09-83C, FLIP09-333C** و**FLIP09-212C** في الحاصل النهائي على الرغم من ان الاختلاف لم يكن معنويا ، ومن جانب اخر الحاصل النهائي للبذور ارتفع تدريجيا حسب المواسم مع ارتفاع كميات الامطار وخاصة في نهاية الموسم وعليه يمكن توصية الاصناف المتفوقة في هذة التجربة للفلاحين و ايضا نوصي باجراء المزيد من الاختبارات لهذة الاصناف بالمقارنة مع بعض الاصناف المحلية وفي مواقع مختلفة للتأكد من ثباتية هذة السلالات الجديدة.