INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES
IJPAES
Volume-5, Issue-4, Oct-Dec-2015 Coden: IJPAJX-CAS-USA, Copyrights@2015 ISSN-2231-4490
Received: 10th Aug-2015 Revised: 27th Aug-2015 Accepted: 4th Sept-2015
Research article

RESPONSE OF SOME CHICKPEA (*CICER ARIETINUM* L.) VARIETIES UNDER RAINFED CONDITION.

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ABSTRACT: A study was undertaken to evaluate the performance of three chickpea varieties (Flip-1, Flip-2 and Flip-3). Field experiment was performed at research area of Faculty of Agricultural Sciences, University of Sulaimani, during spring season of 2014. Experiment was laid out in randomized complete block design (RCBD). There was a significant genotypic difference with respect to all studied characters except number of branches/plant and dry shoot weight. Chickpea variety Flip-2 showed best performance as it gave significantly higher total weight (8.84 g), dry shoot weight (1.52 g), dry root weight (0.91g), and weight of pods. The highest seed yield (3.86 g per plant) was recorded in Flip-2. The associations of different characters have been assessed. There was significant positive correlation of plant height with fresh shoot weight (r=0.75*) and fresh root weight (r=0.79*). On the others hand, the correlation between plant height and dry root weight was negative (r=-0.81*). The result showed a significant negative correlation of total weight with fresh shoot weight (r=-0.79*) and fresh root weight (r=-0.79*). There was significant positive relationship between dry shoot weight and weight of pods (r=0.67*). The maximum correlation was observed by fresh shoot weight and fresh root weight (r=0.99**).
Key words: Chickpea varieties, Seed yield, Plant traits, Correlation, Biomass

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the second most important cool season pulse crop in the world and is grown in at least 33 countries including Central and West Asia, South Europe, Ethiopia, North Africa, North and South America and Australia [1,2]. It is grown in Kurdistan as rainfed spring crop. Chickpea is a hardy deep-rooted dry land crop and can grow to full maturity despite conditions that would prove fatal for most crops. Chickpea acquires importance as it provides food for humans as well as for livestock. Furthermore, chickpea pod covers and seed coats can also be used as fodder. It is consumed as a fresh immature green seed, whole seed, dhal and flour. It is also consumed as a delicacy in India during the chickpea-growing season. In grain legumes, proteins are an important seed component and are responsible for their relevant nutritional and socio-economic impact. The chickpea seed is a good source of carbohydrates and proteins, which together constitute 80% of the total dry seed weight. The crude protein content of chickpea varies from 17% to 24% containing the essential amino acids like tryptophan, methionine and cysteine [3]. It is grown on marginal land and rarely receives fertilizers or protection from diseases and insect pests [4]. The low yield of the crop is characterized by several biotic and abiotic factors. Chickpea with indeterminate habit grows well under favorable conditions.

The crop needs variable temperature during its various growth phases. If grown under favorable moisture, it produces higher pods and grain yield under heat and drought in the later part of it reproductive stage. A significant pod abortion has been observed under sever moisture stress especially during commencement of pod set [5]. The drought tolerance in their case was found to be directly proportional to deep root system and high leaf water potential (LWP). High temperature stress also causes yield losses because of damage to reproductive organs [6] and had reduced total dry matter and grain yield during drought [7]. Some studies have screened out some pulses germplasm accessions with greater genetic variability in various traits [8]. Hence, the study was aimed to identify suitable variety, with respect to growth and yield performance.

MATERIALS AND METHODS

Field experiment was performed at research area of Faculty of Agricultural Sciences, University of Sulaimani, during spring season of 2014 to evaluate the growth and yield performance of chickpea varieties. Three chickpea varieties viz., Flip-1, Flip- 2 and Flip-3 were tested. Experiment was laid out in a randomized complete block design (RCBD) and each treatment was replicated three times. A net plot size of 2 m x 2 m was kept. The crop was sown during first week of 24, February by hand. Seed rate of 110 $kgha^{-1}$ was kept while maintaining row distance of 40 cm and plant to plant distance of 25 cm. NPK in the form of urea, DAP and potassium sulphate, respectively, at the rate of 60-75-30 kg ha-1 was applied. Full dose of each of nitrogen, phosphorus and potassium was applied basally. Weeding was done by hand hoeing and/ or hand pulling when weeds were tender. Weeding began two weeks after planting until peg formation, to ensure that pegs are not destroyed. Parameters related to plant growth and yields such as, plant height, number of branches per plant, number of pods per plant, pod weight, number of seed per plant, fresh shoot weight, fresh root weight, dry shoot weight and dry root weight seeds yield were recorded for analysis. The data thus collected were analyzed statistically by the analysis of variance technique and treatment means were compared using LSD test at 5 % level of probability [9]. To assess the relationship of seed yield with other parameters, correlation analyses were performed on XLSTAT software.

RESULTS AND DISCUSSIONS

The mean squares from the analysis of variance for growth and yield of chickpea are presented in Table 1. The effect of chickpea varieties was significant for the all agronomic characters investigated except number of branches/plant (NB) and dry shoot weight (DSW).

Table 1. Mean square values from the analysis of variance for growth and yield of chickpea.

SOV	*PH*	*NB*	*TW*	*FSW*	*FRW*	*DSW*	*DRW*	*NP*	*WP*	*NS*	*WS*
Block	1.051	1	1.071	0.399	0.104	0.011	0.00068	0.777	11.09	1.44	0.907
Varieties	18.83*	1NS	5.355**	16.489*	3.470*	0.031NS	0.00857**	3.111*	24.95**	5.444*	0.072NS
Error	1.308	0.5	0.113	1.689	0.29	0.01	0.00036	0.111	0.013	0.611	0.012

PH: Plant height (cm), NB: Number of branches, TW: Total weight/plant (g), FSW: Fresh shoot weight (g), FRW: Fresh root weight (g), DSW: Dry shoot weight (g), DRW: Dry root weight (g), NP: Number of pods/plant, WP: Weight of pods/plant (g), NS: Number of seeds/plant, WS: Weight of seeds/plant (g)

The varieties showed significant difference in case of plant height. Flip-1produced the tallest plants (11.94 cm) being closely followed by Flip-3 (11.82 cm). The shortest plants (7.54 cm) were found in Flip-2 (Table 2). Variation among the varieties in respect of plant height appears due to genotype variation. Similar reports are presented by Kabir *et al*., [10] who observed that plant height differed among varieties BARIChola-2, BARI Chola-4 and BARI Chola-6.

Chickpea varieties did not show significant difference in case of number of branches/plant (Table 1). The highest number of branches per plant was produced by varieties Flip-2 (5.36) and Flip-3 (5.35), while the lowest number of branches per plant was found in variety LV88 (4.34) (Table 2). The results are not agreed with the findings of Agrawal [11] who obtained considerable genotypic variability for this character. Total plant weight varied significantly among the studied varieties which had shown wide range of variability (Table 2). Flip-1 showed the highest total plant weight (11.94 g) followed by Flip-3 (11.82 g) with same statistical rank. Flip-2 showed lower total plant weight (7.54 g). Total dry matter production depends on its canopy structure. A greater canopy occupied plant should have higher number of branches as well as leaves, which has capacity to capture more sunlight and produced maximum assimilates. Total plant weight varied significantly among the studied varieties which had shown wide range of variability (Table 2). Flip-1 showed the highest total plant weight (11.94 g) followed by Flip-3 (11.82 g) with same statistical rank. Flip-2 showed lower total plant weight (7.54 g). Total dry matter production depends on its canopy structure. A greater canopy occupied plant should have higher number of branches as well as leaves, which has capacity to capture more sunlight and produced maximum assimilates. The fresh shoot weight, fresh root weight and dry root weight was significantly different in chickpea varieties. Maximum fresh shoot weight and fresh root weight were recorded in Flip-3 (10.93 g and 4.93 respectively) followed by Flip-1 (9.47 and 4.6 g). Flip-2 produced lower fresh shoot weight and fresh root weight (5.89 and 2.92 g) (Table 2). However, there was more variability in dry root weight than all other morphological characters of the studied genotypes ranging from 0.8 to 0.91 g per plant (Table 2).

Dry shoot weight of chickpea mutants/lines/varieties did not differ significantly (Table 2). Chickpea varieties showed significant difference in case of number of pods/plant and pod weight/plant.

It was Flip-1, however, that gave the highest values for average number of pods per plant (12.34) and Flip-3 gave the lowest value for number of pods per plant (10.33) (Table 2). The range of pods weight was between 4.2 and 4.85 (Table 2). This variation might be due to genotypic variation. The results are well supported by the findings of Kabir *et al*., [10] who observed the highest number of pods/plant and seeds/pod were observed in BARI Chola-4, which was statistically at par with BARI Chola-2.

Table 2. Some morphological characters of studied 3 chickpea genotypes

Varieties	*PH*	*NB*	*TW*	*FSW*	*FRW*	*DSW*	*DRW*	*NP*	*WP*	*NS*	*WS*
Flip-1	11.94	4.34	6.49	9.47	4.6	1.32	0.8	12.34	4.2	13	3.5
Flip-2	7.54	5.35	8.84	5.89	2.92	1.52	0.91	11.68	4.85	11.34	3.86
Flip-3	11.82	5.36	6.56	10.3	4.93	1.4	0.85	10.33	4.63	10.33	3.83
LSD	2.59	1.601	0.76	2.945	1.221	0.227	0.041	0.755	0.258	1.771	0.249

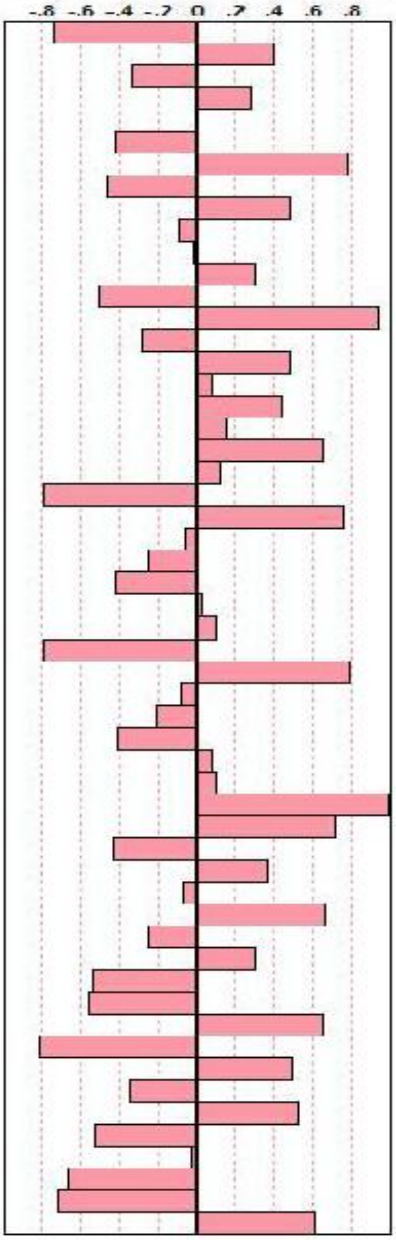
PH: Plant height (cm), NB: Number of branches, TW: Total weight/plant (g), FSW: Fresh shoot weight (g), FRW: Fresh root weight (g), DSW: Dry shoot weight (g), DRW: Dry root weight (g), NP: Number of pods/plant, WP: Weight of pods/plant (g), NS: Number of seeds/plant, WS: Weight of seeds/plant (g)

Table 3. Correlation co-efficient among studied characters of chickpea varieties

Multivariate

Pairwise Correlations

Variable	by Variable	Correlation	Count	Signif Prob
PH	TW	0.7343	9	0.0243*
NB	TW	0.3973	9	0.2897
NB	PH	-0.3395	9	0.3714
NP	TW	0.2743	9	0.4751
NP	PH	0.0040	9	0.9918
NP	NB	0.4271	9	0.2515
WP	TW	0.7800	9	0.0132*
WP	PH	-0.4604	9	0.2124
WP	NB	0.4777	9	0.1934
WP	NP	-0.0884	9	0.8212
NS	TW	-0.0060	9	0.9877
NS	PH	0.2983	9	0.4355
NS	NB	-0.5068	9	0.1638
NS	NP	0.9332	9	0.0002*
NS	WP	-0.2740	9	0.4742
WS	TW	0.4770	9	0.1941
WS	PH	0.0824	9	0.8331
WS	NB	0.4493	9	0.2250
WS	NP	0.1553	9	0.6899
WS	WP	0.6502	9	0.0549
WS	NS	0.1259	9	0.7460
FSW	TW	-0.7916	9	0.0110*
FSW	PH	0.7548	9	0.0187*
FSW	NB	0.0596	9	0.8790
FSW	NP	-0.2480	9	0.5190
FSW	WP	-0.4231	9	0.2568
FSW	NS	0.0275	9	0.9440
FSW	WS	0.0963	9	0.8053
FRW	TW	0.7970	9	0.0101*
FRW	PH	0.7913	9	0.0111*
FRW	NB	-0.0744	9	0.0491
FRW	NP	-0.2082	9	0.5910
FRW	WP	-0.4147	9	0.2671
FRW	NS	0.0735	9	0.8509
FRW	WS	0.1013	9	0.7954
FRW	FSW	0.9043	9	<.0001*
DSW	TW	0.7122	9	0.0310*
DSW	PH	-0.4377	9	0.2387
DSW	NB	0.3716	9	0.3248
DSW	NP	0.0623	9	0.8735
DSW	WP	0.6712	9	0.0478*
DSW	NS	-0.2480	9	0.5185
DSW	WS	0.3001	9	0.4279
DSW	FSW	-0.5414	9	0.1322
DSW	FRW	-0.5558	9	0.1203
DRW	TW	0.6624	9	0.0519
DRW	PH	-0.8163	9	0.0073*
DRW	NB	0.4910	9	0.1792
DRW	NP	-0.3404	9	0.3502
DRW	WP	0.5293	9	0.1428
DRW	NS	-0.5253	9	0.1464
DRW	WS	0.0183	9	0.9628
DRW	FSW	-0.6740	9	0.0461*
DRW	FRW	-0.7155	9	0.0302*
DRW	DSW	0.6151	9	0.0779



However number of seeds/plant and seeds weight varied significantly among different chickpea varieties. However, highest number of seeds (11.84 g) and was given by chickpea variety Flip-2 while the lowest by Flip-3. Maximum seeds yield (3.86 g) was observed in Flip-2 while the minimum seeds yield was showed by Flip-1 (3.5 g) (Table 2). High variability in the number of secondary branches of chickpea genotypes was also reported by Ahmad et al. [12].

The associations of different characters have been assessed and are presented in Table 3. There was significant positive correlation of plant height with fresh shoot weight (r=0.75*) and fresh root weight (r=0.79*). On the others hand, the correlation between plant height and dry root weight was negative (r=-0.81*). The result showed a significant negative correlation of total weight with fresh shoot weight (r=-0.79*) and fresh root weight (r=-0.79*). There was significant positive relationship between dry shoot weight and weight of pods (r=0.67*). The maximum correlation was observed by fresh shoot weight and fresh root weight (r=0.99**). These results are consistent with the results of many workers in chickpea [13-16].

CONCLUSIONS

Out of all the varieties studied, chickpea variety Flip-2 showed best performance as it gave significantly higher total weight, dry shoot weight, dry root weight, weight of pods and seed yield. Therefore it is proved to be most suitable for sowing under agro- climatic conditions of Bakrajo. It is followed by variety Flip-3. However, the varietyFlip-1 was found to be inferior to all other varieties. There was significant positive correlation of plant height with fresh shoot weight and fresh root weight. On the others hand, the correlation between plant height and dry root weight was negative. There was significant positive relationship between dry shoot weight and weight of pods. The maximum correlation was observed by fresh shoot weight and fresh root weight.

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INTERNATIONAL JOURNAL OF
PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

ISSN 2231-4490

International Journal of
Plant, Animal and Environmental Sciences