Effect of two growing seasons on growth, yield and its components of lentil varieties under rainfall condition in north of Iraq

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Abstract

The investigation was conducted at Bakrajo in Sulaimani Province at two seasons (2011-2012 and 2012-2013) to select the best varieties for growth and yield characteristics of lentil that adapted to the environment of Sulaimani province. Eight lentil varieties were utilized in the study. The experiment was designed as a Randomized Complete Block Design (R.C.B.D) with three replications. Mean comparison was carried out by the least significant difference (L.S.D) at a significant level of 5%. The result confirmed the interaction between average seasons and varieties on some growth and forage characteristics for the two seasons. Consequently, the highest value for the characters; plant height with 36.33, days to %50 flowering with 118.33, and days to maturity with 152 were realized by the varieties V.3, V.7, and V.5 consecutively. The characters, number of branches.plant^{-1} with 3.33 for the variety V.1, first pod height with 15 for variety V.6, and variety V.3 for no. of branch nodules.plant^{-1} with 36.677. In the 2012-2013 season, variety V.5 gave the maximum value for plant height with 44 cm, days to %50 flowering with 121.66 days for the variety V.3, days to maturity with 161 days for the variety V.8, no. of branches with 19.33 for the variety V.5, and no. of bacterial nodules/plant for the variety V.3 with 31.66. Effect of the interaction between seasons and varieties on seed yield and its components for two seasons. The variety V.2 produced the highest seed yield and some of its yield components for both seasons. The effect of seasons showed that in season 2011-2012 gave the maximum values for all characters of growth and seed yield components for lentil varieties except for no. of seeds/pod and no. of seeds/plant.

Keywords: Lentil, Legume crops, Varieties, Growth, Yield, Seed production.

Introduction

Lentil (*Lens culinaris* Medik.) belonging to the family Fabaceae is considered an ancient, domesticated, economically important winter legume crop agriculturally cultivated worldwide as human food. Due to the short life of lentil, it is very suitable to be involved in the rotation system, especially with cereals, reducing the effect of weeds, diseases, and soil erosion (2).Pulse crop acres, particularly field peas and lentil, have been expanding in the Northern Plains states and Canadian States (5) Lentils are considered to be a good source of protein. This high protein content in lentils and other pulses makes them a significant food source for developing countries and low-income people (6). Lentil is richer in total soluble fiber than peas and chickpeas. Also, its content of dietary fiber is higher than beans and chickpeas. Like most legumes, lentil is a rich protein source between 20.6% and 31.4% proteins (8) . Lentil Lens culinaris Medik., faba bean Vicia faba L. and chickpea *Cicer arietinum* L. provide a considerable portion of the people's diet in this region. For example, Rwanda bean supplies 65% of the national dietary protein, compared to 4% from animal protein, and 32% of the energy (7). The seeds of this plant are commonly used as an edible pulse. Lentils are nutritional valued for their high protein content of about 30% and a good source of vitamins and other nutrients (6). Lentil has become an important food legume crop in the farming and food systems of many countries globally. The straw is a valued animal feed. Its seed is a rich source of minerals, protein, and vitamins for human nutrition. It is capability carbon sequestration and in nitrogen get better soil nutrient status (15). The crop is known to tolerate hard environmental conditions (8). It has received little research attention to improving quality and yield(13). Pulse crop acres, particularly field peas and lentil, have been expanding in the Northern Plains states and Canadian States (12). Lentil is known to have a tolerance for extreme environmental conditions such as drought and high temperature and can be grown in semiarid regions without irrigation(1).Lentil contributes significantly to soil fertility, having the capability of fixing the atmospheric nitrogen through a symbiotic relationship with nitrogen-fixing *Rhizobium* bacteria. Cool-season grain legumes are important protein-rich food crops of East Africa. Climate Lentils require a minimum of 350mm rainfall a maximum of 550mm; in the higher rainfall areas with good drainage is essential; waterlogging will have a great effect on yields and disease spread (3). Lentil is very rich compared to cereals for higher protein content of 28%. The straw also is a valued fodder containing a reasonable amount of minerals 2% (11). In this study, our objectives were to evaluate eight varieties of lentil under two growth seasons for growth and yield and select the more adaptable varieties to the Sulaimani province Iraqi Kurdistan region.

Materials and Methods

Field Experiment

For two winters growing seasons 2011-2012 and 2012-1013, eight lentil varieties, large seeds, were utilized in this investigation; Flip 2004-56L, Flip2005-2L, Flip2007-11L, Flip2007-12L, Flip2007-19L, Flip2007-29L, Flip 2007-30L, and local check denoted by (V.1-V.8) respectively. They were obtained from the Agricultural Research Station of Bakrajo-Sulaimani. The varieties were grown at Bakrajo. The experiment was laid out according to a Randomized Complete Block Design (RCBD) with three replications in both seasons. A line of 2m length and 30cm apart. Plots have consisted of four rows .The seed rate of 100 kg.ha^{-1} was applied for all varieties in November for both seasons. Also, an amount of 160 kg.ha^{-1} DAP, 40 kg.ha^{-1} urea fertilizer was applied during sowing. Mechanical weed control was applied to the experiment. Data were recorded from the whole plot for seed yield, biomass, and harvest index, while for other traits; the average value from ten plants in each plot was recorded. The measured traits included; plant height cm, days to %50 flowering, days to maturity, no. of branches per plant, first pod height cm, no. of pods per plant, no. of seed per plant, first pod length cm, no. of nodules, no. of seeds per pods, 100 seeds, seed yield kg.ha^{-1}. Seed yield in kg.ha^{-1} as a yield rate per hectare by tons, counted by converting the yield of plot area into a hectare. The average weight of the whole plants for each plot converted to kg.ha^{-1}, and harvest index (HI), counted as the ratio of grain yield to biological yield (16).

Harvest Index (HI %) =

$$\frac{\text{Economic yield(seed yield)}}{\text{Biological yield}} \text{ X } 100$$

All possible comparisons among the means would be carried out using the Least Significant Difference test LSD at a significant 5% level after showing their significance in the general test.

Results and Discussions

Data from Table (1) presents the Means of eight lentil varieties' response in some growth characteristics for the season 2011-2012. Data was found to be significant Difference at 5% (LSD) for plant height, days to maturity, and no. of bacterial nodules/plant, but no significance for days to %50 flowering, no. of branches per plant, and no. of bacterial nodules/plant. The variety Flip 2004-56L gave maximum value for no. of branches per plant and first pod height with 3.33 and 14.33, respectively.

Table 1: Performance of means traits of eight lentil varieties in the growing season 2011-2012.

varieties	Plant height (cm)	Days to%50 flowering	Days to maturity	No. of branches .plant^{-1}	First pod height (cm)	No. of bacterial nodules. Plant^{-1}
V.1	36.33	116.33	147.33	3.33	14.33	**27.333**
V.2	40.66	117.00	147.66	3.00	13.66	**28.333**
V.3	35.33	117.33	145.66	3.00	14.32	**36.667**
V.4	37.66	116.66	144.33	2.63	13.60	**24.667**
V.5	42.00	117.33	152.00	2.65	13.33	**20.667**
V.6	36.33	116.32	148.00	3.00	14.00	**21.667**
V.7	37.66	118.33	150.00	3.00	13.00	**18.000**
V.8	42.01	116.66	145.60	3.00	14.31	**31.333**
LSD (5%)	3.80	N.S	5.073	N.S	N.S	**12.124**

N.S= Non signifiant

Variety V.3 produced maximum value for no. of nodules/plant with 36.66. Variety V.4 recorded the minimum value for days to maturity and no. of branches/plant with 144.33 and 2.63, respectively. Variety V.5 maximum value for plant height 42.00 cm Variety V.6 recorded the lowest value for days to %50 flowering with 116.32.

Table 2: Differences between means eight lentil varieties in the yield and yield components in the growing season 2011-2012.

Varieties	No. of pod. $Plant^{-1}$	No. of Seed. $Plant^{-1}$	No. of seed $.pod^{-1}$	Pod length (cm)	100 seed weight (gm)	Seed yield $kg.ha^{-1}$	Biological yield kg. ha^{-1}	Harvest index%
V.1	40.330	45.000	1.300	1.330	5.560	2635.050	6896.373	**38.3**
V.2	38.000	47.330	1.600	1.560	6.16 0	2759.390	7049.723	**39.1**
V.3	44.330	33.330	1.600	1.260	5.900	2749.570	7842.650	**35.0**
V.4	38.000	39.600	1.010	1.300	6.700	2662.350	7114.870	**37.4**
V.5	38.000	40.000	1.000	1.230	6.400	2485.020	6852.420	**36.2**
V.6	40.000	32.330	2.100	1.460	6.200	2474.830	6426.907	**38.5**
V.7	32.000	34.660	2.000	1.500	6.330	2319.053	5618.603	**41.2**
V.8	32.000	39.330	1.620	1.200	5.700	2571.490	6581.947	**39.0**
LSD (5%)	6.940	10.9 40	N.S.	0.260	N.S.	121.891	176.688	**N.S.**

N.S.= Non signifiant

Data represent in Table (2) explain the performance of seed yield and its components of eight lentil varieties for season 2011-2012. It was noticed that the differences among varieties were significant at 5% (LSD) for no. of pod/plant, no. of $seed.plant^{-1}$, pod length, seed yield, and biological yield. But not significant for no. of $seed.pod^{-1}$, 100 seed weight, and harvest index. Variety V.1 gave maximum value for 100 seed weight with 5.56 gm. However, variety V.2 recorded the highest value for no. of $seed.plant^{-1}$, pod length, seed yield, and biological yield with 47.33 gm, 1.56, gm 2759.39 $kg.ha^{-1}$, and 7049.72 $kg.ha^{-1}$, respectively. Variety V.3 produced the highest value for no. of $pod.plant^{-1}$, while the lowest value recorded in harvest index with 35%. Variety V.4 gave maximum value for 100 seed weight with 6.70 gm, while no. of $seed.pod^{-1}$ gave the minimum value of 1.01. Variety V.6 gave the highest value for no. of $seed.pod^{-1}$ with 2.10. Variety V.7 gave maximum value for the harvest index with 0.41. While the minimum values for no. of $pod.plant^{-1}$, no. of $seed.plant^{-1}$, seed yield, and biological yield with 32.00, 34.66, 2319.05 $kg.ha^{-1}$, and 5618.60 $kg.ha^{-1}$, respectively. The lowest value recorded for the characters; no. of $pod.plant^{-1}$ and pod length with 32.00 and 1.20 cm, respectively, this result in agreement with previous studies (4).

Table 3 Performance of means of traits of eight lentil varieties in the growing season 2012-2013.

Varieties	Plant height (cm)	Days to %50 flowering	Days to maturity	No. of branches .plant^{-1}	First pod height (cm)	No. of bacterial nodules. plant^{-1}
V.1	37.330	117.660	158.330	3.030	17.000	26.333
V.2	42.333	118.667	159.000	3.010	19.000	19.333
V.3	38.660	121.660	158.00	3.030	17.333	31.667
V.4	35.000	118.660	159.333	3.020	19.333	21.333
V.5	44.000	120.660	157.667	4.000	17.000	25.000
V.6	42.330	118.330	158.667	3.020	16.333	15.333
V.7	36.000	117.330	157.33	3.030	18.333	14.000
V.8	39.330	120.333	161.000	3.000	17.000	21.667
LSD (5%)	6.375	2.129	1.921	N.S.	2.088	N.S.

N.S= Non signifiant

The results in Table(3) revealed significant differences between varieties in all characters except for no. of branches.plant^{-1} and no. of bacterial nodules.plant^{-1}. Variety V.3 recorded maximum value for days to %50 flowering and no. of nodules .plant^{-1} with 121.66 and 31.66, respectively, but days to maturity showed a minimum value of 158. Variety V.4 produced the highest value for the first pod height with 19.33 cm and showed the lowest value for plant height with 35.000 cm. Variety V.5 gave maximum value for plant height and no. of branches.plant^{-1} with 44 and 4 respectively, while variety V.6 gave the lowest value for the first height with 16.333 cm, and variety V.7 also recorded the lowest value for the first pod height and no. of nodules.plant^{-1} with 117.33 cm and14.00, respectively. Variety V.8 recorded the highest value with 161.00 by the days to maturity, while no. of branch.plant^{-1} gave minimum value with 3.00 Table (3).

Table 4: performance of means of seed yield and its components of eight lentil varieties for season 2012-2013 average.

varieties	No. of pod. Plant^{-1}	No. of Seed. Plant^{-1}	Pod length (cm)	100 seed weight (g)	Seed yield kg/ha	Biological yield kg.ha^{-1}	Harvest index %
V.1	34	20.660	1.86	5.500	1253.55	5617.543	22.3
V.2	46	25.660	1.66	6.160	1332.25	4628.337	28.6
V.3	42	29.000	1.733	5.660	1264.44	5326.507	23.0
V.4	50	28.660	1.400	6.160	1264.40	4552.450	27.7
V.5	60	29.330	1.460	6.500	1157.11	5044.943	22.9
V.6	36	26.000	1.500	5.830	1159.67	4949.333	23.4
V.7	28	31.660	1.566	6.200	1060.17	4502.863	23.5
V.8	46	36.660	1.56 67	5.166	1281.77	5496.490	23.3
LSD (5%)	6.63	9.219	0.24	N.S.	69.26	142.588	0.09

N.S= Non signifiant

Table 4 displays the performance of means of seed yield and its components of eight lentil varieties for season 2012-2013 performance of means of seed yield and its components of eight lentil varieties for season 2012-2013. Indicated the significant difference between the treatment for most of the characters; however, no. of seed.pod^{-1} and 100seed weight were not significant. Variety V.1 gave the highest value was 1.860 cm achieved by pod length, and the lowest value was 20.66, 5617.54 kg.ha^{-1} and 22 % for no. of seed.plant^{-1}, biological yield, and harvest index, respectively. At seasons 2011-2012, the variety V.2 gave maximum values for seed yield kg.ha^{-1}, biological yield, and harvest index with 1332.25, 4628.33, and 28.6% respectively, while exhibited the lowest value for pod length with 1.400 recorded by the variety V.4, which is similar to previous research result (9). Variety V.5 recorded the highest value with 60 by no. of pod/plant. However, variety V.7 produced the lowest value with 28 for no. of pod.plant^{-1}. Variety V.8 gave a maximum value of 36.66 for no. of seed.plant^{-1}, while 100 seed weight recorded the lowest value with 5.16gm. Which is similar to previous research result **[14].**

Table 5: means of some growth characters of eight lentil varieties for seasons 2011-2012

varieties	**Plant height (cm)**	**Days to%50 flowering**	**Days to maturity**	**No. of branches .plant^{-1}**	**First pod height (cm)**	**No. of bacterial nodules. Plant^{-1}**
V.1	34.333	117.000	152.833	3.166	15.510	26.833
V.2	37.666	117.833	153.333	3.333	16.500	23.8333
V.3	37.500	119.500	151.833	3.166	15.666	34.166
V.4	34.000	117.666	151.835	3.000	16.666	23.000
V.5	37.3333	119.000	154.833	3.333	15.500	22.833
V.6	35.6667	117.333	153.333	3.000	15.667	18.500
V.7	32.500	117.833	153.667	3.1666	16.166	16.000
V.8	32.8333	118.500	153.333	3.000	15.500	26.500
LSD (5%)	0.070	0.0284	0.0455	0.0231	0.025	0.171

Table 5 explains the means of some growth characters of eight lentil varieties for seasons 2011-2012. As the average of both seasons, the interaction effect between varieties and seasons was highly significant for all characters. Variety V.1 showed the highest value for no. of branches.plant^{-1} with 3.16, while the lowest value was recorded days to %50 flowering with 117 days. It was observed that the variety V.2 gave the maximum value for plant height with 37.66. Variety V.3 produced maximum value for days to %50 flowering with 119.50, while days to maturity recorded the minimum value of 151.83 days.

Variety V.4 showed the highest value for the first pod highest with 16.66 cm. In the 2012-2013 season, variety V.5 produced maximum value for the character days to maturity reached 154.83, while exhibited the lowest values for no. of branches.plant^{-1} and first pod height was reached 3.33cm and 15.50, respectively. However, variety V.6 recorded the lowest value for no. of branches.plant^{-1}with 3.00. In contrast, variety V.7 gave the minimum value for the plant high and no. of bacterial nodules.plant^{-1} with 32.500 and 16.00, respectively.

Table 6 illustrates the average of traits of seed yield and its components of some lentil varieties for seasons 2012-2013. It was noticed that the differences among varieties were significant for all traits studied; no. of pod.plant^{-1}, no. of seed.plant^{-1}, no. of seed.pod^{-1}, pod length (cm), 100 seed weight (gm), seed yield (kg.ha^{-1}), biological yield (kg.ha^{-1}), and harvest index.

Table 6: Average of some lentil varieties on seed yield and its components for seasons 2012-2013

varieties	**No. of pod. Plant^{-1}**	**No. of seed.plant^{-1}**	**No. of seed .pod^{-1}**	**Pod length (cm)**	**100 seed weight (gm)**	**seed Yield kg.ha^{-1}**	**Biological yield Kg.ha^{-1}**	**Harvest index %**
V.1	37.500	23.166	1.331	1.600	5.533	1944.300	6256.958	30.1
V.2	42.000	24.500	1.665	1.616	6.166	2045.820	5839.030	33.8
V.3	43.333	17.3330	1.66 4	1.500	5.783	2007.010	6584.578	29.7
V.4	44.333	20.500	1.16 7	1.350	6.433	1963.380	5833.660	32.5
V.5	49.000	20.666	1.500	1.350	6.450	1821.070	5948.681	29.5
V.6	38.333	16.833	1.66 3	1.483	6.016	1817.250	5688.120	30.9
V.7	30.000	17.833	1.833	1.533	6.366	1689.610	5060.733	32.3
V.8	39.000	20.333	1.333	1.383	5.433	1926.630	6039.218	31.1
LSD (5%)	0.080	0.092	0.0137	0.0029	0.010	1.177395	2.6464	29.3

The lowest value for no. of seed.pod^{-1} and 100 seed weight recorded by the variety V.1 reached 1.33 and 5.53gm, respectively. Variety V.2 produced the maximum value for no. of seed.plant^{-1}, seed yield (kg.ha^{-1}), and harvest index with 24.50, 2045.82, and 0.33, respectively. Variety V.5 recorded the highest value for no. of pod/plant, 100 seed weight, and biological yield with 49.00, 6.45gm, and 5948.68, respectively, whereas the lowest value for harvest index was 29.5gm. Moreover, variety V.6 and V.7 provided the lowest value for no. of seed.plant^{-1}, no. of pod.plant^{-1}, seed yield, and biological yield with 16.83, 30.00, 1.38, 1689.61 Kg.ha^{-1}, and 5060.73 Kg.ha^{-1}, respectively, while pod length recorded the minimum value for no. of seed.pod^{-1} with 1.83.

Data represented in Table 7 Effect of the seasons on some growth and forage characters of eight lentil varieties for both seasons. Showed in that were found to affect all characters significantly for both seasons. Variety V.3 produced the highest value for no. of bacterial nodules.plant^{-1} with 36.67.

Table 7: Effect of the seasons on some growth and forage characters of eight lentil varieties for both seasons.

Seasons	varieties	Plant height (cm)	Days to %50 flowering	Days to maturity	No. of branches per plant	First pod height (cm)	No. of bacterial nodules. plant^{-1}
2011 - 2012	V.1	31.333	116.333	147.333	3.333	14.100	23.733
	V.2	33.000	117.000	147.666	3.000	14.310	28.333
	V.3	36.333	117.333	145.666	3.010	14.120	36.677
	V.4	33.000	116.66	144.333	2.666	14.020	24.646
	V.5	30.666	117.333	152.000	2.636	14.200	20.636
	V.6	29.000	116.323	148.000	3.020	15.000	21.616
	V.7	29.010	118.333	150.000	3.011	14.220	18.000
	V.8	26.333	116.66	145.666	3.000	14.014	31.323
2012 - 2013	V.1	37.333	117.666	158.333	3.030	17.000	26.333
	V.2	42.333	118.666	159.000	3.666	19.000	19.313
	V.3	38.666	121.666	158.000	3.343	17.333	31.666
	V.4	35.000	118.666	159.333	3.313	19.333	21.333
	V.5	44.000	120.666	157.666	4.000	17.000	25.000
	V.6	42.333	118.333	158.666	3.000	16.313	15.334
	V.7	36.000	117.333	157.333	3.333	18.333	14.000
	V.8	39.333	120.333	161.000	3.000	17.000	21.666
LSD (5%)		LSD (5%)	0.040	0.064	0.0327	0.074	0.243

Regarding the varieties V.4, V.5, V.6, V.7, and V.8 gave the lowest values for days to maturity, plant height, no. of branches.plant^{-1}, days to %50 flowering, and first pod height with 144.33 days, 29.00cm 2.63, 116.32 days, and 14.014cm, respectively, for the seasons 2011-2012. While days to %50 flowering gave maximum value with 121.66 recorded by the variety V.3. The characters of first pod height, no. of branches, and days to maturity provided maximum value realized by m varieties V.4, V.5, V.6, and V.8 with 19.33cm, 44.00, 4.00, and 161.00 days, respectively, for seasons 2012-2013. It is concluded that this variation is due to differences in temperature degrees, which affected the lateness and earliness of plant development to reach this stage.

Table 8: Effect of the seasons on seed yield and its components characters of eight lentil varieties for both seasons.

Seasons	varieties	No. of pods. Plant^{-1}	No. of seeds. Plant^{-1}	No. of seed .pod-1	Pod length (cm)	100 seed weight (g)	Seed yield kg .ha^{-1}	Biological yield Kg.ha^{-1}	Harvest index %
2011 - 2012	V.1	40.333	45.000	1.333	1.333	5.566	2635.050	6896.373	38.2
	V.2	38.000	47.333	1.676	1.566	6.166	2759.390	7049.723	39.1
	V.3	44.333	42.666	1.656	1.266	5.900	2749.576	7842.650	35.0
	V.4	38.000	39.666	1.333	1.300	6.700	2662.356	7114.870	37.4
	V.5	38.000	40.000	1.635	1.230	6.400	2485.020	6852.420	36.1
	V.6	40.000	32.333	1.334	1.466	6.212	2474.833	6426.906	38.4
	V.7	28.000	34.666	1.666	1.500	6.533	2319.053	5618.603	41.2
	V.8	32.000	39.33	1.027	1.200	5.700	2571.490	6581.946	39.0
2012 - 2013	V.1	34.666	49.666	1.323	1.866	5.500	1253.553	5617.543	22.1
	V.2	46.000	46.000	1.668	1.666	6.166	1332.256	4628.336	28.6
	V.3	42.333	33.333	1.666	1.733	5.833	1264.440	5326.506	23.7
	V.4	50.666	41.333	1.020	1.400	6.166	1264.403	4552.450	27.7
	V.5	60.000	51.000	1.000	1.466	6.521	1157.113	5044.943	22.8
	V.6	36.666	44.666	2.022	1.500	5.833	1159.673	4949.333	23.4
	V.7	32.000	51.000	2.030	1.566	6.200	1060.173	4502.863	23.5
	V.8	46.000	59.333	1.675	1.566	5.166	1281.773	5496.490	23.3
LSD (5%)		0.11406	0.18971	0.019416	0.019416	0.130	1.665085	0.0009	374.2

Table 8 explains Effect of the seasons on seed yield and its components characters of eight lentil varieties for both seasons. At the average of two seasons of the interaction, the highest value for seed yield was 2759.39 kg.ha^{-1} recorded by the interaction between variety V.2 and season 2011-2012. In addition, the maximum value for biological yield kg.ha^{-1} was 7842.65 recorded by the variety V.3 and season 2011-2012. The highest value for pod length (cm) and 100 seed weight (gm) was 1.30cm and 6.70 gm, respectively. In contrast, the lowest value for no. of seeds/plant with 32.33 recorded by the variety V.6 and season 2011-2012. In addition, the lowest value for no. of pod. Plant^{-1} was 28.000 recorded by the interaction between variety V.7 and season 2011-2012. The highest value for harvest index was 0.41 produced by variety V.7 and season 2011-2012. At season 2012-2013, no. of pod.plant^{-1} recorded the maximum value with 60.00 by variety V.5 and the season. Nevertheless, the lowest value for no. of seed/pod with 1.00 was recorded by the variety V.5 and 2012-2013 season. The character no. of seed/pod with 2.03 was recorded by variety V.7. While minimum value for seed yield (kg.ha^{-1}) and biological yield (kg.ha^{-1}) were 1060.173 and 4502.86, respectively, shown by variety V.7 and the 2012-2013 season. The highest value for no. of seed.pod^{-1} with 2.03 was produced by the variety V.7 and the 2012-2013 season. Variety V.8 gave maximum value for no. of seed.plant^{-1} with 59.33 in the 2012-2013 season. In contrast, the lowest value for pod length and 100 seed weight with 1.56 and 5.16, respectively, was recorded by variety V.8.

Table 9 explains the effect of seasons on the growth of lentil varieties. Significant effects were found in both seasons for all characteristics. It is observed that the second season realized more yielding than the first season in all characters, Plant height (cm), Days to %50 flowering, Days to maturity, No. of branches.plant^{-1}, First pod height (cm), No. of bacterial nodules.plant^{-1} by 26.67, 1.85, 15.76, 12.67, 25.06, and 19.46, respectively.

Tables 9: Effect of averages of both seasons on growth characters of eight lentil varieties.

Seasons	Plant height (cm)	Days to %50 flowering	Days to maturity	No. of branches .plant^{-1}	First pod height (cm)	No. of bacterial nodules. Plant^{-1}
2011-2012	39.375	119.166	158.666	3.333	17.666	26.083
2012-2013	31.083	117.000	147.583	2.958	14.125	21.833
LSD (5%)	0.036	0.022	0.034	0.006	0.014	0.053

The first season recorded a significant difference for plant height, days to %50 flowering, days to maturity, no. of branches.plant^{-1}, first pod height (cm), and no. of bacterial nodules.plant^{-1}with 39.37cm, 119.16 days,158.66, days 3.33cm, 17.66cm, and 26.08, respectively.

Table-10: Effect of averages of both seasons on seed yield and its components of eight lentil varieties.

Seasons	No. of pods. Plant^{-1-}	No. of seeds. pod^{-1}	No. of seeds. Plant^{-1}	Pod length (cm)	100 seed weight(g)	Biological yield kg/ha	Seed yield kg.ha^{-1}	harvest index
2011-2012	43.041	1.500	38.958	1.595	6.145	6797.936	2582.096	0.380
2012-2013	37.8333	1.541	48.208	1.358	5.900	5014.808	1221.673	0.244
LSD (5%)	0.0240	0.004216	0.05636	0.0190	0.0054	0.4090	1.6328	0.0003

Data represented in table 10 indicated effects for both seasons' on seed yield and its components of lentil varieties under study. In the first season, no. of pod.plant^{-1}, pod length (cm), 100 seed weight (gm), biological yield (kg.ha^{-1}), seed yield (kg.ha^{-1}), and harvest index with 43.04, 1.59cm, 6.145gm, 6797.93 kg.ha^{-1}, 2582.09 kg.ha^{-1}, and 38%, respectively, were recorded highest values. However, no. of seed.pod^{-1} and no. of seed.plant^{-1} produced the lowest value with 1.50 and 38.95, respectively. In the second season, no. of seed/pod and no. of seed.plant^{-1} with 1.54 and 48.20 gave the maximum value. While no. of pod/plant, pod length (cm), 100 seed weight (gm), biological yield (kg.ha^{-1}), seed yield kg.ha^{-1}, and harvest index with 37.833, 1.35, 5.90, 5014.80 kg.ha^{-1}, kg.ha^{-1} 1221.67 kg.ha^{-1}, and 24%, respectively, gave the minimum values.

Conclusions

Lentil is one of an important legume crop and plays a crucial role in human, animal feeding, and soil improvement.. It is a cool-season food legume playing a significant role in human and animal nutrition and soil fertility maintenance (10). The result of the current investigation indicated the significant differences among the varieties for most of the traits studied, we concluded that the first season 2011-2012 gave the maximum value for days %50 flowering, days to maturity, no. of branches.plant^{-1}, first pod height (cm), and no. of bacterial nodules.plant^{-1} However, the second season realized the highest value for no. of pod.plant^{-1}, pod length, 100 seed weight, biological yield, seed yield, and harvest index of lentil varieties compared to the first season. Depending on the study results, it can be recommended that the variability of variety performance was associated mainly with the climatic conditions and the genetic variation among varieties at each location. Thus, varieties should be carefully selected and released for corresponding regions depending mainly on seasonal weather conditions. Therefore, the Lentil variety V.2 and variety V.3 were selected. Moreover, the first season was better than the second one for planting lentil in the region attributed to climatic differences.

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Appendix

Appendix (1) Mean squares of variance Analysis of Lentil for some growth Characters

S.O.V	d.f	Mean square					
		Plant height (cm)	Days to%50 flowering	Days to maturity	No. of branches .plant^{-1}	First pod height (cm)	No. of bacterial nodules . Plant^{-1}
Replications	2	1.33333	1.08333	6.8125	0.14583	1.27083	55.2708
Year	1	825.021	56.3333	1474.08	1.6875	150.521	216.75
Varieties	7	26.7589	4.33333	5.7976	0.11607	1.37798	183.655
Year*Varieties	7	33.4494	4.14286	16.8452	0.40179	2.52083	30.4167
Year*Replications&Random	2	6.33333	2.33333	5.6453	0.1875	1.02083	13.6875
Varieties*Replications [Year]&Random	28	6.02381	0.97024	2.4910	0.64286	0.78869	35.4554

Appendix (2) Mean squares of variance Analysis lentil for seed yield and its components

S.O.V	d.f	Mean squares							
		No. of pod. Plant^{-1}	No. of Seed. Plant^{-1}	No. of seed .pod^{-1}	Pod length (cm)	100 seed weight (gm)	Seed yield kg.ha^{-1}	Biological yield kg.ha^{-1}	Harvest index
Replications	2	69.9375	106.083	11.0833	0.00271	0.04333	1809.56	7332.56	0.00068
Year	1	325.521	1026.75	16987.7	0.67688	0.72521	2.22775	3.82778	0.22427
Varieties	7	191.473	109.19	45.2113	0.06807	0.97235	82899.2	1178463	0.0015
Year*Varieties	7	160.854	79.0357	41.5923	0.05687	0.08568	8629.89	606944	0.00129
Year*Replications& Random	2	2.77083	15.25	14.250	0.00438	0.14333	31.9959	802.998	0.00044
Varieties*Replications [Year]& Random	28	7.80655	21.5952	10.2857	0.01068	0.14286	1663.51	8404.73	0.0005