Response of some narbon vetch varieties to different plant populations for growth and yield under two locations of sulaimani region

Avan Rahman Abdullah **Jwan Gharib Rafaat**
Assistant professor
Department of Crop science, College of Agriculture Sciences, University of Sulaimani, Iraq
Email: jwan.rafat@univsul.edu.iq

Abstract:

This study was carried out in Sulaymaniyah governorate at two locations Qlyasan (Lat 35°33´ ; N,Long 45° 21´ ; E,750 MASAL) and Kanipanka (Lat 35° 22´; N Long 45° 43´ ; E, 550 MASAL),during the growing season of 2017- 2018 to evaluate the response of four Narbon vetch (ICARDA833, ICARDA225, ICARDA776, ICAR-DA545) varieties, and four plant Density (80Kg,100Kg,120Kg, and 140Kg) and planting date (December 5th)in Kanipanka (December 6th) Qlyasan.The design of factorial within CRBD experiment with three replications. Means comparison was carried out by the mean of least probability difference (L.S.D) at a significant level of 5%. The results confirmed that variety No. 1(ICARDA833) and variety No.4 produced the highest seed yield and some of its yield components of seeds. Using 140Kg seeds hectar-1 produced the highest seed yield and some of exhibited the highest value for seed yield and some it is components and growth characters. The highest value for seed yield and most it is components produced at Kanipanka location compare to Qlyasan location.

Keywords: Forage crops, varieties, Forage Legume, growth, yield, plant populations, Forage seed production, maturity, Leguminosae.

استجابة بعض اصناف الكاكوز عند كثافات نباتية مختلفة للنمو والحاصل لموقعين في منطقة السليمانية

ايفان رحمان عبدالله — **أستاذ مساعد**

جوان رفعت غريب — **استاذ مساعد**

قسم علوم المحاصيل الحقلية، كلية العلوم الزراعية، جامعة السيليمانية، العراق.

البريد الالكتروني:jwan.rafat@univsul.edu.iq

المستخلص :

طبقت الدراسة في محافظة السليمانية ولموقعين الأول قلياسان (خط عرض ´33 °35 و خط طول ´21 °45 و 750 م ارتفاع عن مستوى البحر) والثاني كانيبنكة (خط عرض´22 °35 و خط طول 43 °45 و 550 م ارتفاع عن مستوى البحر) خلال الموسم الزراعي 2017-2018 لغرض تقييم استجابة اربعة اصناف من الكاكوز Narbon vetch (ايكاردا 833 و ايكاردا 225 و ايكاردا 776 و ايكاردا 545) و لأربعة معدل بذار (80 و 100 و 120 و 140 كغم.هكتار$^{-1}$) تمت الزراعة في 5 و 6 ك1 /2017 وللموقعين كانيبنكة و قلياسان على التوالي استعمل ترتيب التجربة العاملية وفق تصميم القطاعات العشوائية الكاملة للعاملين المعشاة بثلاث مكررات تمت مقارنة المتوسطات باستخدام اختبار اقل فرق معنوي (L.S.D) على مستوى 0.05 وبينت النتائج ان الصنفين ايكاردا 833 و ايكاردا 545 اعطت اعلى الحاصل من البذور وبعض مكوناته كما ان الزراعة بمعدل بذار 140 كغم.هكتار$^{-1}$ اعطى اعلى حاصل بذور وبعض مكوناته وكذلك صفات النمو اعطى موقع كانيبنكه القيم الأعلى لحاصل البذور ومعظم مكوناته مقارنة بموقع قلياسان .

Introduction:

The Narbon vetch (*Vicia narbonensis* L.) is the common vetch Vicia sativa, the bitter vetch Vicia ervilia, and the broad pod vetch *Vicia peregrina*, one of the species that have been domesticated since the early centuries of agriculture(Branca et al., 2011) It is believed to have spread to the Mediterranean Basin and originated in North-West Asia. Because of its rise content in ant nutritional elements, before the 16th century, the Narbon vetch was not widely grown, (Enneking and Maxted, 1995, Enneking et al., 1995) In Syria, Narbon vetch is grown as a dual purpose crop for human nutrition and for animal feed, in Turkey and Northern Iraq (Albayrak et al., 2004).Common vetch (*Vicia sativa* L.) is used as green manure, a cover crop, pasture, hay, and silage.(Bakoğlu et al., 2016). During the dry season the quality and quantity quality of the natural pasture deteriorate. There is a range of species such as Narbon vetch used to improve the soil (Mapiye et al., 2006).Vetches has a symbiosis with specific bacteria called Rhizobia. In this symbiotic relationship, the Rhizobia species take nitrogen gas from the soil air and convert it into ammonia, which is quickly converted into amino compounds and protein. Vetches provide the bacteria with a home in root nodules, nutrients and energy. In turn, the bacteria provide nitrogen to the vetch plant through this fixation process (Halvorson et al., 2004) Narbon vetch spe-

cies are the most valuable crops of the rangelands. These species have the ability to yield quality as well as fixing at least 120 kg N per ha resulting in increased soil fertility.

The relationships between plant population and genetic diversity are of major significance in plant ecology, conservation, and evolution all the traits primarily affected by different plant densities in plant Vetches (*Vicia spp*.) Biomass more isolated and the highest seed yield is above ground(Mapiye et al., 2006) Dry matter yield, green forage yield and Seed yield rise as the number of plants increased per unit area (Mezni et al.).The most significant factor for forage species is (for stored forages) harvesting, stage of maturity at harvest and storage methods.Secondary factors comprise fertilization; green forage yield, soil fertility, and dry matter yield were gain with the highest plant density of 100 Plant densities is a prime factor that affects the quality yield and traits of legume. By some researchers, the reaction of legume crops to different plant densities was studied and significant differences were observed (YILMAZ, 2008). The objective of this research was to study the effect of plant population density (PPD) and varieties for growth characters and yield components of some *Narbon vetch* under different locations

Material method :

This study was carried out in Sulaymaniyah region at two locations (Qlyasan and Kanipanka), during the winter season of 2017-2018.Four Narbon vetches (*Vicia narbonensis*) varieties (ICARDA833, ICARDA 225, ICARDA776, ICARDA545) were used to study the effect of plant population density and varieties on growth characters and yield components the seeds were sown for Agricultural Research in the Dry Areas ICARDA were selected for cultivation in 5/12/2017, 6/12/2017 for both location respectively. And four different plant densities were applied (80Kg.h^{-1}, 100Kg.h^{-1}, 120Kg.h^{-1}, and 140Kg.h^{-1}).

The experiments were designed in Factorial conducted in Randomized Complete Block Design with three replication according to the procedure outlined by(d Steel and Torrie, 1986). Plots consisted of four rows, the row was (2) m long with a spacing of (0.25) m between the rows and (30) cm between plants in rows. All possible comparisons among the means would carry out by using L.S.D test (Least Significant Difference) at a significant level of 5%. The following characters were determined.

Growth and forage characters are consisting of: Plant height (cm) include in No. of Days to %50 flowering, No. of Days to maturity, No. of Branches. plant^{-1}, leaf dry weight (g), Stem dry weight (g), No.of bacterial nodules.plant^{-1} .Yield characters which are No.of pods. Plant^{-1}, No of seeds.pods^{-1}, Pod length (cm), a weight of seeds.pod^{-1}, 100 seed weight (g), Seed yield (Kg.ha^{-1}), Biological yield (Kg.ha^{-1}) and Harvest index. Harvest index: measured by separating the seeds from straw yield and weight to calculate the harvest index according to the following equation:

$$\text{Harvest index} = \frac{\text{Total seed yield}}{\text{Total biological yield+Total seed yield}} \times 100$$

Results and discussion:

Table 1: Means of growth and forage characters for Narbon vetch at both locations and their average.

Qlyasan								
Variety	plant height(cm)	No. of branch. Plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
V.1	76.140	3.976	121.500	162.783	2.165	2.363	0.874	9.583
V.2	89.570	3.855	122.600	162.713	1.718	1.607	0.920	11.320
V.3	88.640	3.750	123.000	162.384	1.932	1.755	0.810	10.780
V.4	90.590	4.100	122.000	163.798	1.402	2.716	0.615	14.120
LSD 0.05	2.767**	n.s	0.957*	0.899*	0.449*	0.44**	0.128**	2.181**
Kanipanka								
variety	plant height (cm)	No. of branch. plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
V.1	141.700	3.670	84.693	146.901	2.910	2.793	0.798	11.197
V.2	95.675	3.850	93.490	145.961	2.538	2.158	0.944	11.850
V.3	103.200	3.605	93.215	145.854	2.540	3.478	0.848	11.688
V.4	102.717	3.586	92.834	147.376	1.880	7.276	0.628	14.438
LSD 0.05	n.s	n.s	n.s	0.779**	0.572**	0.75**	0.117**	2.181**
Average of both locations								
Variety	plant height (cm)	No. of branch. plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
V.1	108.900	3.823	103.100	154.800	2.537	2.578	0.836	10.390
V.2	92.620	3.850	108.000	154.300	2.128	1.883	0.932	11.585
V.3	95.920	3.680	108.100	154.100	2.236	2.617	0.820	11.234
V.4	96.650	3.840	107.000	155.600	1.641	4.990	0.622	14.270
LSD 0.05	n.s	n.s	n.s	0.583**	0.356**	0.426**	0.085**	1.529**

V.1 means ICARDA833, V.2 means ICARDA225, V.3 means ICARDA776, and V.4means ICARDA545.

Table 2:Effect plant densities on some growth and forage characters for Narbon vetch at both locations and their average.

plant density plant.m^{-2}	plant height (cm)	No. of branch.plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
Qlyasan								
80kg.h^{-1}	89.825	4.269	123.020	161.210	1.736	1.333	1.006	9.012
100KG. h^{-1}	87.133	3.959	121.320	162.250	1.530	1.435	0.770	12.114
120Kg. h^{-1}	88.267	3.606	122.140	163.500	1.763	2.702	0.735	11.063
140kg. h^{-1}	79.717	3.851	123.140	164.720	2.188	2.970	0.700	13.883
LSD 0.05	2.767**	n.s	0.957**	0.899**	0.449*	0.44**	0.128**	2.239**
Kanipanka								
plant density plant.m^{-2}	plant height (cm)	No. of branch.plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
80kg. h^{-1}	98.042	3.612	93.242	145.146	2.330	1.677	0.999	9.593
100KG. h^{-1}	98.533	3.930	92.323	146.675	1.919	1.808	0.883	12.875
120Kg .h^{-1}	101.417	3.573	85.393	146.321	2.497	4.308	0.626	11.458
140kg. h^{-1}	145.300	3.602	93.273	147.942	3.128	4.863	0.710	15.247
LSD 0.05	n.s	n.s	n.s	1.559**	0.572**	0.75**	0.117**	2.235**
Average of both locations								
plant density plant.m^{-2}	plant height (cm)	No. of branch.plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
80kg. h^{-1}	93.040	3.612	108.120	153.000	2.030	1.510	1.000	9.302
100KG. h^{-1}	92.800	3.930	107.000	154.000	1.720	1.620	0.830	12.500
120Kg. h^{-1}	94.800	3.573	104.000	155.000	2.130	3.510	0.680	11.300
140kg. h^{-1}	113.000	3.602	108.200	156.000	2.660	3.780	0.710	14.600
LSD 0.05	n.s	n.s	n.s	0.583**	0.356**	0.426*	0.085**	1.529**

Data represent in table (2) explain the effect of plant densities on some growth and forage characters at both locations and their average for Narbon vetch.

At Qlyasan location the effect of plant densities was highly significant on the characters plant height.(cm), days to %50 flowering, days to maturity, stem dry weight (g) leaf stem ratio and No.of bacterial nodules.plant $^{-1}$, while it was significant on the character leaf dry weight (g), but not significant on the character No.of branch. plant.At Knipanka location showed the effect of plant densities were highly significant for all characters except the character's plant height (cm) no of branch .plant^{-1} and days to %50 flowering which were not significant As the average of both locations this effect was highly significant for the characters days to maturity, leaf dry weight (g), leaf stem ratio and No.of bacterial nodules/plant, while it was significant for the character stem dry weight (g) and not significant for the characters plant height (cm), No.of branch/plant and days to %50 flowering.

Regarding to Qlyasan location, using 80kg.h^{-1} plant density produced the highest value for the characters plant height. (cm), No of branch plant and leaf stem ratio reached 89.825cm, 4.269, branch and 1.006,respectively. And gave the lowest values for the characters days to maturity, stem dry weight (g) and no of bacterial nodules

plant with 161.21 days, 1.333g and 9.012 ,respectively.The application of 100kg.h had the lowest values for the character's days to %50 flowering and leaf dry weight (g) with 121.320 days and 1.530g. Minimum value for the character no. of branch plant recorded 3.606 branches for application 120Kg.h^{-1}. The application of 140kg.h showed the highest values for the character's days to %50 flowering, days to maturity, leaf dry weight (g), stem dry weight (g) and no. of bacterial nodules plant reached 123.140 days, 164.720 days, 2.188 g, 2.970 g and 13.883 respectively but recorded the lowest value for the character's plant height (cm) and leaf stem ratio with 79.717 cm, and 0.7, respectively. At Knipanka location, the application of 80 kg.h recorded the highest value for the character leaf stem ratio with 0.999, but recorded also the lowest value for the character's plant height. (cm), days to maturity, stem dry weight (g) and no. of bacterial nodules plant with 98.042cm ,145.146 days, 1.677 and 9.593 respectively. The highest value due to the character no.of branch.plant^{-1} was 3.93branches recorded as 100Kg.h^{-1} was used, and using this rate produced the lowest value for the character leaf dry weight (g) with 1.919g.The lowest value for the character no. of branch.plant^{-1}, days to %50 flowering and leaf stem ratio were 3.573branch, 85.393 days and 0.626 produced as 120Kg.h^{-1} was used. Maximum values for most characters recorded as 140Kg.h^{-1} was used including the character's plant height (cm), days to %50 flowering, days to maturity, leaf dry weight (g), stem dry weight (g) and no. of bacterial nodules. plant^{-1} with 145.3cm,93.273days, 147.942days, 3.128g,4.863 and 15.247,respectively. As the average of both locations the applications of 80Kg.h^{-1} gave the highest value for the character leaf stem ratio with 1.00and the lowest values for the character's days to maturity and stem dry weight (g) with 153.00 days and 1.510g respectively.The application of 100 Kg.h^{-1} seeds produced maximum value for the character no. of branch/ plant with 3.944 but, the lowest value recorded by the character plant height (cm) and leaf dry weight (g) with 92.800cm and 1.720g respectively.The minimum values for the characters no of branch.plant^{-1}, days to %50 flowering, leaf stem ratio and No.of bacterial nodules. plant^{-1} was 3.589 branches, 104.00days 0.68 and 11.30 respectively Produced as 120Kg.h seeds was used. 140Kg.h g.h^{-1} seeds exhibited the highest values for most characters including plant height/ (cm), days to %50 flowering, days to maturity, leaf dry weight (g), stem dry weight (g) and no. of bacterial nodules.plant^{-1} with 113.00cm, 108.20days, 156.00 days, 2.66g, 3.78g 14.60,respectively. Taylor et al.(2000) found that ranking field crop cultivars based on population densities (Hollaway, 2002) .It was confirmed that total pod/ production for Narbon vetch crop depend on number of plant/m^2 more than on pods /plant ,the seed yield potential of Narbon vetch would be increased by increasing plant population to produce more pod per area.

Table3:Effect of interaction between varieties and plant densities on some growth and forage characters for Narbon vetch at both locations and their average.

Qlyasan								
plant density plant.m^{-2}	plant height (cm)	No. of branch. Plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
V1.&80 kg.h^{-1}	68.767	4.110	119.827	160.577	1.537	1.323	0.997	5.197
V1.&100 kg.h^{-1}	80.333	3.867	123.787	163.041	2.400	1.317	1.343	10.957
V1.&120 kg.h^{-1}	87.467	4.060	122.820	161.630	2.153	2.737	0.813	8.997
V1.&140 kg.h^{-1}	68.000	3.863	119.647	165.883	2.570	4.073	0.343	13.003
V2.&80 kg.h^{-1}	101.967	4.460	125.243	161.827	2.273	1.337	1.550	7.438
V2.&100 kg.h^{-1}	91.400	3.820	122.277	160.560	1.110	1.270	0.490	12.853
V2.&120 kg.h^{-1}	92.167	3.143	119.510	162.790	1.637	1.970	0.750	11.400
V2.&140 kg.h^{-1}	72.73 3	3.987	123.287	165.673	1.853	1.850	0.890	13.583
V3.&80 kg.h^{-1}	88.000	3..433	127.300	161.6 87	1.697	1.303	0.550	8.817
V3.&100 kg.h^{-1}	88.100	4.440	118.371	160.653	1.833	1.737	0.570	12.113
V3.&120 kg.h^{-1}	85.067	3.743	122.473	165.747	1.897	1.993	0.980	9.257
V3.&140 kg.h^{-1}	93.400	3.403	123.767	161.450	2.390	1.987	1.133	12.923
V4.&80 kg.h^{-1}	100.567	5.067	119.693	160.750	1.527	1.370	0.927	14.600
V4.&100 kg.h^{-1}	88.700	3.700	120.827	164.727	0.777	1.417	0.713	12.533
V4.&120 kg.h^{-1}	88.367	3.477	124.463	163.823	1.364	4.107	0.390	14.600
V4.&140 kg.h^{-1}	84.733	4.153	125.860	165.890	1.940	3.970	0.433	14.753

LSD 0.05	5.534**	n.s	1.913**	1.799**	n.s	0.88**	0.256**	n.s
Kanipanka								
plant density plant.m^{-2}	plant height (cm)	No. of branch. plant^{-1}	Days to %50 flowering	Days to maturity	Leaf stem ratio	leaf dry weight (g)	Stem dry weight (g)	No. of bacterial nodules. plant^{-1}
V1.&80 kg.h^{-1}	82.400	3.570	91.783	144.111	1.014	2.333	1.627	5.887
V1.&100 kg.h^{-1}	87.700	3.785	94.420	148.633	1.230	3.063	1.687	12.800
V1.&120 kg.h^{-1}	99.500	3.980	62.080	145.657	0.493	2.820	5.313	9.967
V1.&140 kg.h^{-1}	197.200	3.330	90.487	149.203	0.455	3.437	7.253	16.133
V2.&80 kg.h^{-1}	101.967	4.083	95.950	146.079	1.262	3.287	1.690	8.067
V2.&100 kg.h^{-1}	98.067	4.203	92.733	144.760	0.724	1.283	1.580	12.967
V2.&120 kg.h^{-1}	100.167	3.330	91.687	143.927	0.880	2.630	3.113	12.500
V2.&140 kg.h^{-1}	82.500	3.810	93.590	149.080	0.909	2.953	2.543	13.867
V3.&80 kg.h^{-1}	97.633	3.410	94.587	144.863	0.769	2.027	1.690	9.820
V3.&100 kg.h^{-1}	109.533	3.620	91.089	144.983	0.761	2.110	2.277	13.200
V3.&120 kg.h^{-1}	101.167	3.550	93.123	148.970	0.777	2.700	2.537	8.763
V3.&140 kg.h^{-1}	104.467	3.840	94.060	144.600	1.086	3.327	2.247	14.967
V4.&80 kg.h^{-1}	110.167	3.377	90.649	145.530	0.951	1.673	1.700	14.600
V4.&100 kg.h^{-1}	98.833	4.119	91.048	148.323	0.817	1.220	1.687	12.533
V4.&120 kg.h^{-1}	104.833	3.429	94.684	146.730	0.355	1.837	6.267	14.600
V4.&140 kg.h^{-1}	97.033	3.420	94.953	148.884	0.388	2.793	7.407	16.020
LSD 0.05	n.s	n.s	n.s	1.559**	0.234**	n.s	1.501**	n.s
Average of both locations								
plant den-	plant	No. of	Days to	Days to	leaf dry	Stem	Leaf stem	No. of bacterial

sity plant.m^{-2}	height (cm)	branch. plant^{-1}	%50 flow-ering	maturity	weight (g)	dry weight (g)	ratio	nodules.plant^{-1}
V1.&100 kg.h^{-1}	84.020	3.830	109.100	155.800	2.730	1.502	1.280	11.880
V1.&120 kg.h^{-1}	93.480	4.020	92.450	153.600	2.480	4.025	0.650	9.480
V1.&140 kg.h^{-1}	132.600	3.600	105.100	157.500	3.004	5.660	0.399	14.570
V2.&80 kg.h^{-1}	102.000	4.280	110.600	154.000	2.780	1.510	1.406	7.752
V2.&100 kg.h^{-1}	94.730	4.010	107.500	152.700	1.190	1.420	0.607	12.910
V2.&120 kg.h^{-1}	96.170	3.240	105.600	153.400	2.130	2.540	0.815	11.950
V2.&140 kg.h^{-1}	77.620	3.900	108.400	157.400	2.403	2.190	0.900	13.730
V3.&80 kg.h^{-1}	92.820	3.420	110.900	153.300	1.860	1.490	0.660	9.310
V3.&100 kg.h^{-1}	98.820	4.030	104.700	152.800	1.970	2.007	0.660	12.660
V3.&120 kg.h^{-1}	93.120	3.650	107.800	157.400	2.290	2.260	0.870	9.010
V3.&140 kg.h^{-1}	98.930	3.620	108.900	153.000	2.850	2.110	1.110	13.950
V4.&80 kg.h^{-1}	105.400	4.220	105.200	153.100	1.600	1.530	0.930	14.570
V4.&100 kg.h^{-1}	93.770	3.910	105.900	156.500	0.990	1.550	0.760	12.530
V4.&120 kg.h^{-1}	96.600	3.450	109.600	155.300	1.601	5.180	0.373	14.600
V4.&140 kg.h^{-1}	90.880	3.790	110.400	157.400	2.360	5.680	0.411	15.385
LSD 0.05	n.s	n.s	n.s	1.166	0.712	0.852	0.17	3.058

V.1 means ICARDA833, V.2 means ICARDA225, V.3 means ICARDA776, and V.4means ICARDA54.

Data represent in table (3) illustrate the effect of the interaction between varieties and plant densities on growth and forage characters at both locations and their average for Narbon vetch. At the first location there were highly significant interaction effect for the character plant height (cm), days to 50% flowering, days to maturity,

stem dry weight (g) and plant height (cm) value restricted between 68cm for variety ICARDA833 under 140Kg .h^{-1} to 101.967cm for variety ICARDA225 under 80 Kg.h^{-1}. The character days to %50 flowering value ranged between 118.371days for the association between variety ICARDA776 with 100 Kg.h^{1-} to while 125.86days recorded by the interaction of variety ICARDA545 joined with 140Kg.h^{-1} .The average days to maturity himited between 160.560days for variety ICARDA225 joined with 100Kg.h^{1-} to 165.89days recorded by variety ICARDA545 with140Kg.h^{-1}.Leaf stem ratio was restricted between 0.343 recorded by variety ICARDA833 with 140Kg.h^{1-} to 1.55 recorded by variety ICARDA225 with 80Kg.h^{-1} seeds. Concerning to the character stem dry weight the values ranged between 1.27g recorded by the association of variety ICARDA225 with 100Kg.h^{-1} to 4.107 for variety ICARDA545 coupled with 120Kg.h^{-1}. Regarding to the second location the effect of interaction between varieties and plant density was highly significant for the character days to maturity it was ranged between 143.927 days for variety ICARDA225 under 120Kg.h^{-1} to 149.203day for variety ICARDA833 under 140Kg.h^{-1}. The values of leaf stem ratio ranged between 0.355 for variety ICARDA545 with 120Kg.h to 1.262 recorded by variety ICARDA225 with 80Kg.h. Data due to the character stem dry weight, the values ranged between 1.580g for variety ICARDA225 with 100Kg.h to 7.407g for variety ICARDA545with 140Kg.h. As the average of both locations the interaction effect between varieties and plant density was highly significant for the character's days to maturity, leaf dry weight (g), stem dry weight (g), leaf stem ratio and no. of bacterial nodulesplant. Days to maturity ranged between 152.3days for Variety ICARDA833 with 80Kg.h to 157.50days for the interaction variety ICARDA833 with 140Kg.h. The character leaf stem ratio between 0.373 for variety ICARDA545 under 120Kg.h to 1.406 for the interaction between Variety ICARDA225 coupled with 80Kg.h.U .The character leaf dry weight ranged between 0.99g for ICARDA545 with 100Kg.h^{-1} to 3.004 g for the interaction variety ICARDA833 coupled with 140Kg.h^{-1} .The character stem dry weight the values ranged between 1.42 g for the interaction of variety ICARDA225 with 100 Kg.h^{-1} to 5.66g for variety ICARDA833 with 140Kg.h^{-1}. Data due to No. of bacterial nodulesplant ranged between 5.54 for variety ICARDA833 under 80Kg.h to 15.058 nodules recorded by Variety ICARDA545 with 140Kg.h^{-1} . this result in agreement with previous studies conducted in different forage crops (Albayrak et al., 2011).

Table 4: Effect of location on some traits.

Locations	plant height. (cm)	No. of branch. Plant^{-1}	Days to %50 flowering	Days to maturity	leaf dry weight (g)	Stem dry weight (g)	Leaf stem ratio	No. of bacterial nodules.plant^{-1}
1	86.200	3.920	122.400	162.900	1.804	2.110	0.805	11.440
L2	111.000	3.680	91.060	146.500	2.468	3..164	0.804	12.290
LSD 0.05	n.s	n.s	5.251**	0.415**	0.192**	0.173**	n.s	n.s

Data represent in table (4.4) indicated the effect of the locations on growth and forage characters for Narbon vetch, it was highly significant for Days to %50 flowering, Days to maturity, leaf dry weight and stem dry weight.The results confirmed that the

flowering and maturity, were earlier at the second location and it produced more values for dry leaf and stem compare to the first location. It was indicated that the second location was earlier in Days to flowering and Days to maturity compare to the first location where it was 34.41 and 11.19% ,respectively. The second location exceeded the first location for the characters leaf dry weight (g) and Stem dry weight (g) recorded 36.807 and 4.995 respectively.

Table 5: Means of seed yield and components for Narbon vetch at both locations and their average.

Qlyasan								
Variety	No.of pods. Plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds/pod	100 seed weight(g)	seed yield kg.h^{-1}	Biological yield kg.h^{-1}	Harvest index
V.1	17.630	4.660	3.318	0.863	19.590	4770.000	15096.581	0.315
V.2	19.890	5.050	3.383	0.775	19.380	4949.917	15010.246	0.326
V.3	19.720	4.850	3.728	0.838	21.600	4617.917	12990.389	0.352
V.4	18.520	5.080	3.747	0.793	19.320	4123.330	13525.764	0.306
LSD 0.05	1.519	n.s	n.s	n.s	0.807	228.045	705.755	0.024
Kanipanka								
Variety	No.of pods. plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg .h^{-1}	Biological yield kg. h^{-1}	Harvest index
V.1	18.560	4.120	3.782	0.868	19.738	7319.251	17880	0.399
V.2	20.370	4.551	3.882	0.829	19.432	5205.805	17629	0.293
V.3	20.730	5.127	4.09	1.460	21.958	4956.138	17557	0.282
V.4	19.996	4.890	4.228	0.858	19.747	4505.08	16727	0.266
LSD 0.05	n.s	n.s	n.s	n.s	n.s	499.841**	477.495**	0.024**
Average of both locations								
Variety	No.of pods .plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg.h^{-1}	Biological yield kg.h^{-1}	Harvest index
V.1	18.100	4.389	3.550	0.865	19.660	6044.630	16489	0.357
V.2	20.130	4.799	3.633	0.802	19.410	5077.860	16320	0.309
V.3	20.230	4.987	3.909	1.149	21.780	4787.030	15274	0.317
V.4	19.260	4.985	3.980	0.825	19.540	4314.210	15126	0.286
LSD 0.05	1.057*	0.386	0.279	0.24	n.s	269.057	417.292	0.017

Data in table (5) illustrate the means of seed yield and its components at both locations and their average. The differences among varieties were highly significant for all characters except pod length (cm) No.of seeds.pod^{-1} and weight of seeds.pod^{-1} which were not significant at the Qlyasan, while at the kanipanka the differences among varieties were highly significant for the character's seed yield Kg.h^{-1}, biological yield kg.h^{1-} and harvest index, but it's not significant for the rest.The average of both locations, the differences among varieties were highly significant for all characters except pod length (cm) and weight of seeds/pod which were not significant and the character 100 seed weight (g).

At the Qlyasan, the highest values for weight of seeds/pod and biological yield kg. h^{-1} were (0.863g and 15096.581Kg.h$^{-1)}$ respectively. Recorded by variety ICAR-

DA833, while variety ICARDA225 recorded the highest values for the character No.of pods /plant and seed yield kg.h^{-1} with 19.890 and 4949.917,Kg.h^{-1} respectively. Variety ICARDA776 recorded maximum value for the characters 100 seed weight (g) and harvest index 21.600g and 0.352 respectively, while the highest for the characters pods length (cm) and No.of seeds/ pod was 5.080cm and 3.747, respectively. But the lowest were 19.320, 4123.330, and 0.360 recorded by variety ICARDA545 .The lowest value for most characters recorded by the variety ICARDA833 and variety ICARDA545.Concerning to the second location and the average of both locations, variety ICARDA833 recorded maximum values for the character seed yield kg.h^{-1}, biological yield Kg. h^{1-} and harvest index reached 7319.251 Kg.h$^{-1,}$17880.492Kg.h^{-1} and 0.399 at the second location and 6044.630, 16488.536Kg.h^{-1} and 0.357 at the average of both locations respectively. No. of pods/plant, pod length (cm), weight of seeds/pod and 100 seed weight (g) at the second location and the average of both location reached 20.730, 5.127cm, 1.460g and 21.958, respectively.At the second location, while as the average of both locations reached 20.230, 4.987cm, 1.149g and 21.780g, respectively.Variety ICARDA545 gave the highest value for the character No.of seeds/ pod reached 4.228 at the second location and 3.98 as the average of both locations.The varieties ICARDA833 and varieties ICARDA545 recorded.The number of seeds per pod did not effect by the plant population .These results assert what was reported (Al-Rifaee et al., 2004) who detected for any cultivar that given, the character of seeds per pod is a relatively steady.The difference among varieties due to seed yield and its components may be referred
to the difference in their performance and to their response to the climatically conditions prevailing in the region.

Table 6: Effect of plant density some growth and forage characters for Narbon vetch atboth locations and their average.

Qlyasan								
plant density plant.m^{-2}	No. of pods. plant^{-1}	pod length (cm)	No. of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg .h^{-1}	Biological yield kg.h^{-1}	Harvest index
80kg.h^{-1}	18.959	4.963	3.600	0.900	19.357	3102.800	12265.429	0.256
100KG.h^{-1}	19.403	4.731	3.410	0.730	19.538	4172.600	13935.476	0.302
120Kg.h^{-1}	17.924	4.973	3.630	0.787	20.296	5096.300	14462.772	0.355
140kg.h^{-1}	19.470	4.960	3.520	0.841	20.700	6089.500	15959.305	0.386
LSD 0.05	n.s	n.s	n.s	n.s	0.807	228.045	705.755	0.024
Kanipanka								
plant density plant.m^{-2}	No.of pods /plant	pod length (cm)	No.of seeds/ pod	weight of seeds/pod	100 seed weight(g)	seed yield kg /h	Biological yield kg/ h	Harvest index
80kg.h^{-1}	19.479	4.452	3.836	1.119	19.706	3617.8	14294	0.253
100KG.h^{-1}	20.134	4.838	4.151	1.071	20.049	4822.52	16340	0.296
120Kg.h^{-1}	19.542	4.893	3.97	0.838	20.848	5976.32	18141	0.331
140kg.h^{-1}	20.522	4.508	4.02	0.987	20.272	7569.63	21019	0.359
LSD 0.05	n.s	0.495	n.s	n.s	0.678	499.841	477.495	0.024

Average of both locations								
plant density plant.m^{-2}	No.of pods /plant	pod length (cm)	No.of seeds/ pod	weight of seeds/pod	100 seed weight(g)	seed yield kg.h^{-1}	Biological yieldkg.h^{-1}	Harvest index
80kg.h^{-1}	19.219	4.707	3.718	1.012	19.531	3360.3	13280	0.254
100KG.h^{-1}	19.768	4.78	3.785	0.902	19.749	4497.56	15138	0.298
120Kg.h^{-1}	18.732	4.932	3.803	0.813	20.572	5536.312	16302	0.343
140kg.h^{-1}	20	4.734	3.773	0.914	20.486	6829.564	18489	0.372
LSD 0.05	n.s	n.s	n.s	n.s	n.s	269.057	417.292	0.017

Effect of plant densities on some growth and forage characters for Narbon vetch at both locations and their average represent in table (4.6) At the first location the effect of plant densities was highly significant on the character,100 seed weight (g) seeds yield K.h^{-1} ,biological yield Kg.h^{-1} and harvest index but at the second location it was highly for all characters except No.of pods.plant^{-1}, No.of seeds.pod^{-1} and weight of seeds.pod $^{-1}$ which were not significant as the average of both locations the effect of plant densities was highly significant on the characters seed yield Kg.h $^{-1}$,biological yield Kg. h^{-1} and harvest index only and not significant on the others.

At the first location, the application of 140Kg.h^{-1} gave the highest value for most characters including 100 seed weight (g), seed yield Kg.h, biological yield Kg. h^{-1} and harvest index reached 20.700 g, 6089.500 Kg.h^{-1} , 15959.305 Kg.h^{-1} and 0.386,respectively While the lowest value for the most characters recorded by using 80 and 100 Kg.h^{-1} At the second location using 120Kg.h^{-1} produce maximum values for the character's pod length (cm) and 100 seed weight (g) with 4.893cm and 20.848g, respectively but using 140 Kg.h^{-1} had the highest value for the characters No.of pods.plant seed yield Kg.h, biological yield Kg.h^{-1} and harvest index (20.522, 7569.63Kg.h^{-1} , 21018.63Kg.h^{-1} and 0.359),respectively.The lowest value for the most characters recorded by using 80Kg.h seeds for the characters No.of pods plant, pod length (cm), No.of seeds.pod^{-1} , 100 seed weight (g), seed yield kg. biological yield Kg.h^{-1} and Harvest index with 19.479 ,4.452, 3.836, 19.706, 3617.800, 14293.71 and 0.253,respectively.Regarding to the average of both locations. The applications of 140Kg.h^{1-} plant densities recorded the highest value with the characters No. of pods/plant, seed yield Kg.h, biological yield Kg. h and harvest index reached 20.00, 6829.564Kg.h $^{-1}$, 18488.967Kg.h^{-1} and 0.372,respectively, while using 80kg.h seeds produced the lowest value for most characters Pod length (cm), No of seeds. Pod $^{-1}$, seed yield Kg .h^{-1} , Biological yield Kg.h^{-1}, and Harvest index with 4.707, 3.718, 3360.300, 13279.571 and 0.254, respectively.This result with the Similar results were reported by(Al-Rifaee et al., 2004) who observed that with increasing plant population biomass of above ground of the dry matter yield is increased .

Table 7: Effect of some interaction of variety and plant density some rowthand-forage characters for Narbon vetch.

Qlyasan								
plant density plant.m^{-2}	No.of pods .plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg .h^{-1}	Biological yield kg.h^{-1}	Harvest index
V1.&80kg.h^{-1}	15.133	4.403	3.190	1.073	18.893	3535.330	13043	0.273
V1.&100 kg.h^{-1}	20.290	4.233	3.610	0.723	18.767	4442.330	14881	0.3
V1.&120 kg.h^{-1}	17.897	5.640	3.650	0.803	20.087	5143.000	15265	0.34
V1.&140 kg.h^{-1}	17.190	4.347	2.810	0.850	20.613	5959.330	17197	0.347
V2.&80kg.h^{-1}	20.787	5.100	3.707	0.780	18.740	3226.000	12777	0.25
V2.&100 kg.h^{-1}	18.840	5.310	2.957	0.697	19.580	4874.330	14177	0.347
V2.&120 kg.h^{-1}	20.770	4.907	3.030	0.737	18.723	5326.330	15800	0.337
V2.&140 kg.h^{-1}	19.143	4.870	3.840	0.887	21.473	6373.000	17287	0.37
V3.&80kg.h^{-1}	20.067	5.120	3.620	0.800	21.323	3236.660	10679	0.303
V3.&100 kg.h^{-1}	20.037	4.337	3.700	0.783	20.517	4136.330	12537	0.33
V3.&120 kg.h^{-1}	18.070	4.637	3.770	0.850	22.553	4936.000	13528	0.363
V3.&140 kg.h^{-1}	20.710	5.293	3.810	0.917	22.000	6162.660	15217	0.41
V4.&80kg.h^{-1}	19.850	5.230	3.880	0.967	18.470	2413.000	12563	0.197
V4.&100 kg.h^{-1}	18.443	5.043	3.403	0.730	19.290	3237.330	14137	0.23
V4.&120 kg.h^{-1}	14.953	4.710	4.073	0.760	19.820	4980.733	13258	0.38
V4.&140 kg.h^{-1}	20.840	5.330	3.630	0.713	19.713	5863.353	14136	0.417
LSD 0.05	3.037	n.s	n.s	n.s	n.s	456.09	1411.51	0.048
Kanipanka								
plant density plant.m^{-2}	No.of pods .plant $^{-1}$	pod length (cm)	No.of seeds.pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg.h^{-1}	Biological yield kg. h^{-1}	Harvest index
V1.&80kg.h^{-1}	15.59	3.617	3.587	0.903	18.92	4304.237	14423	0.299
V1.&100 kg.h^{-1}	20.837	4.06	3.803	0.83	20.07	6391.847	16266	0.393

V1.&120 kg.h^{-1}	19.54	4.78	4.087	0.97	19.983	7774.78	18441	0.421
V1.&140 kg.h^{-1}	18.23	4.567	3.65	0.767	19.977	10806.14	22393	0.482
V2.&80 kg.h^{-1}	20.78	5.567	3.993	0.963	19.953	3625.147	14257	0.254
V2.&100 kg.h^{-1}	18.7	5.053	4.147	0.843	19.603	4788.253	16210	0.296
V2.&120 kg.h^{-1}	21.66	4.41	3.58	0.663	19.56	4788.253	18119	0.313
V2.&140 kg.h^{-1}	20.36	4.173	3.807	0.847	18.61	6750.047	21930	0.308
V3.&80 kg.h^{-1}	20.507	5.223	3.95	1.607	21.39	3479.777	14179	0.245
V3.&100 kg.h^{-1}	21.26	5.103	4.213	1.797	21.803	4539.207	16270	0.279
V3.&120 kg.h^{-1}	20.14	4.797	4.06	0.943	22.76	5327.777	17795	0.308
V3.&140 kg.h^{-1}	21.04	5.383	4.14	1.493	18.55	6477.793	21984	0.296
V4.&80 kg.h^{-1}	21.03	4.4	3.813	1.003	18.553	3062.047	14316	0.215
V4.&100 kg.h^{-1}	19.74	5.137	4.44	0.813	18.65	3570.773	16613	0.215
V4.&120 kg.h^{-1}	16.81	5.583	4.16	0.777	22.043	5142.967	18211	0.282
V4.&140 kg.h^{-1}	22.4	4.44	4.5	0.84	19.74	6244.533	17769	0.351
LSD 0.05	3.06**	n.s	n.s	n.s	1.357	999.682	954.991	0.049
Average of both locations								
plant density plant.m^{-2}	No.of pods .plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg.h^{-1}	Biological yield kg. h^{-1}	Harvest index
V1.&80 kg.h^{-1}	15.36	4.01	3.39	0.99	18.91	3920.03	13733	0.29
V1.&100 kg.h^{-1}	20.56	4.15	3.71	0.78	19.42	5417.45	15573	0.35
V1.&120 kg.h^{-1}	18.72	5.21	3.87	0.89	20.04	6459.12	16853	0.38
V1.&140 kg.h^{-1}	17.74	4.19	3.23	0.81	20.3	8383.03	19795	0.41
V2.&80 kg.h^{-1}	20.79	4.83	3.85	0.87	19.35	3425.86	13517	0.25
V2.&100	18.77	5.18	3.55	0.77	19.59	4831.45	15194	0.32

kg.h^{-1}								
V2.&120 kg.h^{-1}	21.22	4.66	3.31	0.7	19.14	5493.34	16959	0.32
V2.&140 kg.h^{-1}	19.75	4.52	3.82	0.87	19.54	6561.86	19608	0.34
V3.&80 kg.h^{-1}	20.29	5.17	3.79	1.2	21.36	3358.51	12429	0.27
V3.&100 kg.h^{-1}	20.65	4.72	3.96	1.29	21.2	4338.07	14404	0.3
V3.&120 kg.h^{-1}	19.11	4.72	3.92	0.9	22.18	5132.19	15661	0.34
V3.&140 kg.h^{-1}	20.88	5.34	3.98	1.21	22.38	6320.38	18600	0.35
V4.&80 kg.h^{-1}	20.44	4.82	3.85	0.99	18.51	2737.77	13439	0.21
V4.&100 kg.h^{-1}	19.09	5.09	3.92	0.77	18.97	3404.32	15380	0.22
V4.&120 kg.h^{-1}	15.88	5.15	4.12	0.77	20.93	5061.85	15734	0.33
V4.&140 kg.h^{-1}	21.62	4.89	4.07	0.78	19.73	6053.94	15952	0.38
LSD 0.05	2.114**	n.s	n.s	n.s	n.s	2033.483**	834.584**	0.034**

Data in table (7) illustrate the effect on the interaction between varieties and plant densities on some growth and forage characters for Narvon vetch plant at both locations and their average. At the first location, the interaction effect was highly significant for the characters No.of pods .plant^{-1} , seed yield Kg.h and harvest index while it was significant for the character biological yield Kg. h^{-1} and not significant for the rest.

The highest value for the characters No. of pods.plant^{-1} and harvest index was 20.840 and 0.417,respectively.recorded by the interaction between variety ICARDA545 and 140Kg.h^{-1} seed rate densities, while the lowest value for the character No.of pods.plant^{-1} was 14.953 recorded by variety ICARDA545 coupled with 120Kg.h^{-1} seeds, but the lowest value of the characters and harvest index was 0.197 recorded by the associations between variety ICARDA545 with 80Kg.h^{-1} seeds.The highest value for the character seed yield kg.h^{-1} was 6373.00 Kg.h^{-1} and 17286.823Kg.h respectively recorded by the interaction between variety ICARDA225 with 140Kg.h^{-1} seeds,but lowest value for these characters was 2413.00 by the interaction variety ICARDA545 coupled with 80Kg.h^{-1} and 10679.00 Kg.h^{-1} recorded by the interaction variety ICARDA776 under using 80Kg.h seeds.Regarding to the second location the effect of the interaction between varieties and plant densities was highly significant for the characters No. of pods.plant^{-1} , seed yield Kg.h^{-1} , biological yield Kg.h^{-1} and harvest index and it was significant for the characters 100 seed weight(g) and not significant for the rest.Maximum value due the character No.of pods.plant^{-1} was 22.400 recorded by the interaction between variety ICAR-

DA545 coupled with using 140Kg.h^{-1} seeds, while the lowest value was 15.590 recorded by variety ICARDA833 coupled with using 80Kg.h^{-1} . The highest value for the characters 100 seed weight (g) was 22.760g produced by variety ICARDA776 under 120Kg.h^{-1} , but the lowest value was 18.550g exhibited by variety ICARDA776under using 140Kg.h^{-1}. The highest value of the characters seed yield Kg.h^{-1} ,biological yield kg.h^{-1} and harvest index was 10806.140Kg.h^{-1} , 22392.533 Kg.h^{-1} and 0.482, respectively recorded by variety ICARDA833as with 140Kg.h^{-1} , but lowest value for the characters seed yield kg.h and harvest index was 3062.047 and 0.215 respectively by variety ICARDA545 with 80Kg while the lowest value for the character biological yield Kg. h^{-1} was 14179.150Kg.h recorded by variety ICARDA776with 80Kg.h^{-1} . Regarding to the average of both locations the interaction effect was highly significant for the characters No.of pods .plant^{-1} seed yield Kg.h, biological yield Kg.h and harvest index only.The values of the character No.of pods .plant^{-1} restricted between15.360 to 21.620 for the interactions variety ICARDA833with 80kg/h and variety ICARDA545 with 140kg/h respectively. Concerning to the characters seed yield Kg.h, biological yield Kg. h and harvest index the highest value was 8383.03Kg.h^{-1}, 19795.01Kg.h and 0.41 respectively recorded by variety ICARDA833 as with 140Kg.h^{-1}. The lowest value for the character biological yield Kg. h^{-1} was 12429.08 showed by the interaction of variety ICARDA776 with using 80Kg.h^{-1}, but for the characters seed yield Kg. and harvest index the lowest value was 2737.770 and 0.21 ,respectively recorded by variety ICARDA545 coupled with 80 Kg.h^{-1}.

Table 8:Effect locations on seed yield and it is components for Narbon vetch.

Locations	No.of pods .plant^{-1}	pod length (cm)	No.of seeds. pod^{-1}	weight of seeds.pod^{-1}	100 seed weight(g)	seed yield kg.h^{-1}	Biological yield kg.h^{-1}	Harvest index
L1	18.900	4.910	3.540	0.817	19.970	4615.827	14155.745	0.325
L2	19.900	4.670	4.000	1.004	20.220	5496.570	17448.349	0.310
LSD 0.05	n.s	n.s	0.197**	n.s	n.s	234.158**	602.393**	n.s

The effect of the locations on seed yield and components for Narbon vetch represent in table (8) This effect was highly significant on the characters No.of seeds/pod, seed yield Kg.h and biological yield Kg.h only It is clearly observed that the second location out yielded the first location in these characters by 12.99, 19.081 and 23.26% re3portant components are good indicator that confirm the suitability Kanipanka location to produce this crop.:This may refers to the differences in environmental condition between two Locations.

Conclusion:

Significant differences among varieties due to most studied characters was observed, the variation of variety performance was largely associated with climatically conditions and genetic variation existed among varieties at each location Thus, varieties should be carefully selected for corresponding regions depending mainly on seasonal weather conditions. Increasing yield at high density can be directly attributes to large populations, and strong relationship between seed yield and plant population

densities. It was observed that Kanipanka location is more suitable to grow this plant compare to the other location.

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