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RESEARCH ARTICLE

THE EFFECT OF PHOSPHORUS FERTILIZER APPLICATIONS ON SOME CHARACTERS RELATED TO SEED YIELD AND QUALITY IN NARBON VETCH (VICIA NARBONENSIS L.) LINES IN ANKARA ECOLOGICAL CONDITIONS

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ABSTRACT

The research was conducted at the study plots of Department of Field Crops, Faculty of Agriculture, Ankara University, in arid conditions representing the Central Anatolia, in Ankara, in years 2010 and 2011. The does of the phosphorus fertilizer that generates the highest grain yield per unit was investigated on Lebanese-origin H_1; 5143, Turkish-origin H_2; 5526, and Iraqi-origin H_3; 5538 vetch lines that were obtained from ICARDA. Four doses of phosphorus, corresponding to P_2O_5, and including P_k; 0 kg/da, P_1; 4 kg/da, P_2; 8 kg/da, and P_3; 16 kg/da were used in Triple Super Phosphate form on three repetitive narbonvetch lines that were structured as randomly split parcels. In the study, positive effects were observed on plant height (62.53-77.88 cm), main stem thickness (4.90-5.91 mm), thousand grain weight (77.39-114.03 g), biological yield (359.11-397.43 kg/da), harvest index (% 36.21-48.89), grain yield (123.41-217.37 kg/da), number of pods per plant (11.37 to 15.30 pieces/plant) at 4 kg/da P_2O_5 and 8 kg/daP_2O_5 phosphor doses. On the other side, adverse effects were detected on the number of stems per plant (2.12-2.99 unit/plant), the number of seeds per pod (3.59-3.71), germination rate of seeds (91.17-86.33 %), phosphor ratio of seed (0.29 to 0.37 %) and crude protein content in grain (25.00-25.30 %) at levels more than16 kg/da. In the study, 4 kg/da$P_2O_5$and 8 kg/da P_2O_5fertilizer doses gave the best results while the amounts over 8 kg/da were not considered statistically significant.

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INTRODUCTION

Agricultural production takes place in about 31% of 24 million hectares of Turkey's total surface area of 78.5 million hectares. When fallow lands were added, the amount of land under cultivation fell by 20.5 million hectares from 3.2 million hectares in the last decade. The feed area of the feed crops has increased by more than 1 million hectares and the share in the processed land has increased to 9% from3.4%. This proportional increase has been a determining factor in the increase of feed planting areas as well as the decrease in other planted areas. This is a desired and sought after development, but it is still not at the exact desired level. It is clear that the increase in planting of feed crops is a significant influence of government-applied product supports. Fixation of the increase and watching at 9% levels indicate a problem (Acar *et al*., 2015). When the daily animal protein consumption is taken into account, the values of the world and Turkey are different. The daily consumption of animal protein per capita is reported to be 44 g in developed countries, 9 g in undeveloped countries and 27 g on the average. In Turkey, this amount is about 20 g which is below the average. In our country, where the main nutritional elements are included in the bread and other cereal product groups, the most consumed product groups are cereals, cereal products and vegetables respectively. Although meat and meat products are very important as the main sources of, protein, it is reported that 43% of the daily protein needs are met by animal products while the remaining 57% are through vegetative food sources (Çolak 2015). To erase the deficit research and breeding of high-yield species and lines that are highly adaptive to difficult conditions and resistant to diseases is inevitable. For this reason, the agriculture of the feed crops is a bridge between vegetable and animal production and balancing act between all branches of the agriculture. In this study, Four doses of phosphorus, corresponding to P_2O_5, and including P_k; 0 kg/da, P_1; 4 kg/da, P_2; 8 kg/da, and P_3; 16 kg/da were used in Triple Super Phosphate form on Lebanese-origin H_1; 5143, Turkish-origin H_2; 5526, and Iraqi-origin H_3; 5538 vetch lines that were obtained from ICARDA by the Department of Field Crops, Faculty of Agriculture, Ankara University. The trial was carried out in arid conditions, representing the Central

Anatolia. The aim of the study is to determine the dose of phosphorus or the vetch line that reaches the highest grain yield per unit area, according to the results of the experiment and variance analysis conducted by application of the different doses of phosphorus to the different lines of the Narbon Vetch.

MATERIAL AND METHOD

Lebanese-origin H_1; 5143, Turkish-origin H_2; 5526 and Iraqi-origin H_3; 5538 large vetch (vicia narbonensis) lines, obtained from ICARDA by the Department of Field Crosp of the Faculty of Agriculture of Ankara University, were used as main materials on which Four doses of phosphorus, corresponding to P_2O_5, and including P_k; 0 kg/da, P_1; 4 kg/da, P_2; 8 kg/da, and P_3; 16 kg/da were used in Triple Super Phosphate form. The study carried out in the experimental field of the Department of Field Crops, Faculty of Agriculture, Ankara University in three repetitions according to the "Repeated Random Blocks of the Years and the Split Plot Experimental Scheme" for two years in between 2009-2010 and 2010-2011.. Phosphorous fertilizer doses were placed in the main parcels and large vetch lines in the lower parcels in order to ensure ease of application. Each experimental plot consists of 36 plots (3 lines x 4 fertilizer doses x 3 replicates) with a surface area of 6 m^2 (2.0 m x 3.0 m = 6 m^2). The total experimental area is 216 m^2 (6 m^2 x 36 parcels). There are 4 blocks in each parcel, 3 blocks with 12 parcels each and 3 m of space between blocks. In Central Anatolian conditions, fertilization was applied to the main plots before the cultivation of the large vetch which is suitable for winter planting. Phosphorous fertilizer was applied as triple super phosphate fertilizer (P_k : 0 kg / da (Control), P_1 : 4 kg / da P_2O_5, P_2: 8 kg / da P_2O_5, P_3: 16 kg / da P_2O_5). Large vetch lines (H_1, H_2, H_3) were placed in sub parcels. The plants were sowed manually in lines with 3 meters length and 50 cm row spacing. Following the plantations, the rows were closed with a rake and a roll was passed over (1st year: October 8th, 2009 and 2nd year: October 10th, 2010). The seeding rate was 17.5 kg seeds per decare (Cakmak 2002). No additional fertilization was performed during or after sowing and the plants were grown without irrigation in arid conditions. When necessary, weed control was carried out by hand or anchor. In order to determine the characteristics related to seed production of the plants in the parcels, 10 plants were marked and harvested separately in the period when the lower fruits were ripened (1st year: June 20th, 2010) and 2nd year: June 11th, 2011).

On these plants the plant height, main stem thickness, number of main branches in the plant, number of pods in the plant and the number of grains in the pods were measured. All plants harvested from the remaining parts of the plots were first dried in the sun and then weighed to calculate the biological yield, harvest index and the grain yield by blending (Kendir 1999). Analyzes were conducted using appropriate methods to determine the ratio of 1000 grains on the seeds obtained, germination rate on the grain, raw protein content in the grain and phosphorus content in the grain. The research was reestablished in a different part of the same trial area in the autumn of the following year and was carried out for the second year by the same procedures (1st year: July 5th, 2010) and 2nd year: July 10th, 2011). As shown in Table 1.1, the lowest rainfall in Ankara was measured as 0.4 mm in August 2010, while the highest rainfall was 68.0 mm in August 2009 for the period between years 2009 and 2010.

The lowest precipitation was measured as 1.5 mm in September 2010 and the highest as 167.7 mm in October 2010 for the period between years 2010 and2011. The average monthly relative humidity figures in the other months were close to those of long years. The average precipitation was recorded as 30.51 mm for long years. Monthly average temperature values for the trial years are similar to the average of long years. In Ankara, the average annual temperature for long years was measured as 12.02 ° C. The lowest temperature in Ankara between years 2009 and2010 was 3.1 °C in January 2010 and the highest temperature was 28.4 °Cin August 2010. The lowest temperature between years 2010 and 2011 was 2.4 °Cin January 2011 and the highest was25.1 °Cin July 2011. In the other months of the year, the average monthly temperature values were close to the average for many years. For long years the average temperature was recorded as 12.02 °C. The lowest relative humidity in Ankara was 30.5% in August 2010 and the highest relative humidity was 78.5% in December 2009 between years 2009 and 2010.. Between years 2010 and 2011 the lowest relative humidity was measured as 42.38% in September 2010 while the highest value recorded was 78.8% in December 2010.In the other months of the year, the monthly average relative humidity values were similar to those for long years. The overall average relative humidty rate for long years was calculated as 60.72%.

RESULTS AND DISCUSSION

Grain yield: As shown in Table 1.2, variance analyses and multiple comparison tests of grain yield values at different phosphor dose levels are examined ($P < 0.01$). The difference between the years and the difference between the grain yields corresponding to the different phosphorus dose levels are statistically significant ($P < 0.01$).The year x large vetch line interaction is also found statistically significant ($P < 0.01$).As shown in Table 1.3, the highest grain yield value was obtained from the Turkish origin L_2 line with 296.31 kg / da atP_3 dose in 2010 while the lowest grain yield value was obtained from the Turkish origin L_2 line in 2011 with 78.18 kg / da atP_k dose. Among the lines, the highest grain yield value was obtained from the Turkish origin L_2line with 178.67 kg / da, while the lowest grain yield value was obtained from the Iraqi originL_2 line with 160.87 kg / da. Oktay (2008) found that the yield of grain was 90.90 -174.50 kg / da in the study conducted by using *Vicia narbonensis* L. Our findings differs from the results of other investigators. Working on different legume feed plant genotypes than other investigators, Bağcıoğlu (1997) studied the effects of different doses of nitrogen and phosphorus on the growth and development of bacilli (*Vicia faba* L.) and found the grain yield to be 179.8 kg / da. Kadıoğlu (2011) observed grain yieldsbetween108.7 and166.3 kg / da for different phosphor doses in feed pea (Pisum arvense L.). Çomaklı *et al*. (1999) found grain yields between 72.49 and 118.48 kg / da in the research they carried out in order to determine the sequence interval and phosphorus effects on the yield and yield components of Burcakta (*Vicia ervilia* L.). Differences between our findings and findings of the other researchers can be explained by the varying responses the of perennial leguminous forage plants with different genotypes to the environment.

Harvest index: When the analysis of variance and multiple comparison tests of harvest index values at different phosphor dose levels are examined, it can be seen in Table 1.4 that the

Table.1. 1. Climate data for the years of Ankara (1980-2011), 2009-2010 and 2010-2011

	Monthly total precipitation (mm)			Monthly average temperature (Cº)			Monthly average relative humidity (%)		
Months	Long Years	2009-2010 Years	2010-2011 Years	Long Years	2009-2010 Years	2010-2011 Years	Long Years	2009-2010 Years	2010-2011 Years
September	41.8	10.3	1.5	0.3	18.5	22.5	76.3	48.6	42.3
October	36.9	13.7	167.6	1.8	16.6	12.2	72.1	49.2	72.3
November	38.7	43.1	32.0	6.1	7.4	11.2	64.1	74.6	63.6
December	49.0	68.0	67.3	11.3	5.4	6.1	59.8	78.5	78.8
January	51.2	63.0	42.0	16.1	3.1	2.4	57.2	77.8	78.5
February	35.4	65.1	24.3	20.2	6.5	3.2	52.0	70.4	69.8
March	14.5	44.6	57.5	23.5	8.5	6.0	45.6	59.9	67.1
April	10.9	37.5	50.1	23.3	12.2	10.0	45.0	54.4	65.6
May	18.5	31.0	73.1	18.7	18.4	15.2	49.4	44.4	62.3
June	30.2	57.8	44.4	13.1	21.5	19.7	60.3	54.2	55.4
July	33.9	25.7	10.7	7.1	26.2	25.6	70.2	44.2	42.7
Auqust	46.9	0.4	21.1	2.7	28.4	23.8	76.6	30.5	44.9
Total	407.9	460.2	591.6						
Average	30.51	37.49	49.18	12.02	14.39	13.16	60.72	57.23	61.94

Anonymous, 2011. T.C. Ministry of Forestry and Water Affairs - General Directorate of Meteorology Ankara Metropolitan Meteorological Station 2009-2010-2011 Data.

Table 1.2 Results of variance analysis of grain yield characteristics of different phosphorus dosing applications in vicious vetch lines *

Variation Source	D.F	S.S	S.A	F	P
Year	1	3120543	3120543	36.80	**
Between blocks in the same year	4	74768	74768		
Phosphorus doses	3	3101092	3101092	51.72	0.000**
Year × Phosphorus doses	3	13970	13970	0.23	0.872
Phosphorus doses × Block (Year)	12	239836	239836		
Narbon vetch lines	2	133956	133956	1.70	0.199
Year × Narbon vetch lines	2	1040334	1040334	13.20	0.000**
Phosphorus doses × Narbon vetch lines	6	39326	39326	0.17	0.984
Year × Phosphorus doses × Narbon vetch lines	6	31088	31088	0.13	0.991
Error	32	1260972	1260972		
General	71	9055886			

** High significance at 0.01 level and significance at * 0.05 level.

Table 1. 3 Grain yields observed in different phosphorus dosing applications on vetch vines (kg / da) of the year 2010-2011 figures for the character *

Phosphorus applications	2010				2011				Overall average
	Narbon vetch lines				Narbon vetch lines				
	L_1	L_2	L_3	Average	L_1	L_1	L_1	Average	
P_k; Control	137.44	190.07	139.10	155.53	80.01	78.18	115.70	91.29	123.41
P_1; 4 kg/da	190.90	212.97	167.32	190.39	116.86	106.57	152.05	125.16	157.77
P_2; 8 kg/da	205.34	253.48	199.36	219.39	147.24	124.83	171.81	147.96	183.67
P_3; 16 kg/da	244.85	296.31	224.26	255.14	167.16	166.99	204.67	179.60	217.37
Average	194.63b	238.20a	182.51b	205.11	127.81b	119.14b	161.05a	136.00	170.55
	L_1(Origin of Lebanese)			L_2(Origin of Turkey)			L_3(Origin of Irak)		
Overall average	160.87			178.67			171.78		

*There is a significant difference between the averages indicated by different letters in the same row or column (P <0.05)

Table 1.4 Results of variance analysis of harvest index characteristics of different phosphorus dosing applications in vicious vetch lines *

Variation Source	S.D.	K.T.	K.O.	F	P
Year	1	1068.9	1068.9	6.37	*
Between blocks of the same year	4	947.3	947.3		
Phosphorus doses	3	2344.9	2344.9	5.93	0.010**
Year × Phosphorus doses	3	572.8	572.8	1.45	0.278
Fosfor dozları × Blok (Yıl)	12	1583.0	1583.0		
Narbon vetch lines	2	79.9	79.9	0.34	0.713
Year × Narbon vetch lines	2	177.6	177.6	0.76	0.476
Phosphorus doses × Narbon vetch lines	6	1653.9	1653.9	2.36	0.053
Year × Phosphorus doses × Narbon vetch lines	6	645.7	645.7	0.92	0.493
Error	32	3741.8	3741.8		
Overall	71	12815.8			

** High significance at 0.01 level and significance at * 0.05 level.

Table 1. 5 Average values of harvest index (%) observed in different phosphorus dosing applications in the veterinary vet lines for 2010-2011 years *

Phosphorus applications	2010				2011				Overall average
	Narbon vetch lines				Narbon vetch lines				
	L_1	L_2	L_3	Average	L_1	L_2	L_3	Average	
P_k; Kontrol	45.89	36. 57	47.55	43.34	23.21	25.62	38.41	29.08	36.21 b
P_1; 4 kg/da	43.19	42.04	44.64	43.29	32.92	39.56	32.94	35.14	39.22 b
P_2; 8 kg/da	48.05	52.07	60.38	53.50	48.85	49.47	34.50	44.27	48.89 a
P_3; 16 kg/da	55.10	52.87	35.66	47.88	51.77	58.33	38.88	49.66	48.77 a
Average	48.06	45.89	47.06	47.00	39.19	43.25	36.18	39.54	43.27
	L_1 (Origin of Lebanese)			L_2 (Origin of Turkey)			L_3 (Origin of Irak)		
Overall average	43.62			44.57			41.62		

*There is a significant difference between the averages indicated by different letters in the same row or column (P <0.05)

Table 1.6 Results of variance analysis of one thousand weighted characters of different phosphorus dosimetry applications on vetch lines*

Variation source	D.F	K.T	S.A	F	P
Year	1	164.4	164.4	0.19	
Between blocks of the same year	4	3986.6	3986.6		
Phosphorus doses	3	12620.1	12620.1	11.39	0.001**
Year × Phosphorus doses	3	2066.0	2066.0	1.86	0.189
Phosphorus doses × Block (Year)	12	4431.5	4431.5		
Narbon vetch lines	2	17262.7	17262.7	15.30	0.000**
Year × Narbon vetch lines	2	15.6	15.6	0.01	0.986
Phosphorus doses × Narbon vetch lines	6	916.4	916.4	0.27	0.947
Year × Phosphorus doses × Narbon vetch lines	6	467.5	467.5	0.14	0.990
Error	32	18055.1	18055.1		
Overall	71	59985.8			

** High significance at 0.01 level and significance at * 0.05 level.

Table 1. 7 Average values for the year 2010-2011 for the 1000 weight (g) character observed in different phosphorus dosing applications on the vetch lines *

Phosphorus applications	2010				2011				Overall average
	Narbon vetch lines				Narbon vetch lines				
	L_1	L_2	L_3	Average	L_1	L_2	L_3	Average	
Pk; Control	68.27	105.73	80.07	84.69	55.60	94.53	60.10	70.08	77.39 c
P_1; 4 kg/da	81.83	112.17	92.97	95.66	71.33	100.23	76.93	82.83	89.25bc
P_2; 8 kg/da	77.87	112.90	82.97	91.24	85.57	121.43	90.07	99.02	95.13 b
P_3; 16 kg/da	102.70	140.93	87.10	100.24	108.30	138.20	106.93	117.81	114.03a
Average	82.67	110.43	85.78	92.96	80.20	113.60	83.51	92.44	93.95
	L_1 (Origin of Lebanese)			L_2 (Origin of Turkey)			L_3 (Origin of Iraq)		
Overall Average	81.43 b			112.01a			84.64b		

*There is a significant difference (P <0.05) between the averages indicated by different letters in the same row or column.

Table 1.8 Results of variance analysis of phosphorus ratio characteristics of different phosphorus dosing applications on narbon vetch lines *

	D.F	S.S	S.A	F	P
Year	1	0.017113	0.017113	5.36	*
Between blocks of the same year	4	0.026667	0.026667		
Phosphorus doses	3	0.040349	0.040349	10.24	0.001**
Year × Phosphorus doses	3	0.000104	0.000104	0.03	0.994
Phosphorus doses × Block (Year)	12	0.015756	0.015756		
Narbon vetch lines	2	0.007908	0.007908	1.04	0.364
Year × Narbon vetch lines	2	0.001825	0.001825	0.24	0.787
Phosphorus doses × Narbon vetch lines	6	0.009247	0.009247	0.41	0.869
Year × Phosphorus doses × Narbon vetch lines	6	0.000242	0.000242	0.01	1.000
Error	32	0.121178	0.121178		
Overall	71	0.240387			

** High significance at 0.01 level and significance at * 0.05 level.

difference between the mean values of the harvest indexes of phosphorus dose levels at different doses of phosphorus is statistically significant (P <0.01). The difference between the harvest index averages in the phosphorus dose levels of the vetch lines is not statistically significant.

The year factor in harvest index character is statistically significant (P <0.05).As shown in Table 1.5, the highest harvest index value was obtained from the Iraqi origin H_3 line with 60.38% inP_2 dose in 2010 while the lowest harvest index value was obtained from Lebanese origin H_1 line with 23.21% in 2011 with P_k dose.

Table 1. 9 Average values of the percentages of phosphorus content (%) observed in different phosphorus dosimetry applications in vetch vines in 2010 and 2011 *

Phosphorus pplications	2010				2011				Overall average
	Narbon vetch lines				Narbon vetch lines				
	L_1	L_2	L_3	Average	L_1	L_2	L_3	Average	
P_k; Control	0,38	0,37	0,40	0,38	0,36	0,35	0,35	0.35	0.37 a
P_1; 4 kg/da	0,33	0,36	0,39	0,36	0,30	0,34	0,35	0.33	0.35 ab
P_2; 8 kg/da	0,35	0,33	0,38	0,35	0,33	0,31	0,34	0.32	0.34 b
P_3; 16 kg/da	0,32	0,30	0,34	0,32	0,30	0,18	0,28	0.25	0.29 c
Average	0.35	0.34	0.38	0.35 a	0.32	0.29	0.33	0.32 b	0.33
	L_1 (Origin of Lebanese)			L_2 (Origin of Turkey)			L_3 (Origin of Iraq)		
Overall average	0.33			0.32			0.35		

*There is a significant difference between the averages indicated by different letters in the same row or column (P <0.05).

Table 1.10 Results of variance analysis of the characteristics of crude protein ratio in ripened grain products atdifferent phosphorus dosing applications in vetch vines *

Variation source	D.F	S.S	S.A	F	P
Year	1	63.188	63.188	49.11	**
Between blocks of the same year	4	11.633	11.633		
Phosphorus doses	3	0.498	0.498	0.14	0.937
Year × Phosphorus doses	3	0.135	0.135	0.04	0.990
Phosphorus doses × Block (Year)	12	14.694	14.694		
Narbon vetch lines	2	7.080	7.080	2.33	0.113
Year × Narbon vetch lines	2	3.268	3.268	1.08	0.353
Phosphorus doses × Narbon vetch lines	6	3.497	3.497	0.38	0.884
Year × Phosphorus doses × Narbon vetch lines	6	0.683	0.683	0.07	0.998
Error	32	48.581	48.581		
Overall	71	153.258			

** High significance at 0.01 level and significance at * 0.05 level.

Table 1. 11Average values of the crude protein percentage (%) observed in different phosphorus dosing applications on the vetch lines for 2010-2011 years *

Phosphorus applications	2010				2011				Overall average
	Narbon vetch lines				Narbon vetch lines				
	L_1	L_2	L_3	Average	L_1	L_2	L_3	Average	
P_k; Control	26.19	26.35	25.68	26.07	24.12	24.77	24.13	24.34	25.21
P_1; 4 kg/da	26.44	26.43	25.74	26.20	23.93	24.38	24.44	24.25	25.23
P_2; 8 kg/da	26.12	27.14	25.44	26.23	23.95	25.02	24.13	24.37	25.30
P_3; 16 kg/da	25.87	26.50	25.75	26.04	23.14	24.56	24.60	24.10	25.00
Average	26.15	26.61	25.65	26.14a	23.79	24.68	24.32	24.26b	25.20
	L_1 (Origin of Lebanese)			L_2 (Origin of Turkey)			L_3 (Origin of Iraq)		
Overall average	24.97			25.64			24.99		

* There is a significant difference between the meanings indicated by different letters in the same row or column (P <0.05).

Table 1.12 Results of variance analysis on the number of grains per legume (pcs / beans) for different phosphorus dose applications on vetch lines *

Variation source	S.D.	K.T.	K.O.	F	P
Year	1	24.0356	24.0356	101.22	**
Between blocks of the same year	4	1.8689	1.8689		
Phosphorus doses	3	0.1644	0.1644	0.23	0.874
Year × Phosphorus doses	3	0.2622	0.2622	0.37	0.778
Phosphorus doses × Block (Year)	12	2.8600	2.8600		
Narbon vetch lines	2	0.4044	0.4044	0.94	0.400
Year × Narbon vetch lines	2	0.0044	0.0044	0.01	0.990
Phosphorus doses × Narbon vetch lines	6	4.1556	4.1556	3.23	0.014*
Year × Phosphorus doses × Narbon vetch lines	6	0.0311	0.0311	0.02	1.000
Error	32	6.8711	6.8711		
Overall	71	40.6578			

** High significance at 0.01 level and significance at * 0.05 level.

Table 1.13 Groups of differences in averages of grains per legume on the interaction of large vetch lines x phosphorus doses

Phosphorus applications(kg/da)	Narbon vetch lines		
	L_1	L_2	L_3
P_k; Control	3.10 Bb	4.00 Aa	3.67 Aa
P_1; 4 kg/da	3.46 ABa	3.47 ABa	3.80 Aa
P_2; 8 kg/da	3.70 Aa	3.40 Ba	3.73 Aa
P_3; 16 kg/da	3.93 Aa	3.33 Bb	3.73 Aab

* The capital letters in each row and column indicate the grouping of differences between the large vetch lines and the small letters grouping the differences between the doses of phosphorus.

Table 1. 14 Mean values for the number of grain (pods / beans) in legumes observed in different phosphorus dosing applications in the narbon vetch lines between 2010 and 2011 *

Phosphorus applications	2010				2011				Overall average
	L_1	L_2	L_3	Average	L_1	L_2	L_3	Average	
P_k; Control	3.60	4.47	4.20	4.09	2.60	3.53	3.13	3.09	3.59
P_1;4 kg/da	4.13	4.53	4.47	4.38	2.80	3.20	3.13	3.04	3.71
P_2;8 kg/da	4.27	4.00	4.33	4.20	3.13	2.80	3.13	3.02	3.60
P_3;16 kg/da	4.53	3.87	4.27	4.22	3.33	2.80	3.20	3.11	3.67
Average	4.13	4.22	4.32	4.22 a	2.97	3.08	3.15	3.07 b	3.64
	L_1 (Origin of Lebanese)			L_2 (Origin of Turkey)			L_3 (Origin of Iraq)		
Overall average	3.55			3.65			3.73		

* There is a significant difference (P <0.05) between the averages indicated by different letters in the same row or column.

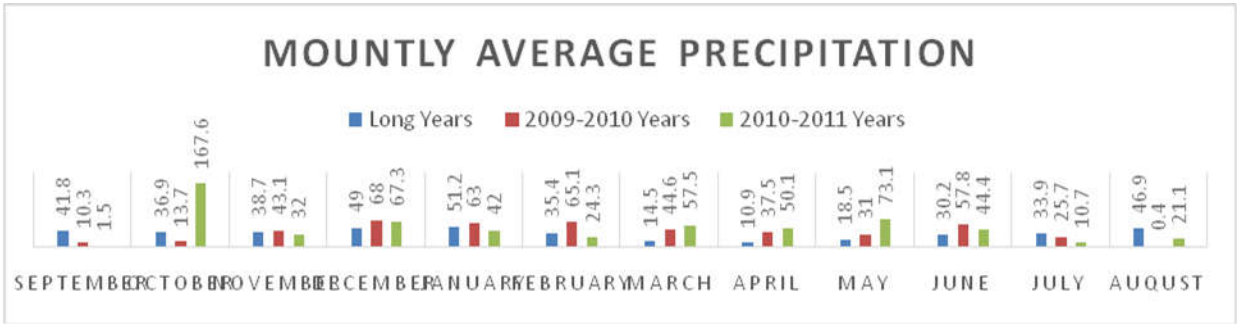


Figure 1. 1.Monthly rainfall values for the years 2009-2010 and 2010-2011 when the experiment was conducted *

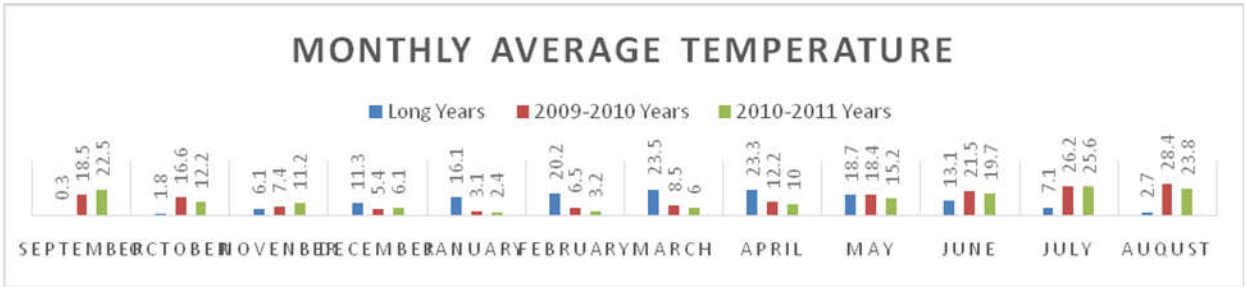
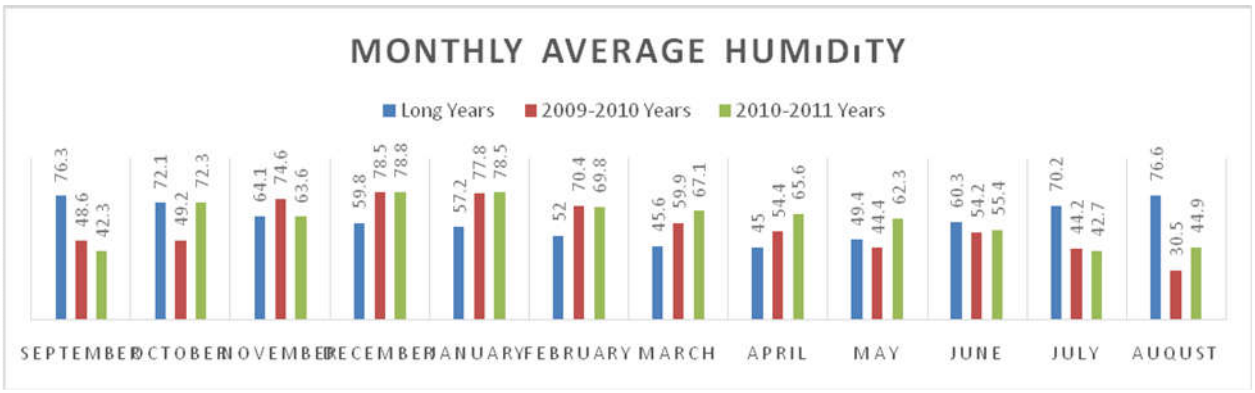


Figure 1. 2 Monthly average temperature values for the years 2009-2010 and 2010-2011 in which the experiment was conducted *



Figurel 1. 3. Monthly humidity values for the years 2009-2010 and 2010-2011 when the experiment was conducted *

Our findings are similar to Oktay (2008)'s harvest index values between 33.30 and 42.00%. Differences between other investigative findings the outputs of the other research activities may be explained by the varying responses of the vetch (*Vicia narbonensis* L.) lines with different origins to the environment. Sönmez (1992) studied the effects of the phoshorus doses on *Vicia ervilia* (L.) Wild and observed that the harvest index ranged from 37.97% to 40.64% while Kadıoğlu (2011) found the harvest index for different doses of phosphorus in feed pea (*Pisum arvense* L.) changing between 25.8%to 49.00%.

Our findings are close to the results of Sönmez (1992) who worked in a different genotype (*Vicia ervilla wild* L.). These findings can be explained by the varying reactions of the different genotypes of the annunal legume feed plants reacting to different climate and environmental conditions and different doses of phosphorus in annual legume feed plants.

Thousand grain weight: As shown in Table 1.6, when the variance analysis and the multiple comparison tests of thousand weight values at different phosphor dose levels are examined, the difference between the average of 1000 grain

weights is found statistically significant (P <0.01). In addition, the difference between the average weight of 1000 grains in phosphorus dose levels in the vetch vines is also found statistically significant (P <0.01).As seen in Table 1.7, the highest one thousand weight value was obtained from Turkish originH_2 line with 140.93 g ofP_3 dose in 2011 while the lowest one weight value was obtained from Lebanesen originL_1line of 55.60 g from P_k dose in 2011. Among the lines, the highest one thousand weight value was obtained from the Turkish originL_2 line with 112.01 g and the lowest one thousand weight value was obtained from the Lebanese origin L_1line with 81.43 g. Working on the big vetch (*Vicia narbonensis* L.), Sümerli (2001), Sabancı (1998), Büyükburç and İptaş (2001), Seydoşoğlu *et al* (2014) and Uzunmehmetoğlu and Kendir (2006) measured the one thousand grain weight intervals as 148.83 -263.67, 124.00-239.00 g, 158.70-301.20 g, 129.50-203.70 g and 150.67-238.00 g respectively. The values measured in this study are lower than those of Sümerli (2001), Sabancı (1998), Büyükburç and İptaş (2001), Seydoşoğlu *et al*. (2014) and Uzunmehmetoğlu and Kendir (2006). These results, which are incompatible with our findings, can be explained by the effects of the genotypes and the environmental conditions on the values of one thousand grain weights of the large vetch lines are important, and that different genotypes respond differently to different climatic and conditions and different doses of phosphorus.

Phosphorus ratioin grain: As seen in Table 1.8, when the analysis of variance and multiple comparison tests of phosphorus ratio values at different phosphorus dose levels are examined, the difference between the mean values of the phosphorus content in the granules at different doses of phosphorus is statistically significant (P <0.01). In addition, year factor is also found statistically significant in terms of phosphorus ratio (P <0.05). As shown in Table 1.9, the highest phosphorus at grain value obtained from the Iraqi origin L_3 line was0.40% P_k in 2010 while the lowest phosphorus value obtained from the Turkey originL_2line was 0.18% P_3in 2011. Among the lines, the highest phosphorus value obtained from the Iraqi origin L_3 line was 0.35% and the lowest phosphorus value obtained from the Turkish origin H_2line was0.32%. No previous research has been found to examine the character of the phosphorus ratio in grains by applying phosphorous fertilizer on the vetch (*Vicia narbonensis* L.) lines. When the values of 0.33% obtained fromL_1 line of Lebanese origin, 0.32% obtained fromL_2 line of Turkish origin and 0.35% obtained from ofL_3line of Iraqi origin, it is observed that the Iraqi origin L_3 line is the best among the lines with a value of 0.3563%. The differences between the lines can be explained by the varying responses of the vetch (*Vicia narbonensis* L.) lines to the environment that are adapted to different ecological conditions.

Crude protein ratio in grain: As shown in Table 1.10, when analysis of variance and multiple comparison tests of crude protein ratio values at different phosphorus dose levels are examined, it is observed that the year factor is statistically significant (P <0.01) in terms of crude protein ratio values. As seen in Table 1.11, the highest crude protein ratio in the obtained from Turkish originL_2line was 27.14% P_2in 2010, while the lowest raw protein ratio in the grain obtained from Lebanese origin $L_1$was 23.14% (%) P_3in 2011. Among the lines, the highest crude protein yield obtained from Turkish origin H_2 line was 25.64% and the lowest obtained from Iraqi origin H_3 was 25.64 %.

Differences between other investigators' findings and findings of this study originates from different origins of vetch (*Vicianarbonensis* L.) lines reacting differently to environmental conditions. Our findings in the study of vetch (*Vicia narbonensis* L.) lines are close to the findings of Çomaklı *et al*. (1999) that were obtained by the application of the different doses of phosphorus to the vetch (*Vicia ervilia* L.).

Number of Grain in Legume: As shown in Table 1.12, when analysis of variance and multiple comparison tests of grain number values at different phosphorus dose levels are examined, year factor is statistically significant (P <0.01).In addition, the interaction between the phosphorus dose levels and the large vetch lines is significant in the large vetch lines (P <0.05). The interaction between phosphorus dose levels and the vetch lines is significant. Therefore, there is a significant difference between the lines (0.01 <P <0.05) in terms of the number of grain per grain at different doses of phosphorus (P <0.005). As seen in Table 1.13, the highest rate of grains obtained from thewas4.53 pcs/ legume obtained from the Turkish origin L_2 line for dose $P_1$and 4.53 pcs/legume obtained from the Lebanese origin L_1 line for doseP_3in 2010, while the lowest rate of grains was 2.60 obtained from the Lebanese origin L_1 line for dose P_k in 2011.Among the lines, the highest number of grain was 3.73 pcs/legume obtained from the Iraqi origin line L_3, while the lowest number of grain was 3.55 pcs/legume obtained from the Turkish origin L_3linen.As seen in table 4.18,in terms of grain number, narbon vetch lines x phosphorus dose interactions is statistically significant (P <0.05). This means that we cannot ignore the phosphorus doses when comparing the lines and the lines while comparing the doses of phosphorus. In such cases, it is necessary to determine the amount of phosphorus appropriate for each line and the vetch line advantageous for each phosphorus dose, by means of multiple comparison tests.

The results of these comparisons are summarized in table 4.20.There is no difference between the number of grains for each fertilizer dose in the Iraqi originL_3 vetch line. Therefore, there is no effect of phosphorus fertilizer doses on IraqiL_3 line. In other words, the effect of all phosphorus fertilizer doses are the same. However, the situation is different on the L_2line of Turkish origin. Because of the interactive effect of both factors, i.e. the vetch lines and phosphorus doses, the grain number of the Turkish originH_2vetch line is to 4.00 pcs / legume. In Lebanese origin L_1 vetch line, an expected increase was observed due to the increased phosphorus doses and the highest number was obtained from P_3dose as 3.93 pcs per legume. In the multiple comparison test conducted on Lebanese origin L_1 large vetch line from Lebanon,P_2 and P_3 doses were in the same group (P <0.05). In the multiple comparison test performed on the Turkish origin L_2 line the P_k and P_1 dose averages were in different groups while the P_2 and P_3doses were in the same group. Phosphorus dose averages of P_k, P_1, $P_2$and P_3were found in the same group in L_3 narbon vetch line of Iraqi origin. Therefore, no effect of phosphorus fertilizer doses was found for the IraqiL_3 line. The interaction between phosphorus dose levels and the vetch lines is significant. Therefore, there is a significant difference between the lines (0.01 <P <0.05) in terms of the number of grains per legume at different doses of phosphorus (P <0.005). Depending on the increase in phosphorus doses applied in the research, the number of grains per legume in the vetch lines ranged from 3.59 to -3.71 / pcs.

The difference between the years is statistically significant at P <0.01 level. The second trial year of the study was more rainy than the first year. Mebarkia *et al*. (2013) observed that the number of grains in the legume for large vetch (*Vicia narbonensis* L.) was 4.94 pcs in the study of where different doses of phosphorus were applied. Seydoşoğlu (2014) and Uzunmehmetoğlu and Kendir (2006) reported that the number of grains in the vetch (*Vicia narbonensis* L.) were between 4.7-5.2 per legume and 3.67-5.33 per legume. The values that were reached in this study by applying different doses of phosphorus and were lower than the grain numbers obtained in the studies of Seydoşoglu (2014) and Uzunmehmetoğlu and Kendir (2006). Differences between the findings of other researches and our findings originate from the varying reactions of the different genotypes of the large vetch to different environmental conditions.

RESULTS

According to the major findings in this study, the positive effects on plant height, number of main branches, weight of seeds, harvest index, grain yield and crude protein ratio characteristics were obtained from the Turkish origin H_2 line, while the positive effects on biological yield, biodegradability, number of grain per grain, seedling rate and phosphorus ratio per grain obtained from the Iraqi origin H_3line originated from Iraq and positive for number of seedlings in plant were obtained from L_1 line originating from Lebanon. According to the findings we obtained in the research; P_1; 4 kg / daP_2O_5 andP_2; 8 kg / da P_2O_5fertilizer doses produced good results. The fertilizer doses after P_2; 8 kg / da P_2O_5were not statistically significant. P_1; 4 kg / da phosphorus can be recommended since it produced good results in both trial years. Where phosphorus is not sufficient in the soil P_2; 8 kg / da can be recommended. As a result, it can be concluded that P_2; 8 kg/da is the highest ratio of the phosphorus fertilizer that could be applied to the large vetch lines to be grwon in Ankara or elsewhere with similar conditions.. It can be said that the fertilizer doses above 8 kg/da will not be economically viable.

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