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## Effects of Inoculation with *Rhizobium* on Seed Yield and Yield Components of Common Vetch (*Vicia sativa* L.)

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**Abstract:** The effects of inoculation with *Rhizobium leguminosarum* on seed yield and yield components of common vetch (*Vicia sativa* L.) were evaluated under Black Sea Coastal Region conditions, Turkey, in the 2001-2002 and 2002-2003 growing seasons using common vetch cultivars Kubilay, Ürem, Karaelçi, Uludağ, Emir, Çubuk and Nilüfer. The experiment was established as a split block design with 3 replications. Inoculation increased seed yield and all yield components of common vetch cultivars. It was observed that inoculated common vetch cultivars gave higher biological yield (8.5%), seed yield (7.6%), straw yield (10.4%), pod length (25.5%), number of seed per pod (16.2%), number of pods (28.4%), main stem length (3.5%) and thousand seed weight (5.5%) compared to non-inoculated cultivars. While the highest biological and straw yields were determined in the inoculated cultivar Kara elçi, the highest seed yield was obtained from the inoculated cultivars Emir. Among the inoculated cultivars Emir had the greatest number of pods, thousand seed weight and the shortest maturity day, and Uludağ showed the highest main stem length and pod length. The highest number of seed per pod was found in the inoculated cultivar Kubilay. Based on these results, the cultivars Emir, Uludağ and Kubilay can be recommended for similar ecological conditions because of their better seed yield and yield components.

**Key Words:** Common vetch, *Vicia sativa* L., inoculation, seed yield

### Rhizobium Aşılmasının Yaygın Fiğ (*Vicia sativa* L.)'in Tohum Verimi ve Verim Öğeleri Üzerine Etkileri

**Özet:** Bu çalışma bakteri aşılmasının yaygın fiğın tohum verimi ve verim öğelerine etkisini belirlemek amacıyla 2001-2002 ve 2002-2003 yılları arasında Karadeniz Bölgesi sahil koşullarında yürütülmüştür. Kubilay, Ürem, Kara elçi, Uludağ, Emir, Çubuk, Nilüfer yaygın fiğ çeşitleri ve *Rhizobium leguminosarum* materyal olarak kullanılmıştır. Deneme bölünmüş parseller deneme desenine göre 3 tekerrürlü olarak kurulmuştur. Bakteri aşılması yaygın fiğ çeşitlerinin tohum verimi ve verim öğelerini önemli derecede artırmıştır. Bakteri aşılması yapılan yaygın fiğ çeşitleri bakteri aşılması yapılmayan çeşitlere göre % 8.5 biyolojik verim, % 7.6 tohum verimi, % 10.4 kes verimi, % 25.5 bakla uzunluğu, % 16.2 baklada tohum sayısı, % 28.4 bakla sayısı, % 3.5 ana sap uzunluğu ve % 5.5 daha fazla bin tane ağırlığa sahip olmuşlardır. En yüksek biyolojik verim ve kes verimi bakteri aşılması yapılan Kara elçi çeşidinde, en yüksek tohum verimi bakteri uygulanan Emir çeşidinde belirlenmiştir. Bakteri aşılması yapılan Emir çeşidi en yüksek bakla sayısı ve bin tane ağırlığına sahip olurken erken hasat olgunluğuna da ulaşan çeşit olmuştur. En yüksek ana sap uzunluğu ve bakla uzunluğu bakteri aşılması yapılan Uludağ çeşidinde bulunmuştur. Bakteri aşılması yapılan Kubilay çeşidi en yüksek baklada tane sayısına sahip olmuştur. Emir, Uludağ ve Kubilay çeşitleri daha iyi tohum verimi ve verim öğelerine sahip olmalarından dolayı benzer ekolojiler için tavsiye edilebilir.

**Anahtar Sözcükler:** Yaygın fiğ, *Vicia sativa* L., bakteri aşılması, tohum verimi

### Introduction

Common vetch (*Vicia sativa* L.) is commonly grown to provide seed and forage under many different farming systems in Turkey and all over the world (DİE, 2004;

FAO, 2005). It is used as a cover crop, green manure, pasture, silage, and hay. Its high dry matter and nitrogen accumulation, and absence of hard seeds make it an excellent winter leguminous cover crop in annual

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vegetable rotations. When planted alone, it provides substantial amount of nitrogen to the following crop (Sattell et al., 1998). However, when first cultivated, the soil may not contain appropriate *rhizobia*, which must be added for adequate nodulation and nitrogen fixation (Somasegaran et al., 1988; Beck, 1992). The success of inoculation is often limited by several factors, including environmental conditions, the number of infective cells applied, and the presence of competing indigenous rhizobia (Brockwell et al., 1995). Therefore, when grown in association with effective and compatible *Rhizobium* strains, it may result in increased symbiotic N fixation having positive effects on yield and yield components (Çakmakçı, 1987).

The aim of this study was to determine the effect of *Rhizobium leguminosarum* inoculation on seed yield and yield components of seven common vetch cultivars (Kubilay, Ürem, Karaelçi, Uludağ, Emir, Çubuk and Nilüfer) under Black Sea Coastal Region conditions, Turkey.

## Materials and Methods

Field studies were conducted at Çarşamba plain of the Black Sea Agricultural Research Institute (41° 21' N Lat., 36° 15' E Long., and 4 m elevation), Turkey. The experiments were carried out during two growing seasons (2001-2002 and 2002-2003). Some major soil characteristics determined by the method described by Rowell (1996) were found as following: the soil texture is clay-loam; pH 7.2; organic matter 2.10%; available P<sub>2</sub>O<sub>5</sub> 57.5 kg ha<sup>-1</sup>; available K<sub>2</sub>O 245 kg ha<sup>-1</sup>. The monthly rainfall for November through June was 94.0, 138.1, 105.4, 35.2, 34.1, 61.9, 10.9 and 53.8 mm in 2001-2002 (533.4 mm total) and 29.7, 71.3, 28.1, 77.8, 73.5, 45.0, 54.7 and 3.3 mm in 2002-2003 (383.4 mm total). The 27-yr mean for the same months is 469.4 mm.

Common vetch cultivars (Kubilay, Ürem, Kara elçi, Nilüfer, Emir, Uludağ and Çubuk) were obtained from the Department of Field Crops the Agricultural Faculty of Ankara University, and they were inoculated with *Rhizobium leguminosarum*, which was obtained from the Soil and Fertilizer Research Institute, Ankara.

The experiment was established using a split block design with 3 replications. Bacteria inoculation was applied in main plots, with common vetch cultivars

constituting subplots. Seeding rate was 100 kg ha<sup>-1</sup>. Individual plot size was 2.1 x 4 m= 8.4 m<sup>2</sup>. Sowing was done by hand on 3 and 5 November, 2001 and 2002 respectively. Bacteria inoculation was mixed with seeds just before seeding; 10<sup>5</sup> live bacteria were added per seed (Halkman, 1991). Nitrogen fertilization was in form of calcium ammonium nitrate (26%) and applied at the rate of 30 kg ha<sup>-1</sup> after sowing to all plots.

Data for morphological components: main stem length, pod length, number of pods, number of seed per pod was taken from 10 randomly selected plants. The plots were harvested at maturity for seed yield in June. Biological yield, straw yield and thousand seed weight were determined after harvest. Significance of the evaluated morphological data was determined through analysis of variance using the SAS statistical software (1998). Means were compared using Duncan's multiple range tests at 0.05 probability level.

## Results and Discussion

The results regarding the yield components of the common vetch cultivars are summarized in Table 1. The results of variance analysis showed that the effects of year, inoculation, cultivar and year x cultivar interactions on biological yield were significant. In the first year, the highest biological yield was obtained from inoculated cultivar Uludağ (8.76 t ha<sup>-1</sup>); in the second year, cultivar Kara elçi had the highest yield (8.83 t ha<sup>-1</sup>) (Table 2). Non-inoculated cultivar Çubuk had the least biological yield in both years (6.50 and 6.44 t ha<sup>-1</sup>, respectively). Because of the different reaction of cultivars to inoculation between the years, year x cultivar interaction was found significant. Previously, it has been found that biological yield varied from 5.82 to 8.05 t ha<sup>-1</sup> in common vetch (Albayrak and Töngel, 2003a).

Year, inoculation and cultivar were significant in seed yield (Table 1). Inoculated cultivar Emir had the greatest seed yield during both years (2.24 and 1.92 t ha<sup>-1</sup> respectively). The least seed yield was obtained from non-inoculated cultivar Kara elçi and cultivar Çubuk (1.20 and 1.34 t ha<sup>-1</sup>, in 2002 and 2003, respectively) (Table 2). It was previously reported that the seed yield ranged from 1.54 to 1.75 t ha<sup>-1</sup> in non-inoculated cultivar Kubilay under the same ecological conditions (Albayrak and Töngel, 2003a, 2003b). Inoculation increases the seed yield of cultivar Kubilay by 8.0-22.7%. Albayrak et al.

Table 1. Source of variation and mean squares for inoculated and non-inoculated common vetch cultivars grown in Samsun during 2001-2003.

Source of variation	df	Biological yield	Seed yield	Straw yield	Pod length	Number of pods	Number of seed per pod	Maturity day	Main stem length	Thousand Seed weight
year (y)	1	757*	48.3*	410	0.03	6.85	0.29	189**	866**	17.19
Rep. x (y)	4	16.72	0.56	11.21	0.35	10.95	2.66	2.77	2.80	2.31
inoculation (i)	1	977*	30.2*	701	36**	201**	100**	25.19**	261*	171**
y x i	1	43.36	5.67	24.22	0.01	2.33	1.14	12.19**	4.98	32*
error 1	4	87.05	2.60	94.85	0.21	1.98	0.26	0.29	18.15	2.81
cultivar (c)	6	274**	71.3**	291**	0.10	15.9**	1.63	216**	90**	125**
y x c	6	149*	4.58	117	0.03	0.38	1.04	14.19**	12.83	2.74
i x c	6	20.1	1.46	21.83	0.07	3.66	0.71	2.44	9.30	1.26
y x i x c	6	26.2	0.42	31.01	0.03	0.52	1.49	0.99	13.23	0.52
error 2	48	52.49	2.14	52.67	0.08	4.41	1.19	1.29	9.29	3.00

\*,\*\* significant at the 0.05 and 0.01 probability levels, respectively.

(2006) reported that the seed yield of common vetch was significantly increased by inoculation under rainfed conditions. Tan and Serin (1995) showed that seed yield of common vetch increased 1.69 to 1.99 t ha<sup>-1</sup> with 15 kg ha<sup>-1</sup> nitrogen fertilization. Kendir (1999) reported that two years average seed yield of common vetch varieties was 1.63 t ha<sup>-1</sup>. In addition, Moneim et al. (1990) pointed out that seed yield of common vetch may vary between 0.93 and 2.37 t ha<sup>-1</sup>. Seed yields found in other studies varied between 0.91 and 2.79 t ha<sup>-1</sup> in common vetch (Tekeli and Ateş, 2002; Karadağ, 2004; Orak and Nizam, 2004). Environmental conditions type and level of inoculation and the cultivars used in the trials could be the possible cause of the variation in seed yields reported in the literature and in the present study.

Straw yield was also affected only by cultivar (Table 1). The highest straw yield was obtained from the inoculated cultivar Uludağ during the first year and inoculated cultivar Kara elçi during the second year (e.g., 6.76 and 7.32 t ha<sup>-1</sup>, respectively). In both years, the lowest straw yield was found with non-inoculated cultivar Çubuk (5.19 and 5.10 t ha<sup>-1</sup> respectively). As an average of both years, the highest straw yield was obtained from inoculated cultivar Kara elçi (6.99 t ha<sup>-1</sup>) (Table 2). It was previously shown that inoculation increased straw yield of common vetch Tan and Serin, (1995). Therefore, the results of this study are consistent with Tan and Serin, (1995).

Pod length was affected only by inoculation (Table 1). In the first year, the longest pod length was measured in the inoculated cultivars Uludağ and Nilüfer (6.63 cm)

while the shortest pod length was found in non-inoculated cultivar Nilüfer (4.90 cm). In the second year, the shortest pod length was found in the non-inoculated cultivars Ürem, Uludağ and Nilüfer (5.03 cm) while the longest pod length was obtained with the inoculated cultivars Uludağ and Emir (6.63 cm). As average of two years, the longest pod length was found in the inoculated cultivar Uludağ (6.63 cm), the shortest pod length was measured in non-inoculated cultivar Nilüfer (4.96 cm) (Table 3). Previous studies showed that pod length ranged from 3.0 to 10.96 cm in common vetch, depending on ecological conditions, cultivars and applications (Yılmaz and Can, 1998; Tekeli and Ateş, 2002; Albayrak and Töngel, 2003b).

Number of pods was affected only by inoculation and cultivar (Table 1). The highest number of pods was obtained from the inoculated cultivar Emir (16.6 and 16.0, respectively), while the least number of pods was obtained from the non-inoculated cultivar Karaelçi (e.g., 9.0 and 9.3, respectively) in both years (Table 3). Orak and Nizam (2004) found that number of pods in common vetch ranged from 7.45 to 18.75. In the other studies, there was a significant variation in the number of pods. For example, Kendir (1999) reported that pod number of common vetch was 23.08 while Açıkgöz et al. (1989) and Atsan (1998) found it as 18.2 and 9.1, respectively.

Inoculation also affected number of seed per pod (Table 1). In the first year, while the greatest number of seeds per pod was obtained from the inoculated cultivar Uludağ (9.7), in the second year, the cultivar Nilüfer had the highest number of seeds per pod (9.3). While the

Table 2. Biological, seed and straw yields in the inoculated and non-inoculated common vetch cultivars.

Cultivars	2001-2002		2002-2003		Average of 2 years		
	Non-inoculated	Inoculated	Non-inoculated	Inoculated	Non-inoculated	Inoculated	mean
Biological yield (t ha <sup>-1</sup> )							
Kubilay	7.65	8.31	6.95	7.67	7.30	7.99	7.65 ac
Ürem	7.80	7.88	6.10	6.47	6.95	7.18	7.07 cd
Kara elçi	7.42	8.25	8.36	8.83	7.89	8.54	8.21 a
Uludağ	7.89	8.76	6.96	8.29	7.43	8.53	7.98 ab
Emir	7.18	8.50	7.09	7.20	7.13	7.85	7.49 bc
Çubuk	6.50	7.59	6.44	6.92	6.47	7.25	6.86 d
Nilüfer	7.37	8.60	6.71	7.01	7.04	7.65	7.35 cd
Mean	7.40 b	8.27 a	6.94	7.48	7.17 b	7.85 a	7.51
Std. deviation	7.40 ± 0.80	8.27 ± 0.64	6.94 ± 0.93	7.48 ± 0.96	7.17 ± 0.89	7.85 ± 0.89	7.51 ± 0.95
Seed yield (t ha <sup>-1</sup> )							
Kubilay	1.88	2.00	1.68	1.79	1.78	1.89	1.83 b
Ürem	1.63	1.78	1.48	1.52	1.55	1.65	1.60 c
Kara elçi	1.20	1.59	1.35	1.50	1.27	1.54	1.41 d
Uludağ	1.79	1.97	1.63	1.67	1.71	1.82	1.77 b
Emir	2.09	2.24	1.83	1.92	1.96	2.08	2.02 a
Çubuk	1.28	1.39	1.34	1.35	1.31	1.37	1.34 d
Nilüfer	1.57	1.67	1.42	1.47	1.49	1.57	1.53 c
Mean	1.63 b	1.81 a	1.53	1.60	1.58 b	1.70 a	1.64
Std. deviation	1.63 ± 0.33	1.81 ± 0.30	1.53 ± 0.19	1.60 ± 0.21	1.58 ± 0.27	1.70 ± 0.28	1.64 ± 0.28
Straw yield (t ha <sup>-1</sup> )							
Kubilay	5.77	6.40	5.27	5.87	5.52	6.14	5.83 bc
Ürem	6.17	6.10	4.62	4.95	5.40	5.52	5.46 c
Kara elçi	6.20	6.66	7.00	7.32	6.60	6.99	6.80 a
Uludağ	6.09	6.76	5.32	6.62	5.71	6.69	6.20 b
Emir	5.97	6.25	5.25	5.27	5.11	5.76	5.43 c
Çubuk	5.19	6.20	5.10	5.57	5.14	5.88	5.51 c
Nilüfer	5.80	6.62	5.29	5.54	5.54	6.08	5.81 bc
Mean	5.88 b	6.43 a	5.41	5.88	5.57	6.15	5.86
Std. deviation	5.88 ± 0.79	6.43 ± 0.64	5.41 ± 0.92	5.88 ± 0.97	5.57 ± 0.86	6.15 ± 0.86	5.86 ± 0.90

Means followed by the same letter(s) and column(s) are not significantly different at P = 0.05 level

non-inoculated cultivar Karaelçi had the least number of seeds per pod during the first year (6.7), non-inoculated cultivar Çubuk had the least number of seeds per pod during the second year (6.7). As an average of inoculation applications, the highest number of seeds per pod was obtained from the cultivar Kubilay (9.2) (Table 3). Orak and Nizam (2004) indicated that number of seeds per pod in common vetch were between 5.23 and 6.33.

The results of the variance analysis showed that the effects of year, inoculation, cultivar, year x inoculation, and year x cultivar interactions on maturity were significant. The earliest harvest was done in the inoculated cultivar Emir in both years (200 days). The latest harvest was realized in the non-inoculated cultivar Kara elçi in both years (219 and 213 days, respectively) (Table 4). Maturity period in common vetch varied from

Table 3. Pod length, pod number and seed number per pod in the inoculated and non-inoculated common vetch cultivars.

Cultivars	2001-2002		2002-2003		Average of 2 years		
	Non-inoculated	Inoculated	Non-inoculated	Inoculated	Non-inoculated	Inoculated	mean
Pod length (cm)							
Kubilay	5.36	6.56	5.30	6.50	5.33	6.53	5.93
Ürem	5.20	6.33	5.03	6.30	5.11	6.31	5.71
Kara elçi	5.13	6.36	5.26	6.56	5.20	6.46	5.83
Uludağ	5.23	6.63	5.03	6.63	5.13	6.63	5.88
Emir	5.43	6.50	5.23	6.63	5.33	6.56	5.95
Çubuk	5.20	6.43	5.06	6.26	5.13	6.35	5.74
Nilüfer	4.90	6.63	5.03	6.46	4.96	6.55	5.75
Mean	5.21 b	6.49 a	5.13 b	6.48 a	5.17 b	6.48 a	5.83
Std. deviation	5.21 ± 0.33	6.49 ± 0.24	5.13 ± 0.31	6.48 ± 0.32	5.17 ± 0.32	6.48 ± 0.28	5.83 ± 0.72
Number of pods							
Kubilay	12.0	15.3	12.3	14.6	12.1	15.0	13.5 ab
Ürem	10.6	14.6	10.3	13.6	10.5	14.1	12.3 bc
Kara elçi	9.0	12.6	9.3	12.0	9.1	12.3	10.7 c
Uludağ	12.3	13.3	11.6	12.6	12.0	13.0	12.5 bc
Emir	13.0	16.6	11.6	16.0	12.3	16.3	14.3 a
Çubuk	11.1	14.0	10.3	12.6	10.6	13.3	12.0 bc
Nilüfer	9.6	15.0	10.3	13.6	10.0	14.3	12.1 bc
Mean	11.1 b	14.5 a	10.8 b	13.6 a	10.9 b	14.0 a	12.5
Std. deviation	11.1 ± 2.11	14.5 ± 2.42	10.8 ± 1.98	13.6 ± 2.24	10.9 ± 2.03	14.0 ± 2.35	12.5 ± 2.68
Number of seeds per pod							
Kubilay	7.7	9.3	7.0	9.0	7.3	9.2	8.2
Ürem	7.3	8.7	7.3	8.3	7.3	8.5	7.9
Kara elçi	6.7	7.7	7.0	8.3	6.8	8.0	7.4
Uludağ	8.0	9.7	7.7	8.3	7.8	9.0	8.4
Emir	7.3	9.3	8.3	7.3	7.8	8.3	8.0
Çubuk	7.3	8.3	6.7	8.7	7.0	8.5	7.7
Nilüfer	8.0	8.0	8.3	9.3	8.2	8.7	8.4
Mean	7.5 b	8.7 a	7.5 b	8.5 a	7.4 b	8.6 a	8.0
Std. deviation	7.5 ± 0.98	8.7 ± 1.23	7.5 ± 1.28	8.5 ± 0.87	7.4 ± 1.13	8.6 ± 1.06	8.0 ± 1.22

Means followed by the same letter(s) and column(s) are not significantly different at P = 0.05 level

209 to 228 days depending on ecological conditions and cultivars used (Albayrak and Töngel, 2003b).

Main stem length was affected by year, inoculation and cultivar. It was determined that the inoculated cultivar Uludağ showed longest main stem length in both years (115.2 and 104.8 cm, respectively). The shortest main stem lengths were obtained with the cultivar Kubilay (102.4 cm) in the first year and cultivar Urem

(93.03 cm) in the second year. Both of them were non-inoculated cultivars (Table 4). Main stem length in common vetch varied from 58.0 to 133.7 cm depending on ecological conditions and applications (Yılmaz and Can, 1998).

Thousand seed weight was also affected by year, inoculation, cultivar and year x cultivar. Inoculation resulted in increases in both years. As average of two

Table 4. Maturity day, main stem length and thousand seed weight in the inoculated and non-inoculated common vetch cultivars.

Cultivars	2001-2002		2002-2003		Average of 2 years		
	Non-inoculated	Inoculated	Non-inoculated	Inoculated	Non-inoculated	Inoculated	mean
Maturity day							
Kubilay	212	210	209	207	210	209	209 c
Ürem	211	211	208	207	209	209	209 c
Kara elçi	219	219	213	211	216	215	215 a
Uludağ	210	211	208	206	209	208	209 c
Emir	201	200	203	200	202	200	201 e
Çubuk	213	211	211	209	212	210	211 b
Nilüfer	210	209	207	205	208	207	207 d
Mean	211	210	208 a	206 b	209 a	208 b	209
Std. deviation	211 ± 4.6	210 ± 5.3	208 ± 3.3	206 ± 3.6	209 ± 4.1	208 ± 4.8	209 ± 4.5
Main stem length (cm)							
Kubilay	102.4	106.5	97.96	102.9	100.1	104.7	102.4 cd
Ürem	103.3	106.5	93.03	100.9	98.10	103.7	100.9 d
Kara elçi	107.5	106.5	101.5	104.1	104.5	105.3	104.9 bc
Uludağ	108.0	115.2	102.4	104.8	105.2	110.0	107.6 a
Emir	106.0	112.6	102.5	104.8	104.2	108.7	106.4 ab
Çubuk	107.2	106.8	98.30	103.7	102.7	105.2	104.0 bc
Nilüfer	104.3	105.8	94.30	96.80	99.30	101.3	100.3 d
Mean	105.5 b	108.5 a	98.60	102.6	102.0 b	105.6 a	103.8
Std. deviation	105.5 ± 3.6	108.5 ± 4.7	98.6 ± 3.9	102.6 ± 3.5	102.0 ± 5.1	105.6 ± 5.1	103.8 ± 5.3
Thousand seed weight (g)							
Kubilay	50.0	54.3	50.3	53.0	50.1	54.0	52.0 b
Ürem	50.0	54.0	50.3	52.6	50.1	53.3	51.7 b
Kara elçi	55.0	58.0	54.6	56.0	54.8	57.0	55.9 a
Uludağ	45.0	49.0	46.0	48.0	45.5	48.5	47.0 d
Emir	55.0	60.3	54.3	55.6	54.6	58.0	56.3 a
Çubuk	52.0	55.6	52.0	53.0	52.0	54.3	53.1 b
Nilüfer	48.3	52.0	50.0	50.6	49.1	51.3	50.2 c
Mean	50.7 b	54.7 a	51.1 b	52.7 a	50.9 b	53.7 a	52.3
Std. deviation	50.7 ± 3.7	54.7 ± 3.9	51.1 ± 3.0	52.7 ± 2.9	50.9 ± 3.3	53.7 ± 3.5	52.3 ± 3.7

Means followed by the same letter(s) and column(s) are not significantly different at P = 0.05 level

years, while the highest thousand seed weight was obtained from the inoculated cultivar Emir (58.0 g), and the least thousand seed weight was obtained from the non-inoculated cultivar Nilüfer (49.1 g) (Table 4). Different thousand seed weight for common vetch is reported by Tekeli and Ateş (2002) as 49.1- 65.1 g, and Albayrak and Töngel, (2003a) as 53.2-69.5 g. Differences in thousand seed weight can be attributed to

the genotypes used in the corresponding studies (Kendir, 2000; Albayrak and Töngel, 2003a).

### Conclusion

Inoculation increased seed yield and all yield components of common vetch cultivars under Black Sea Coastal Region conditions in Turkey. It was observed that

the inoculated common vetch cultivars gave higher biological yield (8.4%), seed yield (7.6%), straw yield (10.4%), pod length (25.5%), number of seed per pod (16.2%), number of pods (28.4%), main stem length (3.5%) and thousand seed weight (5.5%) compared to the non-inoculated cultivars. While the highest biological and straw yields were determined in the inoculated cultivar Kara elçi, the highest seed yield was obtained from the inoculated cultivars Emir. The inoculated cultivar Emir exhibited the highest number of pods,

thousand seed weight and the shortest maturity day. The inoculated cultivar Uludağ showed the highest main stem length, while the inoculated cultivar Uludağ had the highest pod length. Among the cultivars tested, the inoculated cultivar Kubilay had the greatest number of seed per pod. Based on these results, the cultivars Emir, Uludağ and Kubilay can be recommended for similar ecological conditions because of their high seed yield and yield components.

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