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DETERMINATION OF SEED YIELD AND ITS SOME CHARACTERS OF SOME HUNGARIAN VETCH (*VICIA PANNONICA* CRANTZ.) GENOTYPES

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Abstract
The study was conducted between 2015-2017 at Tekirdağ Namık Kemal University, Agriculture Faculty, Field Crops Department, Research and Experimental Area and Atatürk Soil, Water and Agricultural Meteorology Research Institute Research and Experimental Area (Kırklareli) in randomized block design with three replications. Five Hungarian vetch genotypes (cv. Egebeyazı and cv. Sarıefe, 47.1, 47.2, 56.3 lines) were used as material. Plant height (cm), number of branches per plant (pcs), number of pods per plant (pcs), number of seeds per pod (pcs), thousand seed weight (g), seed yield (t ha-1) were determined. The characters which were determined in the study varied between; plant height 76.50-97.97 cm, number of branches per plant 3.87-5.08 pcs, number of pods per plant 17.20-24.35 pcs, number of seeds per pod 3.77-5.47 pcs, thousand seed weight 32.08-39.15 g, seed yield 0.70-1.08 t ha-1. According to seed yield results 56.3 and 47.2 genotypes can be grown for seed in Tekirdağ, Kırklareli and similar ecological conditions.

Keywords: Hungarian Vetch, Seed Yield, Thousand Seed Weight, Vicia Pannonica Crantz.

1. INTRODUCTION

Legume family (*Fabaceae*), with its 727 genera and 19325 species (Lewis et al., 2005), is the largest family after orchid (*Orchidaceae*) and aster (*Asteraceae*) families in the plant kingdom. Legume family, which includes species with great differences in morphological and agricultural characters, has spread all over the world with its annual, biannual and perennial species (Tekeli and Ates, 2011). Annual legumes are utilized in the form of herbage, hay, forage meal, grain, straw and silage, while some of them are suitable for grazing as well (Mihailović et al., 2007). Indeed, forage legumes have an important place in animal feeding and nutrition (Ates, 2015). The vetch species (*Vicia* sp.) in this family constitute the most common group among cultivated annual forage legumes. There are about 150-190 vetch species, most of which are grown in temperate regions of the old world covering Asia, Europe and Africa (ILDIS,1999). The flora of Turkey also possesses 59 vetch species (Davis and Plintman, 1970). A total of 35 taxa, including 23 species and 10 subspecies and 10 varieties belonging to the vetch genus, are located in the Thrace Region of Turkey (Orak et al., 2017). Hungarian Vetch (*Vicia pannonica* Crantz.) is a winter-hardy (-16°C) legume species, which is widely used in Thrace region with cool winter growing conditions. It has satisfactory forage yields with tiny plentiful and palatable leaves, and good quality hay with high crude protein (CP) (Tuna and Orak, 2007; Unal et al., 2011). Hungarian vetch is generally recommended in dry regions, its seed yield was very low and varied greatly depending on the

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amount and distribution of spring rains in such regions (Uzun et al., 2004). The aim of this study was to determine the seed yield and its some characters of some Hungarian vetch genotypes in Tekirdağ and Kırklareli ecological conditions.

2. MATERIALS AND METHODS

This study was conducted between 2015-2017 at Tekirdağ Namık Kemal University, Agriculture Faculty, Field Crops Department, Research and Experimental Area and Atatürk Soil, Water and Agricultural Meteorology Research Institute Research and Experimental Area (Kırklareli) in randomized block design with three replications. Soil properties and climatic parameters belonging to experimental areas are given in Tables 1, 2, 3 and 4. The total precipitations in first year were 280.0 mm at Tekirdağ, 311.2 mm at Kırklareli while the second year 502.7 mm at Tekirdağ, 438.8 mm at Kırklareli. The long term precipitations were 472.5 mm at Tekirdağ and 461.3 mm at Kırklareli. The mean temperatures in first year were 14.4 °C at Tekirdağ, 13.3 °C at Kırklareli while the second year 11.8 °C at Tekirdağ, 11.2 °C at Kırklareli. The long term mean temperatures were 12.1 °C at Tekirdağ and 11.4 °C at Kırklareli.

Table 1. Soil properties of Tekirdağ experimental area*

	Quantity	2015-2016	2016-2017
pH		7.50	7.58
Lime	**%**	0.60	0.65
Organik Matter	**%**	1.50	1.71
Nitrogen (N)	**%**	0.12	0.14
Phosphorus (P)	**(ppm)**	7.80	8.92
Potassium (K)	**(ppm)**	282.51	296.49
Calcium (Ca)	**(ppm)**	3292.3	3440.1
Magnesium (Mg)	**(ppm)**	115.64	117.31
Iron (Fe)	**(ppm)**	7.02	6.98
Copper (Cu)	**(ppm)**	1.5	1.6
Zinc (Zn)	**(ppm)**	1	1
Manganese (Mn)	**(ppm)**	19.51	19.63

*Soil samples analyses were performed by Tekirdağ Commodity Exchange laboratories.

Table 2. Soil properties of Kırklareli experimental area*

Years	ph	Lime (%)	Organic Matter (%)	$P_2 0_5$ (kg/da)	K_2O (kg/da)
2015-2016	7.60	0.38	1.42	22.62	39.76
2016-2017	7.71	0.26	1.95	33.23	100.81

*Soil samples analyses were performed by Atatürk Soil, Water and Agricultural Meteorology Research Institute laboratories.

Two Hungarian vetch varieties (Sarıefe and Egebeyazı) and three lines (47.1, 47.2 and 56.3) were used as seed material in the experiments. The seeds were sown at a rate of 80 kg ha^{-1} (Tekeli and Ates, 2011) on 5.11.2015 and 03.11.2016. The plots consist of four rows of 5 m length with 25 cm row spacing. The area was cultivated before the sowing and basal fertilizer containing N and P (40 kg ha^{-1}) was incorporated into the soil. Weed control was done by hand. To determine the seed yield harvest was made by hand at maturity stage of Hungarian vetch. Plant height (cm), number of branches per plant (pcs), number of pods per plant (pcs), thousand seed weight (g), seed yield (t ha^{-}

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[1]) were determined. The some morphological characters were determined in five plants, which were chosen from plots randomly (Ranilli et al. 1998; Açıkgöz, 2001; Tenikecier et al., 2017).
The results of the study were analyzed with TARIST statistical programmer for statistical analyses of the means (Açıkgöz et al. 1994). Mstat-C programmer was used for the comparison test (Fisher's Least Significant Difference, LSD) of the means (Düzgüneş et al. 1987).

Table 3. Climate Conditions of Tekirdağ Experimental Area (2015-2016, 2016-2017 and long term)

Months	Monthly Total Precipitation (mm)			Mean Realtive Humudity (%)			Mean Temperature (°C)		
	2015 2016	2016 2017	Long Term	2015 2016	2016 2017	Long Term	2015 2016	2016 2017	Long Term
November	18.6	107.4	75.4	81.3	83.1	83.7	13.8	11.5	11.0
December	0.7	43.1	81.5	80.6	80.7	83.6	7.5	3.8	7.1
January	70.7	107.0	68.8	80.3	84.5	84.1	5.4	1.9	4.7
February	69.2	38.8	54.1	85.5	81.8	82.1	9.8	6.4	5.4
March	31.7	32.1	54.4	81.3	82.5	81.2	10.3	9.0	7.3
April	25.4	61.1	40.9	72.8	77.7	78.8	15.6	11.1	11.8
May	28.1	16.7	36.7	75.3	76.5	77.3	17.8	16.8	16.8
June	35.5	44.3	37.9	72.8	78.1	74.2	23.6	21.9	21.3
July	0.1	52.2	22.8	67.0	69.7	70.6	25.5	24.1	23.8
Mean				*77.4*	*79.4*	*79.5*	*14.4*	*11.8*	*12.1*
Total	*280.0*	*502.7*	*472.5*						

Table 4. Climate Conditions of Kırklareli Experimental Area (2015-2016, 2016-2017 and long term)

Months	Monthly Total Precipitation (mm)			Mean Realtive Humudity (%)			Mean Temperature (°C)		
	2015 2016	2016 2017	Long Term	2015 2016	2016 2017	Long Term	2015 2016	2016 2017	Long Term
November	31.9	42.2	66.0	79.7	77.4	83.1	12.7	9.9	9.0
December	0.0	10.4	69.4	80.9	73.2	84.0	5.5	1.3	5.0
January	97.2	63.8	61.5	82.9	83.1	84.4	3.5	-0.4	3.0
February	29.0	60.3	50.9	85.4	83.1	79.8	9.2	4.9	4.1
March	20.9	44.0	46.7	79.1	80.3	76.9	9.4	9.3	6.9
April	46.0	75.8	44.9	66.6	70.1	73.2	15.1	11.6	12.1
May	50.6	43.8	49.6	73.5	71.9	68.9	17.0	17.5	17.3
June	26.2	27.8	26.2	64.5	70.2	65.3	23.3	22.4	21.6
July	9.4	70.7	24.6	61.1	63.0	60.4	24.6	24.4	23.9
Mean	-	-	-	*74.9*	*74.7*	*75.1*	*13.3*	*11.2*	*11.4*
Total	*311.2*	*438.8*	*461.3*	-	-	-	-	-	-

3. RESULTS AND DISCUSSIONS

The plant height, number of branches per plant, number of pods per plant, number of seeds per pod, thousand seed weight and seed yield of some Hungarian vetch genotypes were given in Table 5. Plant height, number of pods per plant, number of seeds per pod, thousand seed weight and seed yield were affected by location at P<0.01, and number of branches per plant at P<0.05. Number of branches per plants and thousand seed weights of the Hungarian vetch genotypes were determined significant at P<0.01 and seed yield was at P<0.05. Genotypes were not affected by plant height, number of pods per plant, number of seeds per pod and thousand seed weight (P>0.05). There were no significant (P>0.05) differences in locationxgenotype interaction on all characters of the study.

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Plant height is the most effective character for seed and forage yield and depends on genotype, climate and soil conditions and other ecological factors (Ates, 2011). The highest plant height was measured at Kırklareli (93.17 cm). One of the factors affecting the forage yield and quality traits of forage legumes is the number of branches/plant (Tenikecier, 2020). The highest number of branches per plant was determined at Tekirdağ (4.54 pcs). The number of branches per plant were varied 4.07 pcs to 4.77 pcs and the highest was in 47.1 genotype. The number of pods per plant, which is a morphological character that directly affects the seed yield. Thousand seed weight, which is another factor affecting seed size and thus seed yield, is also very important in terms of good germination and strong seedling formation as well as its effect on high seed yield. Seeds which have high thousand seed weight; have high storage nutrients and strong embryos, they allow the formation of strong seedlings by germinating rapidly (Tenikecier, 2020). The highest number of pods per plant (22.81 pcs), number of seeds per pod (5.14 pcs) and seed yield (0.97 t ha^{-1}) were determined in Kırklareli. The highest thousand seed weight (37.07g) was determined in Tekirdağ. The seed yields of the Hungarian vetch genotypes varied between 0.72-0.97 t ha^{-1}. The highest seed yields were determined in 56.3 (0.97 t ha^{-1}) and 47.2 (0.91 t ha^{-1}) genotypes.

Table 5. Seed Yield and its some characters of some Hungarian vetch genotypes

Genotypes	***Tekirdağ***	***Kırklareli***	*Genotype*	***Tekirdağ***	***Kırklareli***	*Genotype*
	Plant Height (cm)			***Number of Branches per Plant (pcs)***		
47.2	83.13	89.12	86.12	4.28	4.62	4.45b
Sarıefe	80.13	94.92	87.52	4.30	3.98	4.14c
Egebeyazı	76.50	97.97	87.23	4.28	3.87	4.07c
56.3	79.88	89.80	84.84	4.73	4.42	4.57ab
47.1	76.73	94.07	85.40	5.08	4.47	4.77a
Location	79.28b	93.17a	*86.22*	4.54a	4.27b	*4.40*
LSD	Location: 3.411** Genotype: ns Location x Genotype: ns			Location: 0.206* Genotype: 0.310** Location x Genotype: ns		
	Number of Pods per Plant (pcs)			***Number of Seeds per Pod (pcs)***		
47.2	19.04	24.35	21.70	4.13	4.88	4.51
Sarıefe	17.20	24.18	20.69	3.95	5.08	4.52
Egebeyazı	20.35	22.08	21.22	3.77	5.08	4.42
56.3	21.66	20.92	21.29	4.23	5.20	4.72
47.1	19.05	22.53	20.79	4.50	5.47	4.98
Location	19.46b	22.81a	*21.13*	4.12b	5.14a	*4.63*
LSD	Location: 1.762** Genotype: ns Location x Genotype: ns			Location: 0.305** Genotype: ns Location x Genotype: ns		
	Thousand Seed Weight (g)			***Seed Yield (t ha $^{-1}$)***		
47.2	37.10	35.75	36.42	0.75	1.08	0.91a
Sarıefe	39.15	35.58	37.37	0.75	0.97	0.86ab
Egebeyazı	35.60	35.42	35.51	0.70	0.75	0.72b
56.3	36.27	32.08	34.17	0.91	1.02	0.97a
47.1	37.22	34.17	35.69	0.71	0.96	0.84ab
Location	37.07a	34.60b	*35.83*	0.76b	0.96a	*0.86*
LSD	Location: 1.261** Genotype: ns Location x Genotype: ns			Location: 0.092** Genotype: 152* Location x Genotype: ns		

*: P<0.05; **P<0.01, ns: non significant

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Orak (2000) stated that the means of the 22 different hungarian vetch genotypes plant height, number of branches, number of pods per plant, 1000 seed weight and seed yield, 93.88 cm, 3.15 pcs, 13.45pcs, 29.21 g and 0.70 t ha^{-1} at Tekirdağ ecological conditions. Orak and Nizam (2003) determined the number of seeds per pod 4.12-4.98 pcs, thousand seed weight 22.79-33.22 g and seed yield 0.68-0.97 t ha^{-1} respectively. Orak et al. (2004) determined plant height 4.66-90.66 cm, and stem numbers per plant 2.50-6.00 pcs for Hungarian vetch genotypes. Uzun et al., (2004) determined the plant height 78.0-81.3 cm, number of pods per plant 27.7-43.9 pcs, thousand seed weight 35.3-38.3 g and seed yield 0.50-1.40 t ha^{-1} respectively. Sayar et al., (2010), determined the number of pods per plant 19.60-30.33 pcs, number of seeds per pod 4.26-5.40 pcs, thousand seed weight 33.15-37.50 g and seed yield 0.68-0.99 t ha^{-1} in Diyarbakır ecological conditions. Nizam et al (2011) emphasized that the seed yields of 7 different Hungarian vetch genotypes varied 0.54 to 0.76 t ha^{-1} at 3 different locations of Thrace Region of Turkey. Unal et al., (2011) determined the main stem length 40.4 cm, pod number per plant 7.5 pcs, seed number per pod 0.82 pcs and seed yield 0.59 t ha^{-1}. Sayar et al., (2013) reported seed yield of 12 different Hungarian vetch genotypes between 0.46-1.10 t ha^{-1} at 5 different location in Southeastern Anatolia Region of Turkey. Sayar et al (2014) determined the number of pods per plant, thousand seed weight and seed yield in Hungarian vetch between 8.93-24.93, 32.75-47.65 g and 0.55-0.87 t ha^{-1} respectively. Naydenova and Aleksieva (2014) determined number of seeds per pod 2.2-4.2 pcs, thousand seed weight 17.3-34.7 g. Our results are similar to these researchers.

4. CONCLUSIONS

Its concluded that the highest plant height, number of pods per plant, number of seeds per pod and seed yield were determined in Kırklareli. In adddition the highest number of branches per plant and thousand seed weight were determined in Tekirdağ. One of the factors affecting the forage yield and quality traits of forage legumes is the number of branches/plant and the highest was determined in '47.1' genotype. High forage and grain yield is desired in forage crop cultivation. It is even more important that the grain yield is high in coarse-grained forage legumes which seeds are also used in animal nutrition. As a result, in the province where the study was conducted and in regions with similar climatic conditions, when the aim was to produce grain from Hungarian vetch '47.2' and '56.3' genotypes can be recomended.

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