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Effects of Potassium Doses on Yield and Important Agricultural Properties of Mung Bean [*Vigna radiata* (L.) Wilczek] Genotypes

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HIGHLIGHTS

- Potassium is a macro element with important metabolic effects in plants.
- Mung bean is an uncommon but important legume.
- Potassium fertilizer had significant effects on some agronomic properties of the mung bean.

Abstract

The present study was conducted to determine the effects of potassium doses applied to mung bean [*Vigna radiata* (L.) Wilczek] genotypes on seed yield and important yield components. A field trial was carried out in 2020 in the Prof. Dr. Abdülkadir AKÇİN experimental fields belonging to Faculty of Agriculture located in Alaaddin Keykubat Campus. The study consisted of a total of 45 plots with 3 replications by applying 5 potassium doses (0, 10, 20, 30, 40 kg/da K_2SO_4) on 3 mung bean genotypes (Ermenek, Turkmenistan, Aşağıçağlar) and was planned according to the Factorial Trial Design in Random Blocks. According to the results of the analysis of variance, the difference between genotypes was statistically significant in terms of seed yield, while the difference between potassium doses was statistically significant in terms of protein content. According to the results of the research, the highest seed yield was obtained from the Aşağıçağlar genotype with 20.57 g/plant as the average of the potassium doses, and the plots that were applied 20 kg/da of potassium (18.16 g/plant) as the average of the genotypes. Similarly, the highest protein content was obtained from the Ermenek genotype (25.18%) and the plots (25.47%) treated with 10 kg da^{-1} potassium. As an average of potassium doses, the Aşağıçağlar genotype came to the forefront in terms of important yield factors such as thousand seed weight (69.13 g), plant height (54.52 cm) and first pod height (26.09 cm).

Keywords: Mung bean genotypes, Potassium doses, Protein yield, Seed yield

1. Introduction

Turkiye has rich ecological and biological diversity due to its location. This rich ecology, in which almost every climate type is observed, allows many crops to be grown. From this point of view, it is necessary to emphasize the importance of mung beans, which are grown in different parts of the world and locally grown in small areas in our country, in addition to known edible legumes.

Plants provide an important part of human nutrition and, depending on the plant species, the roots, tubers, stems, leaves, flowers, fruits and seeds of the plant are used. Legumes are one of the largest families in terms

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of the number of species (Ülker and Ceyhan 2008; Varankaya and Ceyhan 2012; Harmankaya et al. 2009; Harmankaya et al. 2010; Harmankaya et al. 2016; Kahraman 2022a). The availability of protein and starch in sufficient proportions, together with fiber, vitamins and microelements, has made legumes an important source of nutrients and the focus of attention. The added value of legumes can be increased by physically breaking them down into essential components such as protein, starch and fiber and using these products as additives to increase the nutritional value of the food (Ceyhan 2004; Ceyhan et al. 2014; Doruk Kahraman and Kahraman 2023). Therefore, legumes are important for the sustainability of food safety (Onder et al., 2011; Kahraman 2022b; Küçük and Ceyhan 2022; Tamüksek and Ceyhan 2022; Tekin and Ceyhan 2022).

Vigna radiata is called mung bean, green gram, golden gram, Oregon pea in English and mung in Turkiye. Its synonym is *V. aureus* Roxb (Bozoğlu and Topal 2005). Mung bean [*Vigna radiata* (L.) Wilczek] is one of the most important edible legumes in the genus *Vigna* (Toker et al. 2002; Kahraman et al. 2015).

Mung bean [*Vigna radiata* (L.) Wilczek] has been cultivated in India since ancient times. It is still widely cultivated in Southeast Asia, Africa, South America and Australia. Some sources even say that it was grown as a "Chickasaw pea" in America in the 1835s. It is also named after green gram, golden gram and chop suey bean. Mung beans are generally grown for human consumption, but their green residues are also used as animal feed (Oplinger et al. 1990).

The mung bean, which shows temperate climate characteristics, is locally called "Meş" in the Karaman Region, is grown in places with approximately 335 mm of precipitation and an altitude of 550-600 meters, and mostly in the villages near the Göksu River in the Ermenek district of Karaman, but not in the highland areas, usually soup, rice, börek. It is known that the above-ground parts are other than seeds are used in animal nutrition (Dalkılıç 2010).

In terms of its plant characteristics, the mung bean is a small, branched, hairy, herbaceous, annual, up right and semi-upright growing plant that can reach 25-125 cm in length. The leaves are broad, opposite on the plant and in the form of three leaves, generally oval and have a narrow leaf in the emergence period. Petiole is long and oval.

Its flowers are large, yellow and brown in color. The flower stalks are 2-10 cm long on the main stem and branches, and there are 5-15 flowers in bunches on each hill. The flowers are largely self-pollinated. The pods are long, narrow and turn gray, brown or black in the ripening period. Each pod contains 10-15 spherical and elliptical seeds. The pods may be widely hairy or glabrous. Seed testa is usually green or yellow, sometimes brown or blackish, flat, shiny or dull. 100 seeds weigh 2-8 grams (Anonymous 1981; 1982; 1983).

According to Jomduang (1985), mung beans contain 23.67% protein, 1.44% fat and 71.82% carbohydrates. On a dry weight basis, mung beans contain 25.0-28.0% protein, 1.0-1.5% fat, 3.5-4.5% cellulose, 4.5-5.5% ash and 62.0-65.0% carbohydrates. However, the protein content varies between 19.0-29.0% depending on the genotype and environmental conditions. In addition to being nutritious as a legume, it is obvious that a more balanced diet will be provided if consumed with grains (Doruk Kahraman and Gokmen 2021).

Mung bean is produced for reasons such as the use of green vegetables and sprouts as a salad in human nutrition, the high protein content of its seeds and its easy digestibility. Its wide adaptability, drought tolerance, high lysine content and ability to prevent gas collection in the stomach are other important features. It is widely grown commercially in Asia, Australia, West India, South America, and tropical and subtropical Africa (Anonymous 1988). In addition, mung bean can fix 58-109 kg/ha nitrogen in the soil thanks to its symbiotic relationship with the *Bradyrhizobium japonicum* bacterium (Singh and Singh 2011).

The newly developed varieties are cultivated on an area of approximately 3 million ha in Bangladesh, Bhutan, China, India, Myanmar, Nepal, Pakistan, Sri Lanka and Thailand. The Philippines and Indonesia are the main producing countries (Mogotsi 2006).

Numerous studies have been conducted on mung beans in the world and our country. Akdağ (1995) determined the seed yield per plant as 4.99-5.16 g, the plant height as 28-45 cm, the number of pods per two as 12-35 and the weight of one thousand seeds as 35-38 g. In different studies, the seed yield was 109 kg da^{-1} (Sharar et al. 1999), 89.7 kg da^{-1} (Ahmad 2001), 72-92 kg da^{-1} (Ihsanullah et al. 2002) and 24.06 g/plant (Dalkılıç 2010) differ. In the ecology of Konya, where the research was conducted, in previous years (Dalkılıç 2010), the protein ratio as the medium of varieties and applications is 27.32%, the weight of a thousand seeds is 47.42 g, the number of pods is 14.45, the number of leaves is 21.99, the number of main branches is 6.98, the plant height is 40.92 cm, the first pod height 8.09 cm, flowering period 58.97 days, pod binding time 61.61 days and vegetation period 133.44 days. In the same study, the relationships between seed yield and yield components were also examined and important results were obtained. In another study conducted in Konya ecology (Baydemir 2013), the average seed yield was 71.00 kg da^{-1}, the protein rate was 21.59%, the protein yield was 15.44 kg da^{-1}, the weight of a thousand seeds was 51.66 g, the number of pods was 17.51, the number of leaves was 17.49, the number of main branches was 7.15, the plant height was 40.39 cm, the first pod height was 10.39 cm, the flowering period was 73.35 days, the pod binding period was 77.58 days and the vegetation period was 110.48 days.

In Konya, which has the largest agricultural area in Turkey, the chance of different plants to alternate in irrigated areas gradually increases with the gradual introduction of Konya Plain Projects (KOP) and reveals an important production potential (Doruk Kahraman and Gokmen 2022). This research was carried out to determine the effects of potassium doses applied to 3 mung bean genotypes on yield and important yield factors in Konya ecological conditions.

2. Materials and Methods

The mung bean used as a material in the research is an annual, herbaceous, upright or semi-upright small structured, 25-125 cm tall, branched hot climate plant. Their pods are long and narrow and may be brown, bronze, gray or black in maturity. The pods may be pubescent or drooping, pubescent or glabrous. It has small seeds and there are 10-15 round seeds in each pod. Seeds are usually green or yellow, rarely brown or blackish. The leaves are broad, usually oval in the form of 3 leaflets and have a narrow leaf in the emergence period. The flowers are yellow and brown in color and emerge from the seat. Its stems are 2-10 cm long on the main stem and branches, and there are 5-15 flowers in bunches on each hill. Flowers are largely autogamy (Anonymous 1981; Şehirali 1988; Oplinger et al. 1990).

The climate values of the vegetation period of the region where the research was carried out show parallelism with the values of the long years and the values of the year of the research. According to the results of the soil analysis, the pH of the soil of the trial field is 7.48, the organic matter is at a medium level (2.34%), it has a calcareous, clay-loamy texture, poor in iron, and sufficient in terms of other elements.

In the field experiment, 3 different mung bean genotypes (Ermenek, Turkmenistan, Aşağıçağlar) were used and 5 different potassium doses (0, 10, 20, 30, 40 kg/da K2SO4) were applied in Selcuk University Faculty of Agriculture, located in Alaeddin Keykubat Campus, Prof. Dr. Abdülkadir AKÇİN Trial Field with 3 replications. A sufficient amount of base fertilizer was first applied to the seedbed prepared in accordance with the technique, and after the parceling process, the required amount of potassium fertilizer was given with planting. The experiment was formed from 45 plots (3 genotypes x 5 potassium doses x 3 replications). These plots are 2m x 3m = 6m2 in size and the total trial area is 425 m2. Seed sowing was done by hand on April 29, 2020 and 5 rows were planted in each plot. Row spacing in planting is 40 cm. By following the field controls carefully, 4 times of sprinkler irrigation and 3 times hoeing were carried out. Harvesting was done by hand carefully between 23-27 September. In the study, the protein ratio was determined over 2 replications.

In the experiment, seed yield per plant (g/plant), protein ratio (%), protein yield (g/plant), thousand seed weight (g), number of pods (number/plant), number of leaves (number/plant), main branch number (pieces/plant), plant height (cm), first pod height (cm), flowering time (days), pod setting time (days) and vegetation period (days).

3. Results and Discussion

Seed yield varied between 11.06-26.87 g/plant. In the experiment, the difference between genotypes was found to be significant in terms of seed yield per plant (Table 1). As the average of potassium doses, the highest seed yield was obtained from the Aşağıçağlar genotype with 20.57 g/plant, and it entered the "a" group according to the Lsd test. In terms of the average of genotypes, the highest seed yield was obtained from 18.16 g/plant and 20 kg da^{-1} potassium dose (Table 2). When the researchers' findings on seed yield were examined, the results showed parallelism with the findings of Dalkılıç (2010) at 16.13-29.25 g/plant.

Dülgerbaki (2011) found the plant seed yield as 3.37 g/plant, while the seed yield per decare was 78-115.2 kg da^{-1}, Mondal et al. (2012) plant seed yield 7.46-11.57 g/plant, Begum et al. (2013) determined as 21.87-45.35 g/plant. Ecological conditions and different methods applied can be shown among the reasons for this difference between the findings.

The difference between potassium doses in terms of protein ratio was found to be significant (Table 1). The protein ratio varied between 22.53-25.82%. As the average of the genotypes, the highest protein ratio was obtained from the potassium dose of 25.47% and 10 kg/da. When the average of the potassium doses was taken into account, the highest protein ratio was obtained in the Ermenek genotype at 25.18% (Table 2). When the findings of the researchers about the protein ratio were examined; Jomduang (1985) 22% to 25%, Ahmad et al. (2016) reported 23.98% to 25.61%, and Karaman (2019) reported that it varied between 17.34% and 18.69% in the first year of his two-year study, and between 20.93% and 22.99% in the second year.

As can be seen in the examination of Table 1, the difference between the genotypes was found to be significant in terms of protein yield and it varied between 2.77-6.56 g/plant. As an average of potassium doses, the highest protein yield was obtained from the Aşağıçağlar genotype with 5.06 g/plant, and the average of the genotypes was obtained from a potassium dose of 4.52 g/plant and 20 kg/da (Table 2). When the researchers' studies on protein yield are examined; Karaman (2019) reported that the protein yield varied between 15.13 kg da^{-1} and 25.83 kg da^{-1} in the first year of his study conducted in 2017 and 2018, and between 37.33 kg da^{-1} and 55.11 kg da^{-1} in the second year. He stated that genetic structure and especially environmental factors were effective in the difference observed between these years.

Thousand seed weights varied between 52.07-74.78 g and the difference between genotypes was significant (Table 1). As the average of the potassium doses, the highest thousand seed weight was obtained from the Aşağıçağlar genotype with 69.13 g, and the average of the genotypes was obtained from the potassium dose of 64.57 g and 10 kg da^{-1}. As can be seen in Table 2, lower values were determined for the Turkmenistan genotype compared to other genotypes. When the researchers' studies on thousand seed weight are examined; Gebeloğlu and Yazgan (1992) 54.23-82.30 g, Sohail et al. (2016) 42.6-55.6 g, Gül (2019) 35.72-70.64 g, Karaman (2019) reported that it varied between 34.13-50.90 g in the first year of his two-year study, and between 52.65-69.55 g in the second year.

Table 1. Variance analysis summary of investigated traits in the trial

		Mean of Squares			
Sources of Variation	**DF**	**Seed yield**	**Thousand seed weight**	**Number of pods**	**Number of leaves**
Total	44	53,71	74,58	307,60	36,48
Replication	2	145,00	88,71	1471,95	169,99
Genotype (G)	2	178,92*	945,11**	737,85	14,27
Potassium doses (K)	4	15,74	20,54	90,63	9,83
(GxK) int.	8	28,24	22,41	290,45	68,74*
Error	28	50,95	34,01	229,59	23,12
Sources of Variation	**DF**	**Number of branches**	**Plant height**	**First pod height**	**Days to flowering**
Total	44	2,53	115,80	68,69	7,60
Replication	2	12,14	655,09	50,77	3,62
Genotype (G)	2	3,38	467,08**	1080,69**	17,15
Potassium doses (K)	4	1,54	4,91	6,31	1,22
(GxK) int.	8	3,16	92,32	11,01	6,99
Error	28	1,74	74,73	23,09	8,29
Sources of Variation	**DF**	**Days to pod**	**Vegetation length**	**Protein ratio**	**Protein yield**
Total	29	21,44	10,21	1,37	31101,28
Replication	1	35,08	26,29	2,44	44788,40
Genotype (G)	2	157,22**	1,09	2,01	129735,20*
Potassium doses (K)	4	10,74	2,64	2,50*	13600,83
(GxK) int.	8	12,02	8,06	1,68	21373,72
Error	14	14,99	11,41	0,70	26591,81

*%5, **%1 statistically significance level

Table 2. Mean Values and Lsd Groups of the Investigated Characteristics in the Trial

Genotypes	Potassium Doses						Potassium Doses					
	0	**10**	**20**	**30**	**40**	**Mean**	**0**	**10**	**20**	**30**	**40**	**Mean**
	Seed Yield (kg/da)						**Protein Ratio (%)**					
Ermenek	11.06	12.04	13.32	17.90	16.22	**14.11b**	25.11	25.35	25.29	25.20	24.94	**25.18**
Türkmenistan	16.36	14.29	14.30	15.23	15.95	**15.23b**	24.97	25.82	25.56	22.53	22.60	**24.29**
Aşağıçağlar	16.92	21.38	26.87	19.09	18.58	**20.57a**	24.25	25.24	24.44	25.16	23.97	**24.61**
Mean	**14.78**	**15.90**	**18.16**	**17.41**	**16.91**	**16.63**	**24.78abc**	**25.47a**	**25.09ab**	**24.29bc**	**23.84c**	**24.69**
	Protein Yield (kg/da)						**Thousand Seed Weight (g)**					
Ermenek	2.77	3.05	3.36	4.51	4.04	**3.55b**	62.05	66.84	63.43	66.41	62.58	**64.26b**
Türkmenistan	4.08	3.68	3.65	3.43	3.60	**3.69b**	55.62	52.07	53.27	52.35	54.73	**53.61c**
Aşağıçağlar	4.10	5.39	6.56	4.80	4.45	**5.06a**	70.95	74.78	66.18	68.26	65.47	**69.13a**
Mean	**3.65**	**4.04**	**4.52**	**4.24**	**4.03**	**4.10**	**62.87**	**64.57**	**60.96**	**62.34**	**60.93**	**62.33**
	Number of Pods (Piece/Plant)						**Number of Leaf (Piece/Plant)**					
Ermenek	38.20	39.06	39.80	37.47	42.60	**39.43**	13.90bcd	14.50bcd	13.73bcd	15.63bcd	19.40abc	**15.43**
Türkmenistan	54.00	48.05	45.80	57.80	60.77	**53.28**	15.53bcd	16.83a-d	13.10cd	19.33abc	21.67ab	**17.29**
Aşağıçağlar	52.20	38.27	63.53	38.93	29.40	**44.47**	19.67abc	11.87cd	23.87a	14.67bcd	9.70d	**15.85**
Mean	**48.13**	**41.79**	**49.71**	**44.73**	**44.25**	**45.72**	**16.20**	**14.40**	**16.90**	**16.54**	**16.92**	**16.19**

* Separately according to the subjects and applications; There is no statistical difference between the averages denoted by the same letter

Table 2 Continues…

Genotypes	Potassium Doses 0	10	20	30	40	Mean	Potassium Doses 0	10	20	30	40	Mean
	Number of Branches (piece/plant)						**Plant Height (cm)**					
Ermenek	7.80	8.47	7.07	8.00	7.80	**7.83**	45.00	50.65	43.29	49.57	45.79	**46.86b**
Türkmenistan	7.40	6.16	5.93	8.27	6.87	**6.93**	48.35	38.66	39.69	41.58	50.00	**43.66b**
Aşağıçağlar	7.07	6.93	9.53	8.13	6.53	**7.64**	53.87	52.41	63.42	52.76	50.13	**54.52a**
Mean	**7.42**	**7.19**	**7.51**	**8.13**	**7.06**	**7.46**	**49.07**	**47.24**	**48.80**	**47.97**	**48.64**	**48.34**
	Height of First Pod (cm)						**Days to Flowering (day)**					
Ermenek	28.52	32.24	27.67	28.79	26.23	**28.69a**	103.33	100.00	101.00	103.33	101.67	**101.87**
Türkmenistan	14.64	11.01	12.23	12.80	13.64	**12.87b**	102.67	101.67	104.00	102.67	103.00	**102.80**
Aşağıçağlar	26.97	24.82	26.60	28.02	24.06	**26.09a**	102.33	106.00	105.00	103.67	103.00	**104.00**
Mean	**23.37**	**22.69**	**22.17**	**23.20**	**21.31**	**22.55**	**102.78**	**102.55**	**103.33**	**103.22**	**102.55**	**102.89**
	Days to Pod Setting (day)						**Vegetation Length (day)**					
Ermenek	102.67	106.67	107.00	102.67	103.33	**104.47a**	138.00	142.33	139.00	142.00	140.33	**140.33**
Türkmenistan	98.33	99.33	95.67	95.67	101.67	**98.13b**	140.67	139.00	140.67	139.00	142.33	**140.33**
Aşağıçağlar	100.00	100.33	101.00	99.67	99.67	**100.13b**	140.33	142.00	141.33	140.67	139.67	**140.80**
Mean	100.33	102.11	101.22	99.34	101.56	**100.91**	139.67	141.11	140.33	140.56	140.78	**140.49**

* Separately according to the subjects and applications; There is no statistical difference between the averages denoted by the same letter

The differences between genotypes and potassium doses were found to be insignificant in terms of the number of pods (Table 1). The number of pods varied between 29.40-63.53 pieces/plant. The highest number of pods as an average of potassium doses was obtained from the Turkmenistan genotype with 53.28 units/plant, and the average of genotypes was obtained from a potassium dose of 20 kg/da with 49.71 units/plant (Table 2). When the researchers' studies on the number of pods are examined; Gebeloğlu and Yazgan (1992) 11.93-35.20 units/plant, Gul et al. (2007) 32.66-58.66 units, Akgündüz (2016) 31.51-33.29 units, Karaman (2019) 18.70-42.06 units in its first year, 36.88-48.62 units in its second year, Akbay et al. (2020) reported that it varies between 9.43-23.98 units/plant. The reason for the differences between the findings is thought to be the result of the differences in the number of pods caused by different ecologies and cultivars/genotypes.

The number of leaves varied between 9.70-23.87 pieces/plant. Differences between potassium doses x genotype interaction were found to be significant (Table 1). The highest number of leaves (23.87 pieces/plant) was obtained with the Turkmenistan genotype from the potassium dose of 40 kg/da, and the lowest number of leaves (9.70 pieces/plant) was obtained from the potassium dose of 40 kg/da with the Aşağıçağlar genotype (Table 2). As it can be understood from here, it is thought that the genetic structure causes the high number of leaves in the Turkmenistan genotype even though the same potassium dose is applied. When the researchers' studies on the number of leaves are examined; Toker et al. (2002) 12-25 units/plant, Dalkılıç (2010) 21.99 units/plant, Baydemir (2013) 17.49 units/plant, Akbay et al. (2020) reported that it varies between 47.30-73.77 units/plant.

According to the results of the research, the number of main branches varied between 5.93-9.53 pieces/plant. Differences between genotypes and potassium doses were found to be insignificant (Table 1). As the average of potassium doses, the highest number of main branches was obtained from the Ermenek genotype with 7.83 units/plant, and the average of genotypes was obtained from a potassium dose of 30 kg/da with 8.13 units/plant (Table 2). When the researchers' studies on the number of majors are examined; Toker et al. (2002) 3-5 units/plant, Mondal et al. (2012) reported that it varies between 0.69-2.77 units, Dülgerbaki (2011) 10.2-12.0 units/plant, Gölgül (2019) 1.0-2.77 units/plant. The reason why these results differ from our findings is thought to be ecological differences. As a matter of fact, our research results are similar to those of Dalkılıç (2010) and Baydemir (2013), who conducted their research in Konya ecological conditions.

As a result of the measurements, the plant height varied between 38.66-63.42 cm. The difference between genotypes was found to be significant (Table 1). As the average of potassium doses, the highest plant height was obtained from the Aşağıçağlar genotype with 54.52 cm, and the highest plant height was obtained from the control (0 kg da^{-1}) dose with 49.07 cm as the average of the genotypes (Table 2). It is seen that different potassium doses do not have a significant effect on plant height. When the researchers' studies on plant height are examined; Gebeloğlu and Yazgan (1992) 28-44.67 cm, Ihsanullah et al. (2002) 44-47 cm, Begum et al. (2013) 55.50-73.50 cm, Pekşen et al. (2015) 39.95-82.53 cm, Akgündüz (2016) 46.44-93.75, Gölgül (2019) 43.3 cm, Akbay et al. (2020) reported that it varies between 36.43-41.70 cm. Present research results are similar to the literature.

The difference between genotypes was found to be significant in terms of first pod height (Table 1). The height of the first pod varied between 11.01-32.24 cm. As the average of the potassium doses, the highest first pod height was obtained from the Ermenek genotype with 28.69 cm, and the highest 23.37 cm as the average of the genotypes was obtained from the control (0 kg da^{-1}) dose (Table 2). As can be seen in the examination of Table 2, the first pod height of the Turkmenistan genotype was found to be quite low compared to the other genotypes. This is thought to be due to the difference in genetic structure. When the researchers' studies on the height of the first pod are examined; Dülgerbaki (2011) 21.8-23.5 cm, Pekşen et al. (2015) 15.75-49.33 cm, Akgündüz (2016) 17.19-52.38 cm, Gölgül (2019) 17.4-29.3 cm, Gül (2019) 22.77 cm, Akbay et al. (2020) reported that it varies between 11.82-21.70 cm. Our research results are partially similar to the literature. It can be said that this is due to the difference in environment and genotype.

As can be seen in the examination of Table 1, the differences between the genotypes and potassium doses in the flowering period were not significant and varied between 100-106 days. The highest flowering period was obtained from the Aşağıçağlar genotype with 104 days as the average of the potassium doses, and the average of the genotypes was obtained from the 20 kg da^{-1} potassium dose of 103.33 days (Table 2). When the researchers' studies on the flowering period are examined; Gebeloğlu and Yazgan (1992) 54.33-64.33 days, Çancı and Toker (2005) 20-76 days, Dalkılıç (2010) 43-73 days, Baydemir (2013) 73.35 days, Begum et al. (2013) 42-67.30 days, Akgündüz (2016) 52.67-55.57 days, Akbay et al. (2020) reported that it varies between 50-67.33 days. The information obtained as a result of the experiment was quite higher than these results. These differences reveal the effect of ecological conditions on the flowering period.

The pod binding time varied between 95.67-107 days. The difference between genotypes was found to be significant (Table 1). As an average of potassium doses, the highest pod setting time was obtained from the Ermenek genotype with 104.47 days, while the highest 102.11 days as an average of genotypes were obtained from a potassium dose of 10 kg da^{-1} (Table 2). When the researchers' studies on pod setting time were examined; Dalkılıç (2010) 46.30-74 days, Baydemir (2013) 75.33-80.67 days, Pekşen et al. (2015) reported that it varies between 47.25-68.25 days, Akgündüz (2016) 55.26-56.48 days in areas that depend on precipitation, and 58.60-59.20 days in plants grown under well-irrigated conditions. It is thought that genotypic and climatic factors may be among the reasons why the pod setting time is higher than in previous studies.

According to the results of the research, the vegetation period varied between 138-142.33 days, and the differences between genotypes and potassium doses were not significant (Table 1). As can be seen from the examination of Table 2, no differences were observed between vegetation periods. When the researchers' studies on vegetation period are examined; Dalkılıç (2010) 133.44 days, Baydemir (2013) 110.48 days, Mondal et al. (2012) 60.0-74.7 days, Begum et al. (2013) 78.25-105.50 days, Akgündüz (2016) 127.31-131.51 days, Akbay et al. (2020) reported that it varied between 73.67-99 days. The fact that the vegetation period is higher than the previous years is thought to be due to the effect of environmental and climatic factors on the vegetation period.

4. Conclusions

According to the research results, while the differences between the genotypes were statistically significant in terms of seed yield, protein yield, thousand-seed weight, plant height, first pod height and pod setting time, the differences between potassium doses were not statistically significant in terms of all other investigated properties except protein ratio. In terms of seed yield, protein yield and some characteristics, Aşağıçağlar genotype and 20 kg da^{-1} potassium dose were seen to come to the fore. Plant height and first pod height values decreased in all the potassium-treated plots compared to the control plots. Potassium application in mung beans had a positive effect on yield.

Mung bean is a very healthy and nutritious vegetable protein source that consumers can choose. Necessary importance should be given to the promotion of this legume species, especially in the Konya region, and its cultivation in more areas.

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