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# The Effects of Different Nitrogen Doses on Seed Yield and Some Agricultural Characteristics of Phaselia (*Phacelia tanacetifolia* Bentham.)

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**ABSTRACT**

This research was conducted to investigate the effects of different nitrogen doses on the seed yield and some agricultural characteristics of phaselia (*Phacelia tanacetifolia* Bentham.) under Isparta ecological conditions in 2017 and 2018 years. This research was conducted in randomized block design with three replication. Five different nitrogen doses doses (0, 40, 80, 120 and 160 kg N $ha^{-1}$) were used in the study. Plant height, first flowering time, 50% flowering time, number of raceme per plant, number of flower per raceme, 1000 seed weight and seed yield were investigated in this research. According to the results of the research, nitrogen doses had a significant effect on all properties. Nitrogen applications increased plant height, beginning of flowering period, 50% flowering, number of raceme per plant, number of flower per raceme, 1000 seed weight and seed yield. According to the two-year average results, in the province of Isparta and similar conditions, it is necessary to apply 120 and 160 kg nitrogen to obtain high seed yield in phaselia.

## Farklı Azot Dozlarının Arı Otu (*Phacelia tanacetifolia* Bentham.)'nun Tohum Verimi ve Bazı Tarımsal Özellikleri Üzerine Etkisi

MAKALE BİLGİSİ

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***Anahtar Kelimeler:*** *İlk çiçeklenme zamanı, azot dozları, arı otu, tohum verimi, 1000 tane ağırlığı*

**ÖZET**

Bu çalışma farklı azot dozlarının arı otu (*Phacelia tanacetifolia* Bentham.)'nun tohum verimi ve bazı tarımsal özellikleri üzerine etkilerini belirlemek amacıyla 2017 ve 2018 yıllarında Isparta'da yürütülmüştür. Deneme tesadüf blokları deneme desenine göre üç tekerrürlü olarak kurulmuştur. Çalışmada beş farklı azot dozu (0, 4, 8, 12 ve 16 kg/da N) kullanılmıştır. Çalışmada incelenen özellikler bitki boyu, ilk çiçeklenme süresi, % 50 çiçeklenme süresi, bitkide kömeç sayısı, kömeçteki çiçek sayısı, 1000 tane ağırlığı ve tohum verimidir. Araştırma sonuçlarına göre azot dozları tüm özellikler üzerine istatistiki olarak önemli etki yapmıştır. Azot dozları arttıkça bitki boyu, ilk çiçeklenme gün sayısı, % 50 çiçeklenme gün sayısı, bitkide kömeç sayısı, kömeçte çiçek sayısı, 1000 tane ağırlığı ve tohum verimi artmıştır. İki yıllık ortalama sonuçlara göre Isparta ve benzer koşullarda arı otundan yüksek tohum verimi alabilmek için 12 ve 16 kg azot dozu uygulamak gerekmektedir.

## 1. Introduction

Phacelia (*Phacelia tanacetifolia* Benth) is an annual herbaceous plant belonging to the family Hydrophyllaceae. The flowers are violet-blue color. Floral scents can be good attractants that attract bees. The whole plant is covered with dense, short hairs, which is resistant to drought. One plant has more than 5000 flowers. Phacelia is one of the honey plants (Kumova and Korkmaz, 2002; Gilbert, 2003; Leszczyńska, 2012; Gösterit et al., 2017; Türk et al., 2018). Many researchers have stated that phaselia, which is mostly used as bee pasture, can be used as a forage plant (Uçar and Tansı, 1996; Sağlamtimur and Baytekin 1993; Karadağ and Büyükburç, 2001; Ateş et al., 2010; Genç Lermi and Palta, 2014). Phacelia is an excellent bee pasture. Under bee pasture is understood the whole flora of a place visited by bees.

Phacelia has a large agro-technical importance. Strong spindly root penetrates over 1 m depth, which improves soil quality, and dying leaves significant amounts of organic matter and nitrogen bound, which makes it an excellent choice for improving poor soils. At the end of flowering, the plant can be plowed making it suitable for green fertilizers. Many studies have have phacelia declared nematocidal plant, because it is very useful for the preservation of soil hygiene. It is suitable for growing in organic production (Popovic et al., 2017).

Seed production phacelia is very profitable and can serve as a generator of economic development. Phacelia has great significance for beekeeping, because it is flowering, when the period without pasture, which lasts until the sunflower. For successful commercial beekeeping honey plants are very important condition for achieving high yields (Popovic et al., 2017).

The objective of this research was to determine the effects of different rates of nitrogen fertilizers on some agricultural characteristics of phaselia (*Phacelia tanacetifolia* Bentham).

## 2. Material and Methods

The field experiments were conducted in experimental area of Agricultural Faculty of Isparta University of Applied Science during 2017 and 2018 growing seasons. In this study, Sağlamtimur cultivar of phaselia was used. The major soil characteristics, based on the method described by Rowell (1996) were as follows: the soil texture was clay-loam (clay: 31.2%, silt: 45.1%, sand: 23.7%); organic matter was 1.1% by the WalkleyBlack method; total salt was 0.3%; lime was 7%; sulphur was 12 mg $kg^{-1}$; extractable P extraction was 3.3 mg $kg^{-1}$; exchangeable K was 119 mg $kg^{-1}$; pH was 7.1 in soil saturation extract. Total precipitation was 205.8 mm in 2017 (March– June) and 134.9 mm in 2018 growing season. The long-term average precipitation was 194.0 mm. The average temperature was 14.22 $^{o}$C in 2017 (March– June) and 15.05 $^{o}$C in 2018. The long-term average temperature was 13.13 $^{o}$C.

The experiments were carried out in a randomized complete block design with three replications. Sowings were done by hand on 11 March in 2017 and 5 March in 2018. Seeding rates were 15 kg $ha^{-1}$. Plot sizes were 1.8 x 6 m = 10.8 $m^2$. Five different nitrogen doses (0, 40, 80, 120 and 160 kg N $ha^{-1}$) were applied in this research. In the study, urea (46%) fertilizer was used as nitrogen fertilizer and triple super phosphate (46%) was used as phosphorus fertilizer. Phosphorus fertilizer was calculated as 50 kg pure phosphorus per hectare and applied before sowing. In the experiment, each parcel consists of 6 rows, 30 cm between rows, 6 m in length of plots, and 2 m between blocks and parcels. The trial consisted of 15 plots, 5 plots in each block.

Plant height, first flowering time, 50% flowering time, number of raceme per plant, number of flower per raceme, 1000 seed weight and seed yield were investigated in this research.

The two-year data were analysed together using the Proc GLM (SAS, 1998). Means were separated by LSD at the 5% level of significance.

## 3. Results and Discussion

According to the results of variance analysis obtained from two years of data, nitrogen applications had significant effects on first flowering time, 50% flowering time, plant height, number of raceme per plant, number of flower per raceme, 1000 seed weight and seed yield (Table 1).

Table 1. Two-year average variance analysis results of the data obtained from the trials.

| Sources of variations | SD df | First flowering time (day) | 50% flowering time (day) | Plant height (cm) | Number of raceme per plant | Number of flower per raceme | 1000 Seed weight (g) | Seed yield (kg $ha^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| Year | 1 | * | * | ns | ns | ns | * | * |
| Block | 4 | ns | * | ns | * | ns | * | * |
| Nitrogen Doses | 4 | ** | ** | ** | ** | ** | ** | ** |
| N x Year int. | 4 | ns | ns | ns | ns | ns | ns | ns |

ns:non-significant. * : P < 0.05, ** : P < 0.01.

According to the two-year average results, first flowering time was delayed as nitrogen doses increased (Figure 1). The first flowering was realized 47.3 days after sowing in control application, but it was 56.9 days after sowing in 120 kg nitrogen application. Similar results were reported by Dağ (2013).

The 50% flowering was realized 56.7 days after sowing in control application, but it was 66.4 and 67.1 days after sowing in 120 and 160 $ha^{-1}$ kg nitrogen applications (Figure 1). Similar results were reported by Dağ (2013).

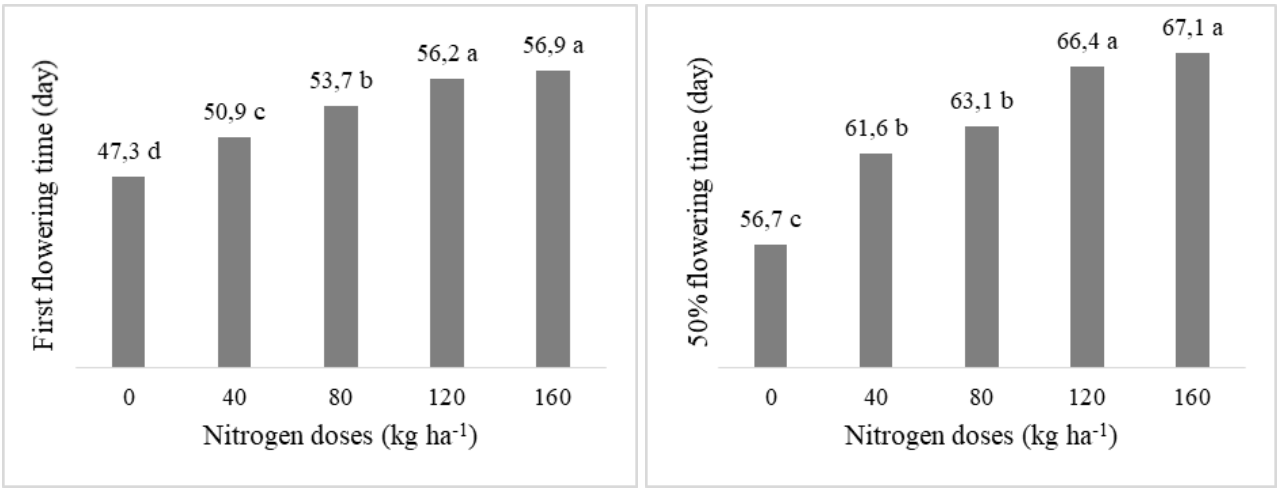


Figure 1. Two-year average values of first flowering and 50% flowering time.

While the shortest plants (50.5 cm) were determined in the control application, the tallest plants (69.3 and 68.1 cm) were obtained in the 120 and 160 kg ha$^{-1}$ nitrogen doses (Figure 2). Plant height values in this study varied between 50.5 and 69.3 cm. Erturk (2019) also stated that nitrogen doses increase the plant height in phaselia. This result supports the result we obtained in our study.

Number of raceme per plant increased as nitrogen doses increased. While the smallest value (4.1) was detected in the control application, the highest values (5.4 and 5.5) were obtained in 120 and 160 kg ha$^{-1}$ nitrogen applications (Figure 2). Dağ (2013) also stated that nitrogen doses increase the number of raceme per plant in phaselia.

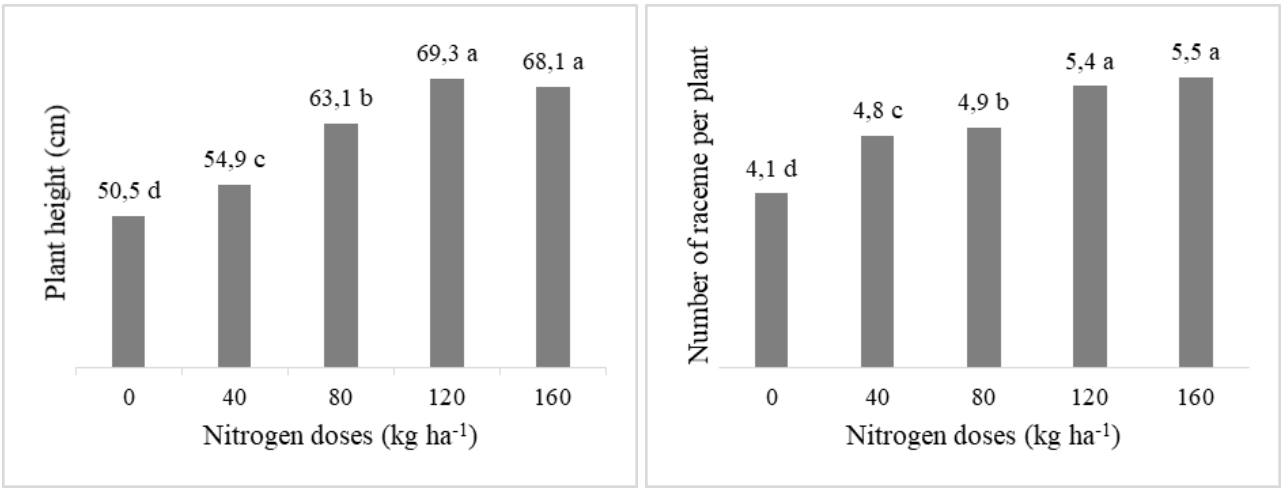


Figure 2. Two-year average values of plant height and number of raceme per plant.

Depending on the nitrogen doses, the number of flowers per raceme also increased. The lowest value (16.7) was obtained in the control application, the number of flowers increased as the nitrogen doses increased, and the highest value (22.3) was obtained in 160 kg ha$^{-1}$ nitrogen applications (Figure 3). Similar results were reported by Dağ (2013).

Increasing N fertilization rates resulted in an increase in 1000 seed weight of phacelia. The lowest 1000 seed weight (1.57 g) was obtained from the control plots, while the highest 1000 seed weights (2.03 and 1.98 g) were determined in the 120 and 160 kg ha$^{-1}$ nitrogen applications (Figure 3). Dağ (2013) also stated that increasing nitrogen doses increased 1000 seed weight. This result supports our conclusion. 1000 grain weight values in this study varied between 1.57 and 2.03 g. The 1000 seed weights we obtained are similar to those obtained by Kızılşimşek and Ateş (2004).

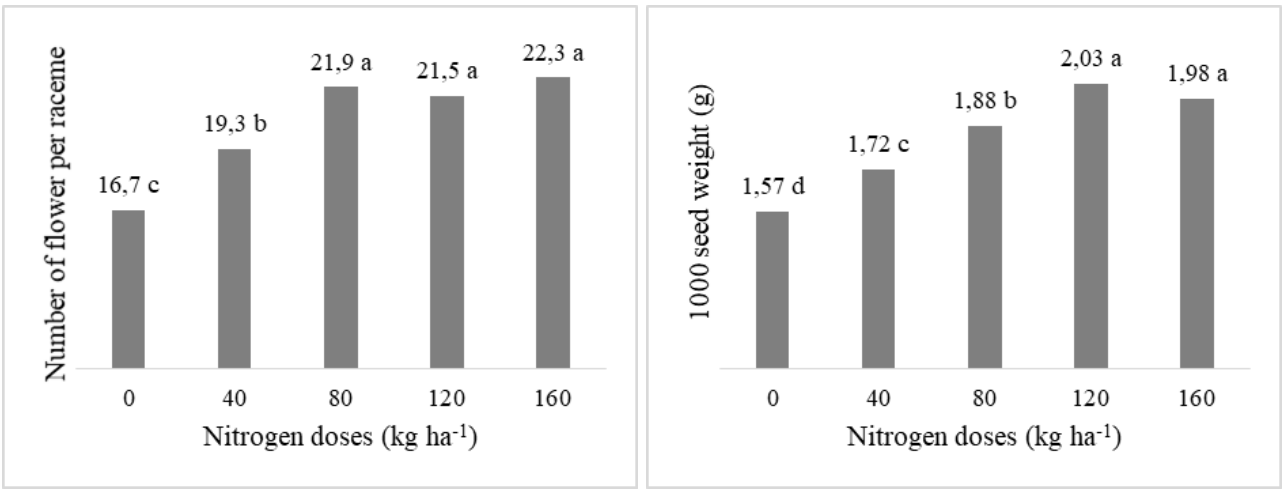


Figure 3. Two-year average values of number of flower per raceme and 1000 seed weight.

Seed yield in this study varied between 130.3 and 209.4 g depending on the fertilizer doses. The highest seed yield (209.4 kg ha$^{-1}$) was obtained by the 160 kg ha$^{-1}$ nitrogen treatment, while the lowest seed yield (130.3 kg ha$^{-1}$) was observed in the controls treatment (Figure 4). Increasing N fertilization rates resulted in an increase in seed yield of phacelia. Dağ (2013) investigated the effect of nitrogen doses on the seed yield of phaselia and found that increasing nitrogen doses increased seed yield. This result supports our conclusion. In their studies on phaselia, they found that the seed yield ranged from 50-160 kg ha$^{-1}$ by Karadağ and Büyükburç (2001), 459-860 kg ha$^{-1}$ by

Kızılşimşek and Ateş (2004), 210-270 kg ha$^{-1}$ by Başbağ et al. (2001) and 201-432 kg ha$^{-1}$ by Uçar (1995), 391-598 kg ha$^{-1}$ by Dağ (2013). Some of these values are higher than our results and some are similar. Different sowing times together with the climatic and soil conditions of the regions where the studies were carried out caused different yields.

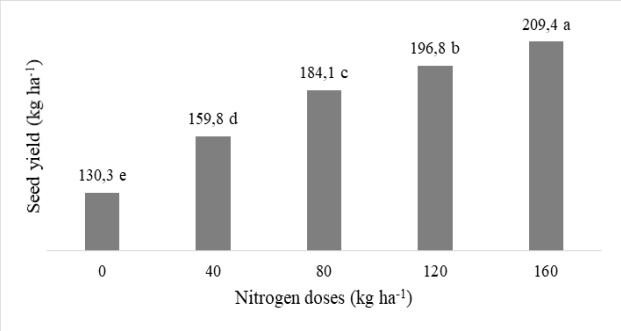


Figure 4. Two-year average values of seed yield.

## 4. Conclusion

According to the results of this research, nitrogen doses had a significant effect on all the properties examined. While the lowest values were obtained from the control application in all the properties examined, the values increased depending on the nitrogen doses. In the province of Isparta and similar conditions, it is necessary to apply 120 and 160 kg nitrogen to obtain high seed yield in phaselia.

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