



Derleme Makalesi

Yozgat Ekolojik Koşullarına Uygun Endüstriyel Yağlı Tohumlu Bitkiler: Pelemir (*Cephalaria syriaca* (L.) Schrad) ve Camelina (*Camelina sativa* (L.) Crantz)

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Öz: Yozgat deniz seviyesinden 1300 m yükseklikte olup yarı kurak karasal iklime sahiptir. Yıllık yağış ortalama 595.7 mm'dir. İlin toplam tarım alanı 6 130 324 dekar olup, bu alanın yaklaşık %76'sında tarla bitkileri yetiştirilmektedir. Bu sahalarda, kuraklığa ve soğuğa dayanıklı ve sonbaharda ekilebilen çeşitli yağlı tohum bitkileri mevcut üretim deseni içinde değerlendirilebilir. Bu kapsamda, tohumlarından elde edilen yağlı farklı endüstri alanlarında (gıda, kozmetik, biyodizel vb.) kullanılabilen pelemir [*Cephalaria syriaca* (L.) Schrad] ve ketencik [*Camelina sativa* (L.) Crantz] türleri ön plana çıkmaktadır. Bu türlerin iklim ve toprak seçiciliği düşük olup önemli alternatif bitkiler olarak dikkat çekmektedir.

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Industrial Oilseed Crops for Yozgat Ecological Conditions: Pelemir (*Cephalaria syriaca* (L.) Schrad) and Camelina (*Camelina sativa* (L.) Crantz)

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Abstract: Yozgat has a semi-arid continental climate at an altitude of 1300 m above sea level. Annual precipitation is about 595.7 mm. The total agricultural area of the province is 6 130 324 decares, and field crops are grown in approximately 76% of this area. Various oilseed plants that are drought and cold-resistant and can be planted in autumn can be evaluated within the current production pattern. In this context, pelemir [*Cephalaria syriaca* (L.) Schrad] and camelina [*Camelina sativa* (L.) Crantz] species, its oil obtained from their seeds can be used in different fields of industry (food, cosmetics, biodiesel, etc.). Also these species have very low climate and soil selectivity, drawing attention as important alternatives.

1. Introduction

Yozgat, located in the Central Anatolia Region, is between 34° 05' – 36° 10' east meridians and 38° 40' - 40° 18' north parallels and is located at an altitude of 1300 meters above sea level. The eastern, western, and central parts of Yozgat are mountainous, and the altitude decreases from east to west. The semi-arid continental climate of the Central Anatolia Region is dominant throughout the province. Since it is close to the influence of the sea, the summers are hot and dry; winters are cold and rainy. The temperature differences between summer and winter, night and day in the province are high. According to the long-term average data of the General Directorate of Meteorology (MGM) (2022), covering the period 1929-2021, the average temperature in the province is 9.7 °C, with the highest temperatures recorded in July (38.8°C) -August (37.4°C). The lowest temperatures are seen in January-February. The average temperature in these months is -4 °C. According to long-term data, the average annual total precipitation is 595.7 mm, while the rainiest month is December with 76.7 mm. This month is followed by March with 70.7 mm and May with 68.8 mm. The driest months are July (12.8 mm) and August (16.9 mm).

The Yozgat economy is based primarily on agriculture (the production of crops and animals). (Anonymous, 2013). Yozgat province has 6 203 771 decares of agricultural land in total. Field crops are grown in approximately 76% of this area (4 680 301 decares). The fruit and vegetable production area (total 84 404 decares) is very low. Most cereals (wheat, barley, and rye) are grown in the province, where fallow dry farming is common. In addition to these, sugar beet, sunflower, potato, and onion are grown in irrigated agricultural areas (Anonymous, 2022; TUIK 2022). However, oilseed plants such as safflower, rapeseed, pelemir, and camelina for the industry can be included in the production pattern. According to 2021/2022 production values of oilseed crops, the oilseed crops with the highest production in the world are soybean (363.86 million metric tons), rapeseed (70.62 million metric tons) and sunflower seeds (57.26 million metric tons), respectively (STATISTA, 2022). According to TUIK data for 2021, oilseed crops production realized in 10 806 728 da of land in our country. When the cultivation areas are taken into account, sunflower (9 011 531 da), peanut (579 192 da), poppy (516 721 da), soya beans (438 917 da) and rapeseed (376 017 da) are in the first places. The production values of these oilseed crops in question were 2 415 000 tons, 234 167 tons, 21 037 tons, 182 000 tons and 140 000 tons, respectively (TUIK, 2021).

In this study, information is given about the usage areas, plant characteristics, and growing conditions of pelemir and camelina plants that can be grown in Yozgat ecological conditions. In this study, information is given about the usage areas, plant characteristics, and growing conditions of pelemir and camelina that can be grown in Yozgat ecological conditions.

2. Pelemir

2.1. Taxonomic classification and plant characteristics

Order: Dipsacales
Family: Caprifoliaceae
Genus: *Cephalaria*
Species: *Cephalaria syriaca* (L.) Schrad

Pelemir is an annual and can grow up to 1 m. The stem, branches, and leaves of the upright plant are hairy. It is a branching plant. The edges of the dark green leaves are toothed. The flowers of the plant are located at the ends of the main stem and branches. Flower buds are 5-9 mm wide and egg-shaped. There are 4 male and one female organ in the flowers of the pelemir (Gokturk and Sumbul, 2014). A large amount of pollen is produced in the flowers. Pelemir is cross-pollinated by the effect of different insects, especially bees. There are 12-20 seeds from a bud in the plant. 1000 seed weight varies between 15.0-16.29 g. It has been revealed that the fixed oil ratio in the seeds of the plant varies

between 21-26%, and an average of 23% (Baytop,1999), and the protein ratio varies between 14-20%. Some development stages can see in Figure 1.



Figure 1. Emergence of winter planted pelemir, flower of plant, experiment area during flowering (Yozgat/2022)

2.2. Uses

Since pelemir seed oil with green-yellow color contains epoxy acid (7-8%), it is not suitable for consumption as cooking oil (Yazicioglu et al., 1978). Pelemir oil is called “bezir oil” and it is produced in Turkey. This oil is used in the manufacture of soap, paint, leather, and textiles (Subası et al., 2021). In addition, it is a concentrated feed source that can be used in animal nutrition with its pulp after oil extraction (Kateretal., 2012; Sezgin et al., 2017). Flour and oil obtained from pelemir seeds are mixed with wheat flour at low levels (0.5-3.0%) and used to delay the staling of the bread and to make the dough rise better (Altinigne and Saygin, 1985; Karaoglu, 2006; Chrzęszcz et al., 2021).

2.3. Climate and soil requirements

Pelemir is a cold and drought-resistant plant. It likes the heat. It grows well in sunny places. The yield increases in the base land. It is mostly found in arid and hillside areas. It shows more branching and development in clay and loamy soils. It is not very selective in terms of climate and soil requirements (Sezgin et al.,2017).

2.4. Cultivation techniques

The pelemir which is not very selective in terms of climate and soil demand is quite resistant to cold. Due to this feature, it is a candidate to be an important oilseed plant that can be cultivated with a satisfactory yield by sowing in the fall in marginal areas subject to erosion and slope with a low soil depth. Pelemir is grown in winter and summer (Subası et al., 2021). It usually matures in 100-150 days.

Field preparation is done as with other plants. Winter sowing is done in November. Summer sowing is in February and March. It is appropriate that the row spacing is 25 cm in sowing (Katar et al., 2012). 1.5-2 kg seeds are planted per decare and the planting depth is 2-3 cm. 10 kg/da of nitrogen, and 6-9 kg/da of phosphorus is sufficient for the plant (Arslan et al., 2012). Maintenance works such as weeding, hoeing and, if necessary, irrigation is carried out. Plants usually reach harvest maturity in July. Leaves and stems turn yellow. Seeds harden and ripen. In the timely harvest, there is no grain spillage. It can be easily harvested with a combine harvester. In manual harvesting, it is necessary to mow, pluck, dry, and thresh the plants. It can also be done with threshing. It must then be cleaned. Seed yield is 60-100 kg per decare in dry conditions and 200-400 kg in wet conditions (Arslan et al., 2022).

3. CAMELINA

It is one of the six widely known camelina species (*C. sativa*, *C. laxa*, *C. rumelica*, *C. macrocarpa*, *C. hispida*, and *C. anomaly*) in the Brassicaceae family. *C. sativa* is the only economically important species in the genus camelina (Eryilmaz et al., 2022).

3.1. Taxonomic classification and plant characteristics

Order: Rhodales

Family: Brassicaceae

Genus: *Camelina*

Species: *Camelina sativa* (L.) Crantz

Cultivated camelina varieties are annual, wild forms are generally perennial. Plant height generally varies between 30-100 cm. The stem is round, hairy on top, and usually branches from below. The leaves are lanceolate, 5-8 cm long, and the margins are straight. Flower; It consists of 4 green sepals, 4 yellow or yellowish-white petals, 6 stamens, and one female organ. Camelina is a self-pollinating plant. The fruit is in the form of capsules, 0.7-2.5 mm in diameter, ranging from orange to brown in color. The capsule contains 8-16 seeds. The seed color of cultivated varieties varies from dark yellow to light brown and is bright (Putnam et al., 1993; Iskandarow et al., 2014). The 1000-seed weight of the seed varies between 0.8-1.8 grams. Seeds contain 30-40% oil (Iskandarow et al., 2014). Some development stages can see in Figure 2.



Figure 2. Emergence of *Camelina sativa* (L.) Crantz, flower of plant, experiment area during flowering (2018/Yozgat) (Dag Subas, 2022)

3.2. Uses

Traditionally used in human nutrition, camelina oil is rich in linoleic and linolenic fatty acids. In addition, the amount of tocopherols in camelina oil is high (700 mg/kg). 100 grams of camelina oil contains 10 mg of vitamin E. In addition to being used as cooking oil (Flachowsky et al., 2011), it can be used in salads, meals, and frying excluding cakes and chips, it can also be used in the production of mayonnaise, sauce, and ice cream. Camelina oil is rich in polyunsaturated fatty acids and is used in the cosmetic industry, in the production of products such as body lotion, bath foam, and bath cream for skin care, soap and mild detergents (Ehrensing and Guy, 2008). It is considered a biodiesel raw material. After removing the oil from the camelina seed, the remaining pulp is used in animal nutrition (Moser, 2010).

3.3. Climate and soil requirements

It doesn't want too much heat. It grows well in cool climate zones. It can be cultivated in winter in places with mild winters. Camelina is tolerant of cold, frost, and extreme drought. Except for heavy

clay soils, it can easily grow in dry areas, weak soils, and high altitudes where other cultural plants cannot grow (Iskandarow et al., 2014). Seed germination begins when the soil temperature reaches 3-4 °C. Camelina has a high potential for fallow in semi-arid areas.

3.4. Cultivation techniques

Camelina can be cultivated in summer and winter. The vegetation period in summer varieties is about 120 days (Zubr, 1997), and it reaches the flowering period about 60 days from germination. Due to the small size of the camelina seed, it is very important to prepare the soil well for planting. 0.4-0.6 kg of seeds are sown per decare (McVay and Lamb, 2008), depending on the weight of 1000 seeds, with a spacing of 10-15 cm in rows and 1-2 cm in rows. It is grown without irrigation in places with annual precipitation of 800-900 mm. Rainfall during the growing season is more important when planted as a summer residence. Camelina is resistant to diseases and pests. Commonly known pests do not cause any economic damage to this plant. Therefore, there is no need for any pesticide application. Camelina is a plant suitable for machine harvesting. At the time of harvest, the moisture content of the seed should be around 11% and less than 8% in terms of storage. Although it varies depending on the variety, ecological conditions and cultivation technique, the yield per decare is around 160 kg in summer plantings and 300 kg in winter plantings (Urbaniak et al., 2008; Berti et al., 2011).

4. Conclusion

The consequences of global warming are starting to be felt nowadays. Decreased precipitation or irregular rains, milder winters, and dry summers bring along the need for irrigation in summer plantings agricultural lands. In agricultural land with limited water supplies, it is essential to cultivate plants that can benefit from winter precipitation. Pelemir is drought and frost-resistant, however, its oil cannot be consumed by humans. Pelemir oil can be assessed in various industries such as soap, paint, leather, textiles, etc. Pelemir oil needs to undergo further research before it can be used in the human diet. Camelina can be grown in both summer and winter seasons. Although it is harmful to human nutrition with the amount of erucic acid contained in its oil, studies are carried out on low lines of erucic acid. Pelemir and camelina plants have the potential to be alternative oilseed plants in the future.

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