NEGLECTED AND UNDERUTILIZED A CROP IN TURKEY: LINSEED (LINUM USITATISSIMUM L.)

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ABSTRACT

Linseed (*Linum usitatissimum* L.) is the only economically important crops species of the Linaceae family, which includes 13 genus and 300 species. It has two different types, is an annual industrial crop used in fiber and oil production. The tall, high branching types with strong fibers are grown for fiber production and the short, partially low branching types are grown for oil production. Linseed contain 30-45% oil and are an important raw material for the dye and varnish industry as the oil has a natural drying characteristic. Linolenic fatty acid (omega-3) content of linseed oil is high and in recent years, its varieties with high quality oil for edible use have been developed using some breeding methods. Despite the many uses of linseed, it has remained a minor or alternative oilseed crop in Turkey. Therefore, scientific research on this crop is necessary and popularize it as a commercial crop for edible oil, dye and varnishes industry, source of α-linolenic acid, quality and cool keeping fabric. In addition, if the cultivation of oilseed flax can be expanded in our country and cultivated primarily in fallow areas, it can be one of the alternative oilseed crops that have the potential to close the vegetable oil deficit of Turkey.

Keywords: Oilseed crops, Linseed, Flax, Neglected crops

INTRODUCTION

The neglected and underutilized crops are a rich source of secondary metabolites, vitamins, and micronutrients and thus have the potential to bring dietary diversity with high nutrient value and production for low-income consumers (Baldermann et al., 2016; Hunter et al., 2019). However, most of neglected or underutilized crops are due to their highly low sowing area, production, relatively low yield, consumption, and demand.

Linseed (*Linum usitatissimum* L.) is the only economically important crops species of the Linaceae family, which includes 13 genus and 300 species. The word *usitatissimum*, which means most useful, is appended because of its traditional usefulness as an agricultural crop. (Chand and Fahim, 2008; Koçak and Bayraktar, 2011). It is grown either for its fiber (fiber flax) or for its oil (oilseed flax) (Hall et al., 2016). The tall, high branching types with strong fibers are grown for fiber production and the short, partially low branching types are grown for oil production (Yıldırım and Arslan, 2013). In past, linseed was main source to get industrial oil like dye, linoleum, polish, inks and cosmetic (Green and Marshall, 1984). Linseed contain 30-45% oil and are an important raw material for the dye and varnish industry as the oil has a natural drying characteristic. Linolenic fatty acid (omega-3) content of linseed oil is high and in recent years, its varieties with high quality oil for edible use have been developed using some breeding methods (Green, 1986). Since the Republican Period, our country has experienced an unstable development process in linseed and in recent years it has almost completely disappeared in agricultural terms. On the other hand, since 2018, remarkable attempts have been

made regarding linseed. Locally scaled developments have taken place in this area, such as the promotion of planting and the reproduction of traditional fabrics (Şahin and Yıldız, 2022). This review focuses on the uses of linseed, the characteristics of its oil, the importance of its fiber, its cultivation and production in Turkey and its future.

LINSEED USES

Oil

Linseed oil, extracted from seeds of flaxseed (*Linum usitatissimum* L.), a crop widely cultivated in Europe for fiber or oil for industrial use (Prasad, 1997). Its seed consist of about 25% indigestible fibre, 25% protein and 30-45% oil, which contains mostly unsaturated omega-3 fatty acids (Siva Kumar et al., 2017). Linseed oil contains approximately 9-11% saturated (5-6% palmitic acid and 4-5% stearic acid) and 75-90% unsaturated fatty acids (50-55% linolenic acid, 15-20% oleic acid). The fatty acid composition of linseed oil is dominated by linolenic acid (Bayrak et al., 2020) and it is the best source of the n-3 fatty acid, α-linolenic acid, which constitutes nearly 55 % of its total fatty acids (Bloedon and Szapary, 2004).

Alpha-Linolenic acid (ALA) is an omega-3 (ω-3), essential fatty acid. ALA is found in many seeds and oils, including linseed, walnuts, chia, hemp, and many common vegetable oils (Chen et al., 2002). Omega-3 fatty acids have many beneficial effects. It is thought to decrease the risk of heart disease by helping to maintain normal heart rhythm and pumping (Blondeau et al., 2015). Linseed cultivation has resumed in Turkey in the last few years. Especially in the last two years (2021 and 2022), the cultivation area has increased from 10 da to 95 da (TSI, 2022). Therefore, with the expansion of the cultivation area in the future, the potential to provide raw materials to the oil industry can be reached.

Fiber

Flax fiber is obtained from the bast or skin of the stem of flax plant. It is consisting of 70-80% cellulose and 20-30% non-cellulose compounds such as hemicellulose, lignin, pectin, waxes and fats, mineral salts, natural coloring matter and water-soluble compounds (Chand and Fahim, 2008). The fiber is used in textiles, weaving, automotive industry, dye, paper and dietary products (Karimah et al., 2021). Flax fiber is preferred for weaving summer dress fabrics because of its ability to keep cool (Lisson, 2003). Despite all these superior properties of the fiber, developments in the artificial fiber industry have recently shifted linseed production more towards seed production. But the precious and special fiber of flax should not be ignored. Because Turkey has many years of experience in flax cultivation, flax processing and flax fiber industry.

High labor force, lack of mechanization, cheaper synthetic and staple fibers and the inability to compete with cotton plants have led to the extinction of flax in Turkey. Linseed is a potential alternative oilseed and fiber crop for the future as it is cold and drought resistant. It can reach the potential to provide raw materials to the oil and fabric industry by expanding its cultivation area in the future in Turkey.

Global Distribution

Although the origin of linseed is not known exactly, according to the researches, it is stated that it was cultivated in Mesopotamia in 3500-4000 BC and the first cultivated linseed was found near Switzerland (Lay and Dybing, 1989; Özüstün, 2001). Flax fabrics were worn in ancient Egypt and it has even been found in mummy tombs (Bakır, 2005). There is also evidence that linseed oil was used in embalming (James, 2005).

Currently, linseed is grown in about 50 countries, occupying over 4 million hectares of agricultural land and producing over 3.3 million tons of seed. The top 10 leading countries for

linseed production are Russia (1.300.173 t), Kazakhstan (775.568 t), Canada (345.708 t), China (340.000 t), India (111.000 t), Ethiopia (82.000 t), United Kingdom (71.000 t), France (72.940 t), USA (68.790 t) and Ukraine (42.230 t) (FAOSTAT, 2021). On the other hand, only 8 tons of linseed was produced in Turkey in 2022 (TSI, 2022). Linseed has unique drought tolerance; in extreme conditions, it can complete its life cycle in climates in which annual rainfall is only 200 mm (Li and Wang, 2016). Currently, linseed cultivation is increasing in arid and semi-arid regions due to the crop's drought, heat and cold tolerance properties (Yadav et al., 2022; Arslan and Culpan, 2023).

CONCLUSIONS

Compared to other oilseed crops, linseed is minor and underutilized in Turkey, despite its growing importance in the world. The importance of this crop must be emphasized and highlighted in Turkey as in the world. There are four locally registered linseed varieties (Karakız, Beyaz Gelin, Sarı Dane and Yılmaz) in our country. There is a need to increase the number of varieties due to the different climate and soil characteristics in our country and the increasing vegetable oil deficit every year. In addition, if the cultivation of oilseed flax can be expanded in our country and cultivated primarily in fallow areas, it can be one of the alternative oilseed crops that have the potential to close the vegetable oil deficit of Turkey. Although flax fiber has come to the forefront with its superior qualities (especially fiber fineness and strength) compared to other vegetable fibers, it has continuously declined and its share in natural fibers has continuously shrunk due to its inability to compete economically with other fibers, especially cotton. The economic value of flax is increasing year by year with the diversity of its uses, and its importance increases even more when the production of various industrial products, especially food supplements, cosmetics and paper industry, is added to its oil and fiber production. Therefore, scientific research on this crop is necessary and popularize it as a commercial crop for edible oil, dye and varnishes industry, source of α-linolenic acid, quality and cool keeping fabric.

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