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Evaluation of Dry Bean Farming in Konya Region and Its Importance for Sustainable Agriculture

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HIGHLIGHTS

- Dry beans are an important species of legume for a sustainable human-animal-environment supply.
- Consumption of dried beans is recommended for the prevention of many diseases, especially cancer, diabetes, celiac and heart diseases.
- In this study, the perspectives of producers for dry beans, which should be included in sustainable production systems, are presented.

Abstract

Establishing policies for the sustainability of the sector by increasing legume production and consumption is a critical issue for both Turkiye and the world and is a strategic issue that needs to be emphasized. Dry beans are an important edible legume that should alternate in sustainable agriculture, as well as providing easy supply of healthy and nutritious food to the increasing world population. Present research realized to determine the main problems faced by Konya City farmers in bean farming in 2021 and to offer appropriate solutions. For this purpose, questions about bean farming were asked to one hundred farmers who were randomly selected from the districts with the highest bean cultivation in the Konya region, and the results obtained were examined as "%" unit. As the result of the present research, it was seen that Konya farmers are insufficient in matters such as fertilization quantity and technic, irrigation density, control of diseases and pests, and usage of the certified seeds in dry bean farming. Since the cultivation techniques have direct or indirect impacts on the seed yield and seed quality of the beans, so it is necessary to correct the important deficiencies or mistakes of our farmers. In addition, intending to ensure agricultural sustainability and healthy human nutrition, it is essential to increase production and quality by determining the problems related to legumes that should be included in the rotation systems and on the food menu, and related issues are overseen inwardly the aim of the present research.

Keywords Agricultural production, Legumes, *Phaseolus vulgaris*, Producer problems, Sustainability

1. Introduction

Change in soil characteristics - production systems and adaptation technologies, consumer demand, quality perception, challenges in production and harvest, the change for income standard, conventional and

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organic growing, conservation of genetic diversity, fast urbanization gives a different agricultural perspective from nutritional habits to food supply (Bwengye et al., 2023; Doruk Kahraman and Kahraman, 2023¸ Wang, 2023; Zamukulu et al., 2023). In addition to the protection of soil and water resources, it significantly affects production and consumption of legumes, which are known to be a source of essential protein over one of four humans in the world. Legumes, as they are rich in nutritional values, have positive effects on the soil where they are grown, their ability to symbiotic fixation of the free nitrogen of the air to the soil, and the popularity of environmentalism and sustainable agriculture increases the importance of these plants.

It is important to include legumes, which are an important family for both human and animal nutrition and soil improvement, in crop rotation systems and to carry out the necessary research for producers to be more conscious. The dry bean plant, which is an important species in the edible legumes' family, is the most produced legume type in the world.

Thomas (1998) reported for the definition of the questionnaire, it as a material consisting of a set of questions aimed at determining the conditions, behavior patterns, belief phenomena or tendencies of human beings in life. Compared to the techniques used for the collection of some other data (interview, observation), the surveys can be applied to the more crowded masses in different places and are lower in cost. However, it is also noted that the questionnaire is based on two basic assumptions: "the respondent can read and understand the survey items" and "the respondent is ready to answer the items honestly" (Wolf, 1988). There are various types of survey methods. One of the benefits of a face-to-face survey method is that the interviewer can assist the participant with questions that are difficult to understand.

According to TURKSTAT 2019-2020 marketing year data, our country's adequacy rate for dry beans is 88% (Anonymous, 2022). Dry beans are an excellent pre-plant for sugar beet and wheat, which are widely grown in Konya, which has a share of 33% in seed production in Turkiye. Significant yield increases are observed in sugar beet and wheat planted after dry beans.

Human welfare depends on quality soil and proper land use. It is quite important that we take the necessary measures to the lands we use in crop production for a longer term and more efficiently. Unfortunately, legume production has been decreasing in recent years in Turkiye, which has traditionally been an important producer and exporter of legumes. This situation has a significant impact on the sustainability of legume production. It is necessary to meet the important needs of the farmers and to carry out studies in line with the determined needs. With a view to increase the yield per unit area in dry beans, cultural processes must be conducted both on time and appropriately, and the selection of the most suitable genotypes for ecological conditions is also important. Additionally, increased production and consumption of dry beans due to being a legume plant; essential for sustainable agriculture. For these reasons, this research was carried out in 2021 aiming to determine the common current problems in dry bean production in Konya ecological conditions.

2. Materials and Methods

This research was conducted in 2021 by interviewing (face to face) randomly selected farmers from the districts of Konya where dry beans are widely produced (Çiçek and Erkan, 1996; Şenol, 2012).

The survey development process is formulated in different ways in the literature. For example, Anderson (1990) describes the survey creation process as "determining general research questions", "listing of sub-questions", "design of materials", "ordering of items", "Editing the survey" and "preliminary application of the questionnaire" examined in sub-stages. As a matter of fact, within the scope of this research, it has been modified by taking the mentioned literature into consideration.

This study was carried out with a total of 100 dry bean producers in Konya Province: 48 in Altınekin, 13 in Çumra, 8 in Cihanbeyli, 8 in Yunak, 6 in Sarayönü, 5 in Kadınhanı, 5 in Karapınar, 4 in Ereğli, 1 each in Bozkır - Ilgın and Karatay. The results obtained were evaluated with the Microsoft Excel program and expressed as a percentage (Kahraman, 2022a).

Within the scope of the study, the survey questions prepared to obtain basic data were created in order to inspected various sources prepared to reveal the basic needs in agricultural production and to bring them into a form suitable for the purpose of this research.

3. Results

In this section, the Questions are abbreviated as "Que".

Que 1) What size of land do you produce beans on? (1 da = 1 decare= 1000 m2)

A) 0-50 da= 40%

B) 50-150 da= 36%

C) 150-250 da= 14%

D) 250 da= 3%

E) More than 250 da = 7%

As it can be understood from the examination of Question 1, it is seen that bean farming is generally carried out in small areas.

Que 2) How many years have you been engaged in bean farming?

A) 0-5 year= 23%

B) 5-10 year= 28%

C) 10-15 year= 17%

D) 15-20 year= 12%

E) More than 20 years = 20%

Looking at Question 2, it is seen that bean farming has been dealing with for 5-10 years.

Que 3) When do you do the first soil preparation in beans?

A) Spring= 30%

B) Autumn= 70%

It is seen that there was a problem in terms of tillage in Konya closed basin in previous years, but there is no problem now. These results show that the results of previous studies (Varankaya and Ceyhan, 2012) are reversed.

Que 4) Do you apply crop rotation?

A) Yes= 97%

B) No= 3%

While 97% of the surveyed farmers said that they practice rotation, it was revealed that 3% did not practice rotation. The results were determined in the survey studies conducted by Ülker and Ceyhan (2006).

Que 5) Which plants do you use in the crop rotation?

A) Cereals= 96%

B) Forage crops= 4%

According to the research, it is seen that 96% of the farmers apply the rotation with cereals.

Que 6) After which front crop do you get a higher yield from the bean planted?

A) Fallow= 15%

B) Forage Crops= 9%

C) Cereals= 76%

Crop rotation is essential in sustainable agriculture, and many years are needed for results to be consistent. As a matter of fact, this result obtained based on the experience of the producers is extremely valuable, and it has been revealed that higher yields are obtained if beans are grown after cereals.

Que 7) Do you use certified seeds?

A) Yes= 52%

B) No= 48%

It has been determined that approximately half of the producers use certified seeds.

Que 8) Why not use certified bean seeds?

A) Low yield = 24%

B) Because seeds are expensive = 28%

C) Because it is not resistant to diseases = 22%

D) Because it has no market value = 8%

E) Since I have available seeds = 16%

F) Insufficient government support = 2%

It is essential that dry bean producers prefer to use certified seeds of varieties that are adapted to the climate, have higher seed yield besides higher quality, and are more tolerant to diseases (Doruk Kahraman and Gökmen, 2022). As a result of this research, it is seen that some aspects of registered varieties are not preferred by the farmers. It is of great importance to reveal the differences by screening the gene pool of different genotypes and wild types of beans, which has a wide genetic variation, as in other plants (Nadeem et al., 2020; Toker et al., 2021; Uysal et al., 2021).

Que 9) Where do you get the seeds from?

A) My own production = 17%

B) From the seed dealer = 58%

C) From other farmers = 25%

As can be seen in Question 9, 58% of our farmers obtain dry bean seeds from seed dealers.

Que 10) How many kg da-1 of seeds do you use?

A) 10 kg and below = 77%

B) 10-12 kg = 18%

C) 12-14 kg = 4%

D) 14 kg and more= 1%

As seen in Question 10, 77% of the farmers use seeds of 10 kg da-1 or less.

Que 11) When do you sow the bean seed?

A) April 1-15= 0%

B) April 15-30= 2%

C) May 1-15= 19%

D) May 16-30= 79%

Beans are affected by temperatures below 00C. Therefore, it should be planted after the last frosts (Şehirali, 1988). This is until the first half of May for the Central Anatolian region (Akçin, 1988). On the other hand, researcher Önder and Şentürk (1996) stated that when the seed sowing time is delayed, there is a decrease in grain yield.

Que 12) What is your sowing method in beans?

A) Spreading= 0

B) With Seeder= 100%

According to the research, sowing of the bean seeds is done by seeders.

Que 13) What is your sowing depth for beans?

A) 2 cm= 0%

B) 3 cm= 26%

C) 5 cm= 62%

D) 8 cm= 12%

Previous studies on the subject (Ülker and Ceyhan, 2006; Varankaya and Ceyhan, 2012) show that most of the farmers plant at suitable depths.

Que 14) What is the row spacing in seed sowing?

A) 30-40 cm= 0%

B) 40-50 cm= 99%

C) 50-60 cm= 1%

D) 60-70 cm= 0%

When the results of the research are evaluated, it shows a great deal of similarity with the findings related to the sowing norm stated in the literature (Şehirali, 1988; Akçin, 1988; Önder and Şentürk, 1996).

Que 15) What is the up spacing in seed planting?

A) 5 cm= 5%

B) 8 cm= 48%

C) 10 cm== 32%

D) 12 cm= 11%

E) 15 cm= 4%

When question 15 was examined, 48% of the farmers stated that they adjusted the up spacing as 8 cm, 32% as 10 cm, 11% as 12 cm, 5% as 5 cm and 4% as 15 cm.

Que 16) Do you inoculate bacteria in bean farming?

A) Yes= 8%

B) No= 82%

C) I don't know about inoculation= 10%

Based on these findings, it has been understood that the yield can be increased by bacterial inoculation and the cost can be reduced by minimizing the use of fertilizers. As a matter of fact, it has been revealed in a study that a remarkable change in grain yield and quality will occur with fertilization at the appropriate dose and in the appropriate period in legumes as in other plants (Bozoğlu et al., 2007; Athar et al., 2020).

Que 17) Do you fertilize in bean farming?

A) Yes= 100%

B) No= 0%

All the surveyed farmers are fertilizing in dry bean farming.

Que 18) When do you apply fertilizer?

A) With seed sowing = 16%

B) Before planting = 84%

C) As top fertilizer = 0%

Que 19) Which fertilizer do you apply before planting?

A) DAP (18-46)= 75%

B) 20-20-20= 1%

C) 15-15-15= 14%

D) 20-20= 1%

E) Others= 9%

Many of the surveyed farmers prefer DAP fertilizer in the bean cultivation base fertilizer application.

Que 20) How much nitrogen do you use for the base in bean production?

A) 2 kg da-1= 1%

B) 3 kg da-1= 6%

C) 4 kg da-1= 43%

D) 5 kg da-1= 16%

E) 6 kg da-1= 16% F) Other= 18%

In different survey studies, it has been revealed that the farmers mostly use similar amounts of nitrogen fertilization (Ülker and Ceyhan, 2006; Varankaya and Ceyhan, 2012).

Que 21) Do you apply herbicides before sowing the seeds?

A) Yes= 80%

B) No= 20%

Que 22) How many times do you hoe the beans?

A) 1 time= 33%

B) 2 times = 55%

C) 3 times = 11%

D) More than 3 times = 1%

Que 23) Which irrigation method do you use in bean farming?

A) Drip Irrigation= 28%

B) Release Irrigation= 0%

C) Sprinkler Irrigation= 72%

Researcher Muirhead (1978) determined that the drip irrigation system increased bean growth positively. As can be understood from this, it is seen that drip irrigation in dry beans will increase the quality and yield of dry beans, save water and the farmers should switch to drip irrigation in dry beans.

Que 24) How many times do you irrigate in bean farming?

A) 3 times = 0%

B) 4 times = 2%

C) 5 times = 4%

D) 6 times = 17%

E) More than 6 times = 77%

In a study conducted in Konya ecology in order to examine the amount of irrigation water as well as the seasonal water consumption in dry beans, it was found to be 453-520 mm (Topak et al., 2009). As it can be understood from here, the farmers should be informed about irrigation.

Que 25) What are the diseases you encounter in your field in bean farming?

A) Rust Disease= 9%

B) Powdery Mildew= 14%

C) Root Rot= 23%

D) Bacterial Blight = 4%

E) Anthracnose = 14%

F) Leaf Blight = 14% G) Other= 8%

It has been stated in different studies that root rot (*Fusarium* ssp. and *Rhizoctonia* ssp.) is commonly seen in the closed basin of Konya in dry bean agriculture (Ülker and Ceyhan, 2006; Varankaya and Ceyhan, 2012).

Que 26) How do you combat with diseases?

A) Late sowing = 27%

B) Use of resistant varieties = 2%

C) Seed spraying= 2%

D) Surface spraying= 63%

Considering that in various survey studies conducted on the subject (Ülker and Ceyhan, 2006; Varankaya and Ceyhan, 2012) all of the farmers stated that they were fighting with pesticides, it is seen that in the fight against diseases, late sowing is tried to be prevented in addition to surface spraying.

Que 27) What pests do you encounter in bean farming?

A) Agrotis sp. = 3%

B) Aphids = 1%

C) Legume Seed Beetle = 37%

D) Red Spider= 32%

E) Other= 8%

Que 28) How do you combat with these pests?

A) Early Sowing = 1%

B) Late Sowing = 10%

C) Seed Spraying = 1%

D) Surface Spraying = 86%

Considering that in other survey studies conducted on beans (Ülker and Ceyhan, 2006; Varankaya and Ceyhan, 2012), all the farmers stated that they were fighting with pesticides, it is seen that in the fight against pests, late sowing is tried to be prevented in addition to surface spraying. It was stated in another study conducted in Konya ecology that planting time has a significant effect on the mineral composition of beans (Kahraman and Önder, 2018).

Que 29) Do you use top fertilization by nitrogen in bean farming? If yes; what is the amount?

A) Yes= 100%

B) No= 0%

Although there is no need for overhead nitrogen fertilization, the bean producers apply high amounts of nitrogen fertilizer in case of bacterial inoculation in dry beans. For this reason, the soils are polluted and production costs are increasing more than normal.

Que 30) What is your dry bean seed yield on average?

A) 100-150kg/da= 2%

B) 150-200 kg/da= 2%

C) 200-250 kg/da= 9%

D) 250-300 kg/da = 23%

E) 300-350 kg/da = 24%

F) 350-400kg/da = 33%

G) 400-450 kg/da= 7%

Like the findings of this research, it is seen that the grain yield of beans varies in a wide range, the highest seed yield was determined as 371.89 kg per decare (Önder and Özkaynak, 1994), 318.58 kg/da (Önder and Şentürk, 1996), 303.80 kg/da (Ülker and Ceyhan, 2006) in Konya conditions.

In addition to the selection of seeds suitable for the soil and ecological conditions in plant production, it has been emphasized in many studies that significant increases not only in yield but also in quality can be achieved by performing appropriate cultural processes (Ceyhan et al., 2014; Harmankaya et al., 2016; Gülsoy et al. et al., 2019; Kahraman, 2022b).

4. Conclusions

When the results of the research are examined, dry bean production in Konya is in rotation with grains, instead of using certified seeds due to the high cost, the producers use their own seeds or obtained from other producers and dealers selling sifted seeds, they plant seeds using seeders, and the fertilizer applied from the top. When looked at, an average of 40 kg/da of UREA (46% nitrogen) was given, and DAP (18% N, 46% P) was preferred as base fertilizer, irrigation is done more than 6 times, the disease is quite common and the most important one is root rot, surface spraying and late planting are done to prevent root rot.

Farmers who do not use certified or registered seeds in bean cultivation; they stated that registered or certified bean seeds are expensive, low yield, lack of market value, registered or certified bean seeds are not resistant to diseases, there are seeds available and government support is insufficient. In the production of edible legumes in the Konya region; it understood that the farmers performed the rotation, the region has an important share and potential for seed production in Turkiye, and the herbicides are widely used after planting and pre-emergence. With a focus on ensure the sustainability of legume production in the long term, it is necessary to conduct studies focusing on both producer and consumer demands. As a conclusion, there is a need for studies to take sustainable agriculture systems as a basis and to spread this awareness in dry beans.

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