International
SOCIAL SCIENCES STUDIES JOURNAL
SSSjournal (ISSN:2587-1587)

*Economics and Administration, Tourism and Tourism Management, History, Culture, Religion, Psychology, Sociology, Fine Arts, Engineering, Architecture, Language, Literature, Educational Sciences, Pedagogy & Other Disciplines in Social Sciences*

| Vol:5, Issue:37 | pp.3039-3056 | 2019 |
|---|---|---|
| *sssjournal.com* | ISSN:2587-1587 | sssjournal.info@gmail.com |

Article Arrival Date (Makale Geliş Tarihi) 07/04/2019 | The Published Rel. Date (Makale Yayın Kabul Tarihi) 24/06/2019
Published Date (Makale Yayın Tarihi) 24.06.2019

# STATUS OF FORAGE LEGUMES IN TURKEY WITHIN THE SCOPE OF 2016 YEAR OF PULSES

## 2016 BAKLİYAT YILI KAPSAMINDA TÜRKİYE'DE BAKLAGİL YEM BİTKİLERİNİN DURUMU

Prof. Dr. Süheyla BALCI AKOVA
İstanbul Üniversitesi, Edebiyat Fakültesi, Coğrafya Bölümü, İstanbul/TÜRKİYE
ORCID: https://orcid.org/0000-0002-3746-4111
Dr. Güven ŞAHİN
İstanbul Üniversitesi, Sosyal Bilimler Enstitüsü, Coğrafya ABD., İstanbul/TÜRKİYE
ORCID: https://orcid.org/0000-0002-5054-3711

**Article Type** : Research Article/ Araştırma Makalesi
**Doi Number** : http://dx.doi.org/10.26449/sssj.1543
**Reference** : Balcı Akova, S. & Şahin, G. (2019). "Status Of Forage Legumes In Turkey Within The Scope Of 2016 Year Of Pulses", International Social Sciences Studies Journal, 5(37):3039-3056.

## ABSTRACT

The plants in the Fabaceae family have taken a special place in human and animal nutrition as an important source of protein from past to present. Within the scope of the cultivation of leguminous plants, forage legumes have taken place in the agricultural life with their various functions. It is a group of forage plants that have direct effects on animal nutrition and indirect effects on human nutrition, and have yield and quality enhancing properties in the supply of animal products. 22 % of the vegetable protein in human nutrition and 38 % of the protein requirement of farm animals are provided from pulses worldwide. Leguminous plants have a very high capability of soil rehabilitation and can positively affect agricultural productivity in economic terms. However, in spite of their such important and positive effects, considering their small share in the total field crops, it is a necessity to examine leguminous plants by different disciplines sensitively.

All of the forage legumes examined within the scope of the study are easily grown in Turkey either naturally or by cultivation. The culture of the Turkish forage legumes was evaluated as a whole in this study within the scope of drawing attention to leguminous plants, all kinds of which are cultured all over the world, in the context of the 2016 International Year of Pulses. Following this evaluation, in the light of the findings obtained, the issue was analyzed from the geographical perspective and alternatives on the spatial scale were tried to be brought to the agricultural activity in question.

**Key Words:** Forage legumes, alfalfa, vetch, sainfoin, 2016 International Year of Pulses, Agricultural Geography, Turkey.

## ÖZ

Baklagiller familyasında yer alan bitkiler geçmişten günümüze önemli bir protein kaynağı olarak, insan ve hayvan beslenmesinde özel bir yere sahip olmuşlardır. Baklagil bitkileri yetiştiriciliği kapsamında, baklagil yem bitkileri ise çok çeşitli fonksiyonlarıyla ziraat hayatında yer edinmişlerdir. Hayvan beslenmesinde doğrudan, insan beslenmesinde ise dolaylı etkileri olan, hayvansal ürünlerin temininde verim ve kaliteyi artırıcı özelliklere sahip bir yem bitkisi grubudur. Dünya genelinde insan beslenmesindeki bitkisel proteinin % 22'si, çiftlik hayvanlarının protein ihtiyacının ise % 38'i yemeklik tane baklagillerden sağlanmaktadır. Baklagil bitkilerinin yetiştirildiği toprağı rehabilite kabiliyeti oldukça yüksek olup, ekonomik açıdan zirai verimliliği olumlu ölçüde etkileyebilmektedirler. Ancak bu kadar önemli ve olumlu etkilerine karşın toplam tarla bitkileri içerisindeki küçük payı göz önüne alındığında, baklagil bitkilerin farklı disiplinlerce hassasiyetle ele alınması bir zorunluluk arz etmektedir.

Çalışma kapsamında ele alınan baklagil yem bitkilerinin tamamı Türkiye'de doğal ya da kültüre alma yoluyla kolaylıkla yetişmektedir. 2016 Uluslararası Bakliyat Yılı kapsamında tüm dünyadan her çeşit kültürü yapılan baklagil bitkisine dikkat çekilmesi kapsamında, bu çalışmada Türkiye baklagil yem bitkileri kültürü bir bütün olarak değerlendirilmiştir. Bu değerlendirmenin ardından elde edilen bulgular ışığında konu coğrafi perspektifle analiz edilerek söz konusu zirai faaliyete mekânsal ölçüde alternatifler getirilmeye çalışılmıştır.

**Anahtar Kelimeler:** Baklagil yem bitkileri, yonca, fiğ, korunga, 2016 Uluslararası Bakliyat Yılı, Ziraat Coğrafyası, Türkiye.

## 1. INTRODUCTION

With a total of 727 genera and 19.325 species, the *Fabaceae* family is the largest family after the families of orchids and compound flowers in the plant universe (Batello et al., 2008; Tekeli and Ates, 2011: 5). There is a large number of traditional leguminous plants as well as that many exotic leguminous plants in the area of approximately 14 million km² between 25 – 45 north and 25 – 45 southern latitudes where the typical Mediterranean climate, in which Turkey is located, is observed, and these constitute 10% of the total flora (Le Houérou, 2001). Within this large family, many plants have played an active role in human and animal nutrition for many years and have been among important protein sources (Reckling et al., 2016; Mahmood et al., 2016: 65). Within the scope of the cultivation of leguminous plants of which past extends thousands of years ago, there are species used for various purposes from a wide variety of classes such as field crops, industrial plants, control plants, alternation plants, and forage plants. Among these, forage legumes take a special place in the agricultural life with their various functions.

Forage legumes are a very important forage plant group in terms of their direct effects on animal nutrition and indirect effects on human nutrition as well as having yield and quality enhancing elements in the obtainment of animal products (Reckling et al., 2016). The forage plant group in question is especially attractive with being used as roughage in a wide variety of forms such as grain, silage, dry and green grass. Moreover, forage legumes are an important nutritional source not only for bovine and ovine breeding, but also for Equidae, poultry, and bees. 22% of the vegetable protein in human nutrition and 38% of the protein requirement of farm animals are provided from pulses worldwide (Özdem, 2012; 1; Şahin, 2016: 1666).

The aim of examining forage legumes in Turkey as a whole in the agricultural geography focus is the fact that the year 2016 was declared as the "International Year of Pulses (IYP)" at the 68$^{th}$ UN General Assembly with the proposals of Turkey and Pakistan in order to draw attention to the importance of legumes in the aspects of food safety, environmental problems, sustainable rural development, and balanced nutrition. By the year of 2014, only 77.4 million tons of legumes were produced in the world, although 2.8 billion tons of cereals and 203 million tons of oilseeds were produced (FAO, 2017). The increasing world population, hunger and not being able to keep balanced diet due to the uneven distribution of food resources, negative developments in nutritional habits (such as the fast food culture spreading on a global scale), and the increase in the related health problems (such as obesity) have laid the groundwork for drawing attention to legumes. Furthermore, although leguminous plants have a very high capacity for soil rehabilitation and can affect the agricultural productivity positively from the economic point of view due to their characteristics, it is a necessity to examine leguminous plants by different disciplines sensitively considering their small share in the total field crops. The facts that the plants in question are more sensitive to diseases and pests compared to grains in the cultivation of legumes, unstable prices in the sector, and low competitive power compared to grains and grain products have unfortunately caused the remarkable regression of the legume production not only in Turkey but also all over the world (Wery and Ahlawat, 2007; Mahmood et al., 2016: 66). In this respect, it may be said that the 2016 International Year of Pulses is a positive step towards creating awareness in drawing attention to the issue. However, after taking the decision on the Year of Pulses, the "Global Pulse Confederation (GPC)" decided the third Wednesday of January to be celebrated as the "World Pulse Day" every year.

## 2. MATERIAL AND METHODS

All of the forage legumes examined within the scope of our study are easily grown in Turkey either naturally or by cultivation. Sainfoin (*Onobrychis* Mill.), trefoil (*Trifolium* L.), vetch (*Vicia* L.), alfalfa (*Medicago* L.), pea (*Risum arvense* L.), bitter vetch (*Vicia ervilia*), and lupin (*Lupinus* L.) are the forage legumes examined in the study. The plants such as soybean, lathyrus, and fenugreek were not evaluated since they are consumed not only in animal nutrition but also in human nutrition in Turkey. After explaining the importance of forage legumes in the study, the long-year data of the above-mentioned plants were compiled, and their geographical spreads were examined. Within the scope of their spatial

distribution, they were mapped using ArcGIS 10.1 and places where they were cultured or not according to plant characteristics were evaluated within the cause-effect relation. The culture of the Turkish forage legumes was evaluated as a whole in this study within the scope of drawing attention to leguminous plants, all kinds of which are cultured all over the world, in the context of the 2016 International Year of Pulses. Following this evaluation, in the light of the findings obtained, the issue was analyzed from the geographical perspective and alternatives on the spatial scale were tried to be brought to the agricultural activity.

## 3. IMPORTANCE OF FORAGE LEGUMES

The importance of the group of forage legumes among forage plants is versatile, and they are observed in a wide range from animal production to vegetable production. The principle factor among these is that they provide quality and beneficial nutrients for animals and establish the locomotive of animal breeding. The basic characteristics of forage legumes are briefly evaluated below to demonstrate their importance.

**a.** *In animal feeding:* The undoubted main characteristics of forage legumes and their contribution to the agricultural life are positive effects on animal feeding and the quality and amount of animal products. In many developing and underdeveloped countries, animals largely feed on natural meadow-pastures and with low-quality feeds such as plant wastes, stubble, and hay. Nowadays, pastures the livestock industry has been using considerably face many problems such as overgrazing, lack of care, non-improvement, and misuse. On the other hand, it cannot be said that adequate and qualified food is provided in the cattle animal breeding. However, forage legumes have superior characteristics when compared to other forage plants. This importance is due to the fact that forage legumes give more grass, are tastier, and more importantly, are more beneficial due to the high protein content. They also take an important place in animal feeding as both green and dry. There is no other plant group that provides energy, protein, and minerals in a balanced way, except for forage legumes, for high-productive animals (Conrad and Klopfenstein, 1988). According to the estimations made, 38% of the protein consumed by animals, 16% of lipids, and 5% of carbohydrates are obtained from forage legumes (Açıkgöz, 2001). These form essential nutrients for the production of high-productive animals at a high quality.

As well as being an important feed material for bovine and ovine animals, forage legumes are a valuable source of pollen and nectar for bees. In many sources, it is stated that forage plants of the Fabaceae family are very important pollen and nectar sources for bees (Howes, 1979; Sorkun, 1987; Balcı, 1992; Ötleş, 1995). From one-hectare area, alfalfa supplies 200-500 kg honey, white trefoil supplies 50-200 kg honey (Rodet et al. 1998), red trefoil supplies 100 kg (Sorkun, 1985), sainfoin supplies 100 kg, and yellow-flowered bird's foot trefoil (Robinson and Oertel, 1975) supplies 16-37 kg honey (Özyiğit and Bilgen, 2003).

**b.** *In arranging the soil structure and increasing productivity*: Nowadays, the soil conservation and productivity are an important issue. The soil gets out of hand, on the one hand, by factors such as erosion and, on the other hand, by the misuse of lands. It is an important human duty to protect the soil and to make it more quality in the face of such loutish use and loss of agricultural lands. In this regard, forage legumes play a very important role. Forage legumes go deep into the soil with their taproot systems. Thus, the soil is ventilated deeply, and water and nutrient movements are provided throughout the root system, and it improves in terms of both the soil surface, the parts near the surface, and deeper parts and the soil structure and the nutrient contents. The residues of legumes increase the amount of the organic matter in the soil, thereby increasing the activity of microorganisms. The most important feature of leguminous plants is that *Rhizobium* bacteria in their roots can bind free nitrogen in the air to the soil. Due to this feature, leguminous plants provide 50% to 75% of the nitrogen requirement of the plant that comes after them (Wittver, 1977; Altın et al., 2009: 17). For example, the amount of nitrogen supplied by alfalfa to the soil is between 7.9 kg and 22.4 kg and this value is between 6.2 kg and 23.5 kg in Alexandria trefoil, and is 11.1 kg in hairy vetch (Miller & Heichel, 1995).

High quality and abundant yields can be obtained without nitrogen fertilization especially in perennial forage legumes. A similar situation applies to plants that are planted following the plants in question. According to the study of Serin et al. (1998), although an average of 683 kg dry grass can be obtained from a decare provided that 8 forage Poaceae are fertilized, an average of 1.151 kg dry grass can be obtained from meadow trefoil and alfalfa without a fertilizer. In other words, the yield of forage legumes is 68.5% higher than that of forage Poaceae in the unit area. Forage legumes do not need much fertilization, but they are also used as green fertilizers. In particular, peas (*Pisum sativum* L.), red trefoil (*Trifolium incarnatum*),

and vetch (*Vicia sativa*) are ideal green fertilizer plants, and it is observed that they are also becoming widespread in the Turkish agricultural life.

**c.** *In the soil preservation:* As mentioned above, forage legumes have a taproot system. With this powerful root system, they go into the depths of the soil and hold and preserve the soil. Also with this root system, they improve the soil structure, loosen the soil, and facilitate its processing. Particularly, perennial forage legumes keep the water coming to the surface with precipitation, reach it to the depths of the soil, and prevent the water from flowing as a surface flow and dragging the soil during the flow. They show this resistance that they show against the precipitation, against effective winds and prevent the sweeping of the soil and protect the soil in this respect.

**d.** *In the meadow - pasture improvement and organic animal breeding:* Nowadays, in performing the animal breeding economically, it is necessary to improve meadow - pasture areas and to increase the cultivation areas of forage plants because the feed input alone accounts for 70% in the animal production. In addition to being an inexpensive source, quality roughage in animal feeding is important in terms of including the protein, fat, and cellulose necessary for the development of rumen microflora and fauna of animals, being rich in minerals and vitamins, improving the performance of animals, preventing many metabolic diseases related to nutrition, and providing high quality animal product (Alçiçek and Karaayvaz, 2003).

The meadows and pastures that have been used intensively for many years are still under extreme pressure in Turkey. For this reason, even if an improvement is performed in animal breeds, the large impoverishment of existing meadows and pastures is causing the sector to regress for pasture and organic animal breeding. With the increased production of forage legumes, the pressure on meadows and pastures will be reduced, and they even will be used for the improvement of meadows and pastures and pastures will become more quality.

Nowadays, organic agriculture is of great importance. With the organic vegetable production, organic animal breeding continues its development. As is known, the use of chemicals is prohibited at every stage of organic farming. As mentioned above, forage legumes provide organic wastes and nitrogen for the plants grown after them or the crops with which they grow together, thus eliminating the use of chemical fertilizers. Furthermore, forage legumes are also effective in combating diseases and pests. In the fields where they are planted, the life cycles of diseases and pests are broken, and the need for the chemical fight is eliminated.

Within the scope of the provisions of the *Regulation on the Principles of Organic Farming and Their Implementation* published in the Official Gazette dated August 18, 2010 and numbered 27676 according to the EU legislation in organic animal breeding, forced feeding of animals is forbidden in organic breeding, and it is made possible to reach grasslands at different times of the year. At this point, organic grasslands and pastures are needed, and when entered in indoor areas, organic forage plants obtained from these grasslands and pastures are needed. Meadow - pasture areas where the organic animal breeding will be performed are first taken to the transition period of 2 to 3 years. At this point, the importance of forage legumes increases more in terms of both the animal feeding and meadow - pasture improvement and organic animal breeding.

**e.** *In narrowing and alternating fallow fields:* Fallow fields can be easily narrowed with their (forage legumes) inclusion in the alternation in grain-fallow practice in regions where the fallow practice is intensive. The most successful example of this situation is that significant narrowing was realized in Turkey due to the extension of vetch and lentil planting within the scope of the "Project of Narrowing Fallow Fields in Turkey (NAD)" in the 1980s. At the same time, due to the structural characteristics of the plants in question, quite high yield increases were recorded in wheat planted after them in the 1980s. In this respect, it is necessary to draw attention to multi-dimensional advantages of forage legumes with a single application.

Forage legumes also play an important role in sowing seasons, and their intercropping should also be emphasized. As is known, crop rotations are practices that are carried out to obtain high quality and high yield from a certain area by preserving the soil in the long term. It was determined in various studies that legumes are effective in this practice, provide the nutrient increase in the soil, are effective in the fight against weeds, diseases, and pests, and are labor savers. For example, grains such as wheat or silage corn that follow legumes in the crop rotation system can meet a significant portion of their nitrogen needs from residual wastes left from legumes of the previous period and from the nitrogen they have added to the soil

(Stute and Posner, 1995). However, the cultivation of forage legumes as a second crop will require a continuous labor force in agricultural enterprises. Thus, it is not the case that the labor force is idle, but the labor force will be distributed throughout the year and will always be active. The nitrogen that legumes provide to the soil is a great benefit for the plants that are planted together as well as for the plants that come after them. For this reason, high yields can be obtained without using the nitrogen fertilizer (N) in legume + wheat rotations (Dumlu Gül & Tan, 2013). This comes as a nonignorable alternative for a country, where intensive and unconscious chemical fertilizer consumption is very common, such as Turkey.

## 4. SUPPLY AND DEMAND STATUS OF FORAGE LEGUMES IN TURKEY

In Turkey's agricultural life, animal breeding has occupied an important place from past to the present day. However, despite the increasing population and welfare level and the diversity of dietary habits, problems in the animal breeding sector have become chronic and come until today. One of the chronic problems in the Turkish agriculture is the inability to meet the need for feed and thus, the instability between animal products and feed. In dairy or feeder cattle businesses, feed inputs constitute 60% to 70% of the production cost (Alçiçek et al., 2010: 1071). However, it was pointed out that, in 1985, nearly 30% increase in the income in animal breeding could be achieved only by solving the problem of feed (Kabukçu, 1987: 85). Increasing the productivity of the animal production and animal products in Turkey and the uptake of the quality have mainly been tried to be solved by the improvement of animal breeds and post-breeding practices have mostly been ignored. However, when compared with milk and meat yields from the same breeds in developed countries where the improvement studies alone are not enough, it is clearly understood. At this point, the forage production, feed technology, and meadow - pasture improvement are the key.

In the agricultural life of Turkey, unfortunately, the cultivation of forage plants has not taken an important place as an economic activity. The continuation of the traditional methods of grazing animal breeding for many years in the pastoral form in meadow - pastures has been a major obstacle to the development of the cultural activity in question. As a result, the share of forage plants in the total arable land has never exceeded 10%. However, the understanding of the importance of forage plants in animal breeding and thus, with the inclusion of the support of the government in this direction, their ratio to the total agricultural areas increased exponentially in the selected years and increased to 8% in 2015 as seen in Table 1. The cultivation area of about 1 million hectares was close to 2 million in 2015. However, the fallow fields, which still have a very serious share, are about twice the area of forage plants. On the other hand, very positive results have been obtained within the scope of the Project of Narrowing Fallow Fields in the 1980s, especially with the incentive to plant leguminous plants, and fallow fields have decreased very much in Turkey. Forage legumes and especially vetch among these can be considered as strategic products that need to be taken into consideration in this respect.

**Table 1.** Cultivation Amounts and Ratios According to Vegetable Groups by the Selected Years

| Alan (ha.) | 1995 | Rate (%) | 2005 | Rate (%) | 2015 | Rate (%) |
|---|---|---|---|---|---|---|
| **Cultivated land** | 18.252.476 | 68 | 18.005.319 | 67,6 | 15.723.021 | 65,7 |
| **Fallow Land** | 5.124.069 | 19 | 4.876.164 | 18,3 | 4.113.976 | 17,2 |
| **Cereals** | 13.816.470 | 51,4 | 13.893.241 | 52,2 | 11.713.223 | 49 |
| **Industrial crops** | 2.059.639 | 7,6 | 1.737.636 | 6,5 | 1.732.866 | 7,2 |
| **Pulses** | 1.591.183 | 6 | 1.175.100 | 4,4 | 690.289 | 2,8 |
| **Forage crops** | **612.137** | **2,3** | **1.043.020** | **4** | **1.921.757** | **8** |
| **Starchy crops** | 200.047 | 0,7 | 154.322 | 0,6 | 154.132 | 0,6 |
| **Total agricultural area** | 26.834.828 | 100 | 26.606.715 | 100 | 23.933.949 | 100 |

**Source:** TurkStat, 2018.

Forage legumes are very important in terms of their nutritional content and the fact that they are a food group that animals consume fondly. Furthermore, their various advantages mentioned above constitute a group which should be handled separately in all forage plants. Unfortunately, however, there is a significant decline in the proportion of forage legumes among forage plants in Turkey. The support for forage plants and grants related to animal breeding, unfortunately, have not become a positive reflection on forage legumes. So that in 1995, when the rate of forage legumes in the total forage plants was close to 90%, in 2015, this rate decreased by 50% and forage Poaceae emerged (Figure 1). In Turkey, which is a country where the cultivation of forage legumes can be easily performed when the geographical conditions are considered as a potential for animal breeding, the decline in the plant group in question is perturbative

in all respects. As a matter of fact, forage legumes are not only agricultural crops that are produced in agricultural terms, but also are a group of plants that cannot be ignored in both outdoor and indoor animal breeding because they are the most attractive products in the meadow and pasture improvement.

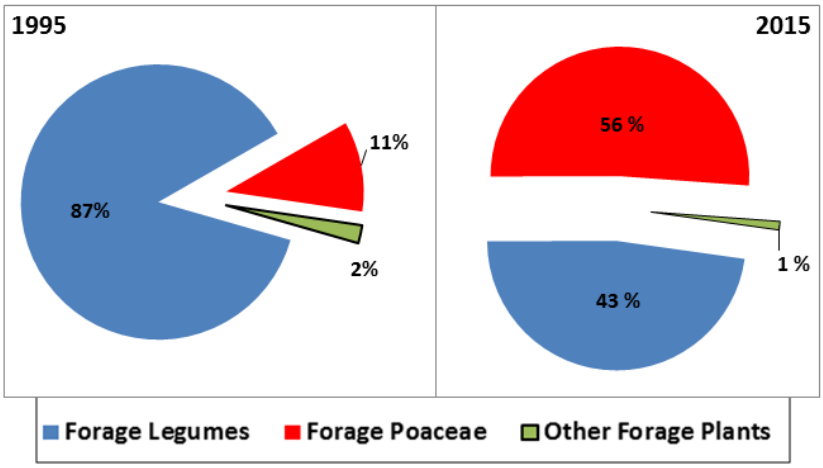
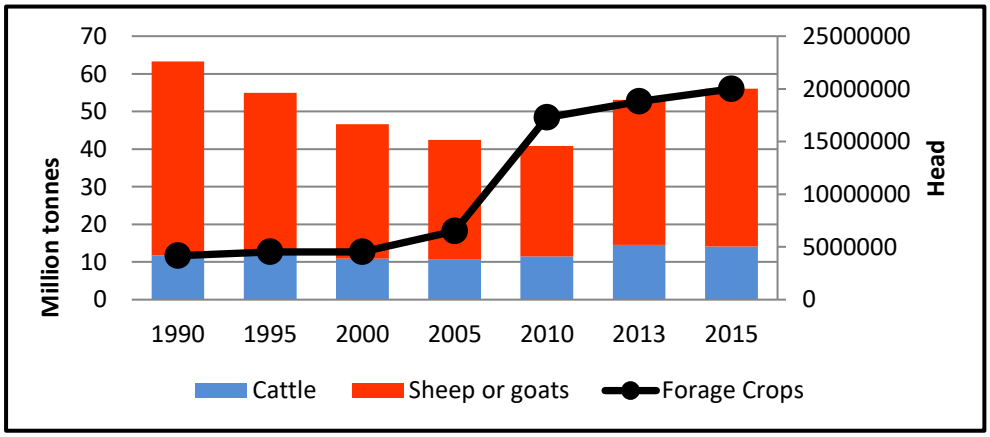



**Figure 1.** Production Rates by Forage Groups in Turkey by 1995 and 2015
**Source:** TurkStat, 2018.

When we compare the production of forage legumes with the presence of bovine and ovine animals, although there is a general increase in the forage plant group in question, there is an increase in the number of animals in general, especially in ovine animal breeding. The total forage legume production is close to 20 million tons, whereas the number of ovine animals, which was about 30 million (29.382.924) in 2010, reached 41.9 million and the number of bovine animals, which was 10.6 million in 2005, reached 14.1 million (Figure 2). However, as will be noted in the analyses made according to the BAU (Bovine Animal Unit) in the following sections, the production is far from satisfactory. Moreover, it is known that the production is mainly aimed at bovine animal production, especially considering that ovine animal breeding is still carried out with the method of grazing in meadow - pastures, which is called the pastoral animal breeding. In recent years, the number of high-yield culture breeds has gained importance in our bovine animal asset with successful practices to spread culture breeds instead of low-yield breeds. However, it is not possible to get a high yield from the breeds in question, in the case of being away from ideal feeding conditions. At this point, forage legumes play a major role. In the case of ovine breeding practices, even it is dominantly in the form of free grazing as mentioned earlier, it is not possible to obtain high yields from animals that are grazed in low-yield and low-quality meadow and pastures. It is possible to both have a remarkable development in the bovine and ovine sectors and improve the meadow - pasture ecosystem by widely using forage legumes in the meadow - pasture improvement.




**Source:** Edited from TurkStat data, 2018.
**Figure 2.** The Status of Bovine and Ovine Animal Assets and the Production of Forage Legumes in Turkey by the Selected Years

When we examine the animal asset, feed production and the need for feed on the scale of the whole country and selected regions, it is revealed that they are worrisomely inadequate not only on the scale of forage legumes but also in the production of all forage plants. When our existing animal asset is calculated on the scale of Turkey, as of 2015, according to the method of the Bovine Animal Unit, it corresponds to

12.671.898. There is a need for 57.815.534 tons of feed per year in order to benefit economically from this animal asset in question. However, only a very limited portion of the need, at 9.37%, could be met in the same year. Remarkable results were observed in the provinces we selected as a sample from different locations. For example, although this rate has increased to 34.47% in Muş, where animal breeding is the main economic activity, in Ağrı, where animal breeding is also one of the main income sources, this ratio has remained at 13.85 % (Table 2). In Adana, which has been a major polyculture center from past to present, the rate of meeting the need for feed according to the BAU was very low at 2.72%, while in Aksaray, where animal breeding lagged behind the vegetable production, the rate has increased to 37.21%. When the related table is taken as a whole, there is a result as follows. The fields of the production of forage plants in Turkey and the fields where animal breeding is performed are not exactly parallel to each other. This situation makes it necessary to meet the need for feeds from outside, which adds an additional burden to animal breeding activities by adding transportation costs to forage plants constituting the basic input in animal breeding. Moreover, against the increased costs, the roughage shortage is met with products, of which nutritional value is very low compared to forage legumes such as cereal hay and other crop residues (Uzun et al., 2008). Due to the increased costs, most of the producers that provide their livelihood with animal breeding are trying to meet the animals' nutritional needs by free grazing, resulting in a remarkable drop in the animal yield.

**Table 2.** The Rate of the Selected Provinces in Meeting the Roughage and Production Needs with 2015 BAU

| Provinces | BAU* | Total roughage requirement (Tonnes) | The amount of dry grass produced (Tonnes) | Demand rate (%) |
|---|---|---|---|---|
| **Ağrı** | 301.069 | 1.373.627 | 190.333 | 13.85 |
| **Muş** | 249.449 | 1.138.111 | 392.377 | 34.47 |
| **Denizli** | 228.695 | 1.043.421 | 167.953 | 16.09 |
| **Sivas** | 222.521 | 1.015.252 | 157.004 | 15.46 |
| **Çanakkale** | 209.470 | 955.706 | 217.940 | 22.80 |
| **Adana** | 184.332 | 841.015 | 22.928 | 2.72 |
| **Antalya** | 182.819 | 834.112 | 25.169 | 3.01 |
| **Aksaray** | 178.992 | 816.651 | 303.877 | 37.21 |
| **Kastamonu** | 161.256 | 735.730 | 36.185 | 4.91 |
| **Eskişehir** | 148.788 | 678.845 | 73.005 | 10.75 |
| **Turkey** | **12.671.898** | **57.815.534** | **5.417.840** | **9.37** |

*: It was calculated according to the Bovine Animal Unit.

Contrary to the expectations in Turkey, where forage plants meet a very limited portion of the production needs, import amount is not very high. Almost all of the total export (95.48 %) was realized in the USA and EU countries in the same year. Considering the high value of the animal assets and animal productivity of the countries in question, the significant presence of export after meeting their needs indicates that they are intensely inclined towards the production of this group of plants. It is also noteworthy that Switzerland alone imported 59.21 % of the EU total import of forage plants. Turkey realized import at a very limited value of 10.169 tons in 2013, and almost half of this amount was exported. As it is understood from these data, the production in animal feeding in Turkey is inadequate as well as the shortage is not met with the supply of outsourced feed. This is because of the fact that, as stated at the beginning of this chapter, animal feeding in Turkey is still largely achieved by free grazing. This, in turn, results in failure to achieve the expected levels of animal production and productivity, due to the lack of strategic planning in animal feeding in response to the improvement in animal breeds.

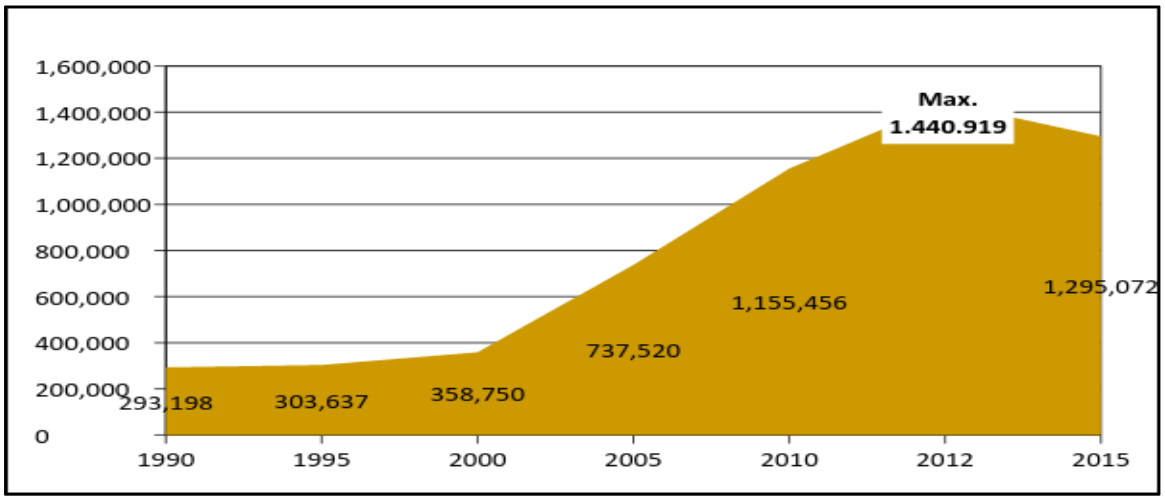
**Table 3.** Import and Export Amounts of Forage Plants of the Selected Countries and Worldwide According to the 2013 Data

| Countries and Regions | Export (Tonnes) | Imports (Tonnes) |
|---|---|---|
| **USA** | 4.279.823 | 226.674 |
| **EU** | 1.263.401 | 277.953 |
| **France** | 132.153 | 15.268 |
| **Mexican** | 93.351 | 1.746 |
| **Argentina** | 46.976 | - |
| **Poland** | 19.669 | 5.934 |
| **Canada** | 12.888 | 31.048 |
| **Turkey** | 4.870 | 10.169 |
| **Swiss** | 1.447 | 164.595 |
| **Belgium** | - | 16.438 |

**Source:** FAO, 2018.

## 5. THE PLACE OF FORAGE LEGUMES IN THE LAND USE

As of 1990, the areas where forage legumes were planted were 293.198 hectares, which constitutes 1.5% of the total cultivation area. Between 1990 and 2000, although there was an increase in the areas of the cultivation of forage legumes, the actual increase occurred after 2000. The cultivation areas, which were 358.750 hectares as of 2000, reached 737.520 hectares in 2005, 1.155.456 hectares in 2010 and 1.295.072 hectares in 2015 (Figure 3). Between 2000 and 2005, the cultivation area more than doubled. The increases continued in the following years. In these increments, the incentive effect is rather high. It was decided to expand the cultivation areas of forage plants since 2000, and in this direction, the Ministry of Food, Agriculture and Livestock began to support the cultivation of forage plants with the decree numbered 2000/467 (Decision on Supporting Livestock). The increase both in the area and in the production of forage plants observed after 2000 is related to the policy of supporting the cultivation of forage plants. Supported forage plants include alfalfa, sainfoin, vetch, Hungarian vetch, bitter vetch, lathyrus, triticale, silage corn, sorghum, sudan grass, sorghum-sudan grass hybrid, animal beet, feed turnip, vetch or Hungarian vetch-grain mixture, and sown meadows and pastures (Anonymous, 2006). Although this support has increased cultivation areas and production amount, this increase is not reflected on the quantity and quality of meat and milk as expected.




**Source:** TurkStat, 2018.

**Figure 3.** The Change in the Cultivation Areas of Forage Legumes in Turkey

In general, although all forage plants have a certain increase in the cultivation area, the share of forage plants in the total cultivation areas is very small when compared to developed countries in this area. As can be seen from Table 4, the proportion of the cultivation areas of forage plants in Australia is about 50% of the total land area. It is 36.5% in Germany, 31.4% in the Netherlands, 30.2% in Italy, 30.2% in Denmark, 25.8% in France, 25.4% in the United Kingdom, and 23% in the USA.

**Table 4.** The Total Cultivation and Forage Plant Areas in the Selected Countries and Turkey

| Countries | Total cultivated area (million ha.) | Forage crops area (million ha.) | Rate (%) |
|---|---|---|---|
| **USA** | 174.448 | 40.225 | 23,0 |
| **Australia** | 49.402 | 25.056 | 49,8 |
| **France** | 18.507 | 4.757 | 25,8 |
| **Turkey** | 15.723 | 1.884 | 11,9 |
| **Germany** | 11.903 | 4.317 | 36,5 |
| **Italy** | 7.744 | 2.470 | 30,2 |
| **UK** | 5.729 | 1.437 | 25,4 |
| **Denmark** | 2.237 | 693 | 30,2 |
| **Netherlands** | 908 | 284 | 31,4 |

**Source:** FAO, 2007; TurkStat, 2018.

The forage legume that has the highest cultivation area is alfalfa. Alfalfa is followed by vetch, sainfoin, and other forage legumes. Upon examining since the year of 2015, it is observed that more than half (51.12 %) of the cultivation areas of forage legumes have been formed by alfalfa (Table 5). 33.7 % of the cultivation areas of forage legumes are constituted by vetch, 14.78 % by sainfoin, and 0.39 % by other forage legumes.

While alfalfa had a share of 1 % in the total cultivation area as of 1990, its share in the total cultivation area rose to 4.2 % in 2015.

**Table 5.** The Main Cultivation Areas (hectare) of Forage Legumes and Their Proportional Values in Turkey by the Selected Years

| Years | Baklagil Yem Bitkileri | Alfalfa | % | Vetch | % | Sainfoin | % | Other Forage Legumes | % |
|---|---|---|---|---|---|---|---|---|---|
| **1990** | 293.198 | 197.439 | 67,3 | - | - | 95.759 | 32,6 | - | - |
| **1995** | 303.637 | 214.010 | 70,4 | - | - | 88.953 | 29,3 | 674 | 0,2 |
| **2000** | 358.750 | 250.800 | 70 | - | - | 107.500 | 29,9 | 450 | 0,1 |
| **2005** | 737.520 | 375.000 | 50,8 | 250.000 | 33,8 | 110.000 | 14,9 | 2.520 | 0,3 |
| **2010** | 1.155.456 | 568.810 | 49,2 | 428.840 | 37,1 | 157.081 | 13,5 | 725 | 0,06 |
| **2012** | 1.440.919 | 674.183 | 46,7 | 569.425 | 39,5 | 196.334 | 13,6 | 977 | 0,06 |
| **2014** | 1.318.677 | 692.305 | 52,4 | 426.934 | 32,3 | 194.908 | 14,7 | 4.530 | 0,3 |
| **2015** | 1.295.072 | 662.045 | 51,1 | 436.518 | 33,7 | 191.403 | 14,7 | 5.106 | 0,4 |

**Source:** TurkStat, 2018.

When we examine the distribution of the cultivation areas of forage legumes in Turkey, it is observed that it is not evenly distributed throughout the country. As of 2015, 51.7% of the cultivation areas of forage legumes in question are located in fifteen provinces. Among these, Van is the province that has the most cultivation areas of forage legumes (9.4%). This is followed by Kars and Ağrı with a rate of 7 %, Sivas with a rate of 6.6%, Bitlis with a rate of 4.7 %, and Samsun and Konya with a rate of 2.8% (Table 6).

**Table 6.** Provinces with the Most Cultivation Areas of Forage Legumes in Turkey and Their Rates

| Provinces | Forage legumes areas (ha.) | Rate (%) |
|---|---|---|
| **Van** | 122.294 | 9,4 |
| **Kars** | 91.331 | 7,0 |
| **Ağrı** | 90.449 | 7,0 |
| **Sivas** | 86.103 | 6,6 |
| **Bitlis** | 61.752 | 4,7 |
| **Samsun** | 37.405 | 2,8 |
| **Konya** | 37.260 | 2,8 |
| **Denizli** | 25.078 | 1,9 |
| **Mersin** | 23.208 | 1,8 |
| **Aksaray** | 21.188 | 1,6 |
| **Kastamonu** | 20.785 | 1,6 |
| **Afyon** | 20.143 | 1,5 |
| **Manisa** | 20.035 | 1,5 |
| **Aydın** | 17.454 | 1,3 |
| **Bursa** | 14.967 | 1,1 |
| **Toplam** | 669.309 | 51,7 |
| **Turkey** | **1.295.072** | **100** |

**Source:** TurkStat, 2018.

The provinces where there are wide cultivation areas of forage legumes correspond to areas where also animal breeding is dominant. The intensive animal breeding is not common in Turkey, where the pasture animal breeding, of which main feed source is formed by natural meadows and pastures, is dominant. Meadows and pastures, where overgrazing is dominant and improvements are not performed, are under the pressure of many animals with the low-yield capacity. By 2015, still 13.3% of the total bovine animals and 93% of our sheep assets constituted of low-yielding domestic breeds (TurkStat, 2017). Thus, on the one hand, meadows and pastures are destroyed, and on the other hand, it is tried to feed a large number of nonyielding animals in these low-yielding areas. In the light of these data, the presence and importance of the areas where forage legumes are cultivated come to light. In recent years, with the supports of the Ministry of Food, Agriculture and Livestock, the number of meat and milk high-yielding hybrid and purebred culture breeds has increased. The increase in both hybrid and purebred culture breeds, and necessitating of the intensive breeding have revealed the necessity for a high amount of roughage feed. Since the cattle animal breeding is dominant in the intensive animal breeding, businesses need forage plants in a significant amount to provide the nutrients needed to feed animals.

## 6. THE STATUS OF THE PRODUCTION AND GEOGRAPHICAL DISTRIBUTION OF FORAGE LEGUMES IN TURKEY

The main forage plants cultivated in Turkey are alfalfa, vetch (Hungarian, lucerne, and others), sainfoin, feed peas, bitter vetch, trefoil, and lupin bean. In addition to these, while the production of legumes such as soybean, lathyrus, bird's foot trefoil, chickpea milkvetch, etc. is also present, the production of some of them is very limited, and it is not known at which rate the rest is used in animal feeding (as in soybean).

When we evaluate the data of the production of forage legumes in Turkey, the production (green + dry grass), which was 4.164.988 tons in 1990 exceeded 5 million in 2003 and 6 million in 2005. Although not being reflected on the production at the beginning, an increase was observed in the production amounts as well as in the cultivation areas with the post-2000 supports. There was a remarkable increase in the amount in 2010 since the collection of the dry grass statistics was abolished, and only the green grass production values were recorded. In this respect, pre and post-2010 should be evaluated as separate periods. In the post-2010 period, since 2012, the amount of forage legumes (green grass) has regularly increased, approaching 20 million in 2015 (Table 7).

**Table 7.** The Production Amounts of Forage Legumes in Turkey

| Years | Production (Tonnes) | Years | Production (Tonnes) |
|---|---|---|---|
| 1990 | 4.164.988 | 2005 | 6.489.816 |
| 1993 | 4.149.067 | 2010 | 17.286.590 |
| 1995 | 4.535.252 | 2011 | 18.144.033 |
| 1997 | 4.380.634 | 2012 | 17.287.227 |
| 1999 | 4.433.220 | 2013 | 18.796.310 |
| 2001 | 4.661.255 | 2014 | 19.350.664 |
| 2003 | 5.307.400 | 2015 | 19.999.250 |

**Source:** TurkStat, 2018.

When we examine the production and geographical distribution of the products, in particular, alfalfa is among the main products in the production of forage legumes, and this is followed by vetch, sainfoin, bitter vetch, lupin bean, and other legumes, respectively.

**a. Alfalfa:** Alfalfa (*Medicago* L.) is regarded as the "Queen of Forage Plants" because of the characteristics it possesses. It deserves its title due to the facts that in addition to its deep root system, it has soil-preserving and improving characteristics due to being a spreading plant, it is not a forage legumes. It is known that alfalfa was used in animal feeding in Anatolia even during the Hittite period (the 1350s BC) (Gençkan, 1992). Due to the fact that it has been known by people since ancient times, the cultivation of alfalfa has spread to the world today, and it is the most cultivated forage legume.

**Table 8.** The Cultivation Area and Production Amount of Alfalfa (Green grass) by Years

| Years | Area (da.) | Production (Tonnes) | Years | Area (da.) | Production (Tonnes) |
|---|---|---|---|---|---|
| **1990** | 1.974.390 | 1.848.825 | 2006 | 4.440.296 | 1.814.990 |
| **1992** | 1.955.430 | 1.658.646 | 2008 | 5.557.215 | 1.843.961 |
| **1994** | 1.948.010 | 1.570.439 | 2010 | 5.688.107 | 11.676.115 |
| **1996** | 2.290.510 | 1.935.087 | 2011 | 5.585.525 | 12.076.159 |
| **1998** | 2.300.000 | 1.750.000 | 2012 | 6.741.832 | 11.536.328 |
| **2000** | 2.508.000 | 1.807.000 | 2013 | 6.286.419 | 12.616.178 |
| **2002** | 2.600.000 | 1.900.000 | 2014 | 6.923.055 | 13.432.968 |
| **2004** | 3.200.000 | 2.300.000 | 2015 | 6.620.459 | 13.949.958 |

**Source:** TurkStat, 2018.

Lucerne (*Medicago sativa* L.), hybrid alfalfa *(Medicago varia* L.), blackdisk medick (*Medicago orbicularis* L.), elegant alfalfa (*Medicago elegans* L.), and triturus alfalfa (*Medicago tuberculata* L.) are among the major alfalfa species which spread naturally and are cultivated in Turkey. Among these, lucerne is the most cultivated species. When we examine the production of alfalfa in the selected years, it can be said that there is an increasing tendency in the production in general. Approximately 2 million decares of the cultivation area in the 1990s exceeded 6 million in 2015. The amount of the production remained around 2 million tons between 1990 and 2008. After 2010, the values of the dry grass production were abolished, and all production was started to be evaluated on green grass, and according to this, the production amount does not decrease below 11 million tons, and it is observed to be close to 14 million in 2015 (Table 8).

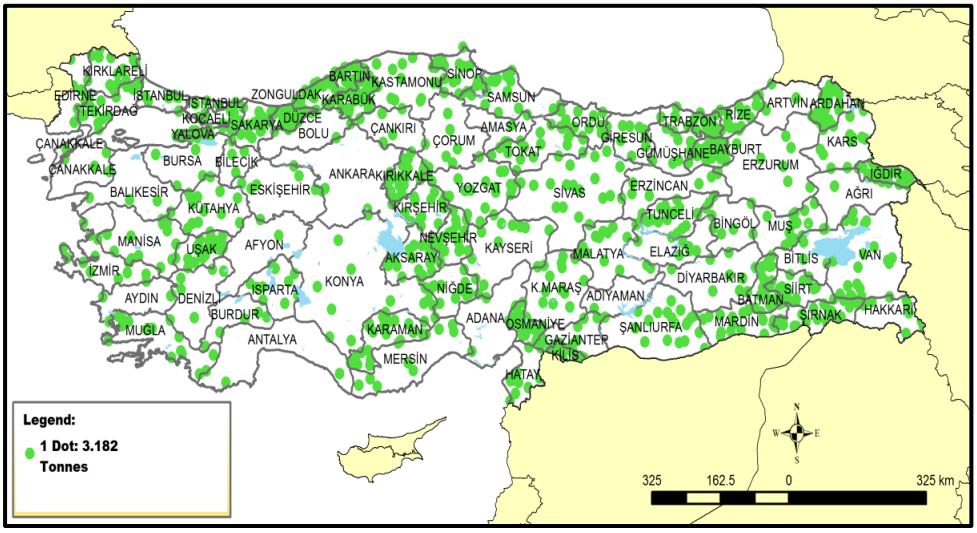



**Figure 4.** The Geographical Distribution of Alfalfa Cultivation in Turkey in 2015

**b. Vetch:** Vetch, which is used in animal feeding as green and dry grass and of which grains and other parts such as the stem, trunk, and leaves are evaluated separately in terms of the nutrient content, is an important forage. Vetch, especially with a content of protein above 20 %, is a product wanted in animal feeding. Vetch, which has species grown naturally in Turkey, has a wide adaptation capability. Thus, new varieties developed can be easily grown in Turkey. The most common species of vetch in Turkey is spring vetch *(Vicia sativa*). However, the cultivation of some varieties such as Hungarian vetch (*Vicia pannonica*), narbon vetch (*Vicia narbonensis*), and hairy vetch (*Vicia villosa*) is also performed. The incentive of water-resistant and nutritional forage such as vetch is of great importance in areas where the terrestrial climate of the Central Anatolia Region dominates, especially in the Southeastern Anatolia Region, where ovine breeding is especially common.

**Table 9.** The Cultivation Areas and Production Amounts of Vetch in Turkey by the Selected Years

| Years | Area (da.) | Production (Tonnes) | Years | Area (da.) | Production (Tonnes) |
|---|---|---|---|---|---|
| **1990** | - | 294.460 | 2006 | 3.862.882 | 1.026.324 |
| **1992** | - | 298.255 | 2008 | 5.796.842 | 1.249.948 |
| **1994** | - | 293.895 | 2010 | 4.288.400 | 4.018.984 |
| **1996** | - | 395.000 | 2011 | 4.754.756 | 4.442.017 |
| **1998** | - | 325.000 | 2012 | 5.694.254 | 4.245.417 |
| **2000** | - | 395.000 | 2013 | 4.990.430 | 4.492.466 |
| **2002** | 2.200.000 | 450.000 | 2014 | 4.269.348 | 4.168.085 |
| **2004** | 3.862.882 | 540.000 | 2015 | 4.365.182 | 4.281.259 |

**Source:** TurkStat, 2018.

When the historical course of vetch production in Turkey was examined, the total production of green and dry grass did not reach 1 million tons from the end of the 1980s until 2004 (TurkStat, 2017). However, since 2005, there has been a remarkable increase in both items, as green and dry grass. This has played a major role, especially in animal-related politics, especially in the context of including forage plants within the scope of support. Training on farmer education and the formation of agricultural cultures of forage plants in Turkey also contributed to this increase. As stated earlier, from 2010 onwards, the hold of the dry grass statistics has been abolished, and only the production values of green grass have begun to be compiled. In this respect, although there is a significant increase in the figures, the increase in the amount is due to the green grass feature[1]. When evaluated in this respect, green grass vetch production has not fallen below 4 million tons since 2010. When we examine the distribution of the production on the provision scale, it is understood that there is a wide spread in the whole of Turkey. Lastly, according to the data of 2015, Samsun is in the first place with 481.890 tons of production, followed by Kars (279.544), Manisa (177.115), Konya (156.894), Denizli (137.212), and Afyonkarahisar (131.916 tons), respectively (TurkStat, 2017). These provinces in question constitute a significant part of the vetch production in Turkey at the rate of 32%. However, when we examine the first 15 provinces where vetch is cultivated at most, all of them, when Kars is excluded, are provinces where animal breeding is in the second place among agricultural activities. However, with the expression that cultivation can be carried out easily in arid conditions, the most important producers of these 15 provinces, especially the province of Samsun, are the coastal

provinces. Diyarbakır, Gaziantep, Adıyaman, Malatya, Şırnak and Hakkâri are the provinces that are in the last places in vetch production, whereas animal breeding is important there. In this respect, it is necessary for the vetch production areas in Turkey to be reviewed and paralleled with animal breeding, especially in some of our provinces, by increasing incentives.

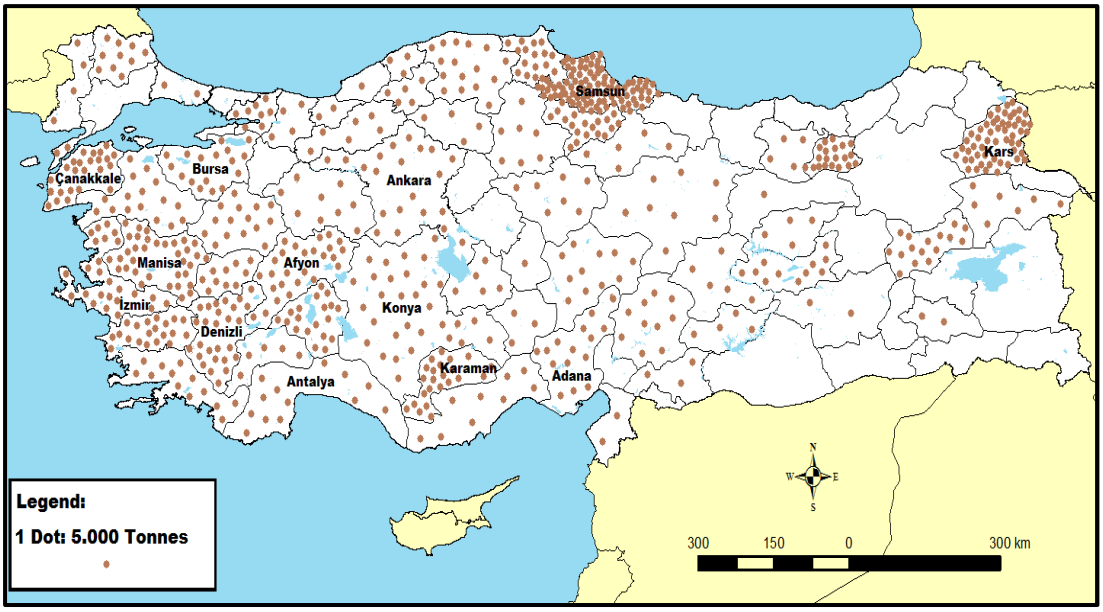



**Figure 5.** The Geographical Distribution of Vetch Cultivation in Turkey by 2015

**c. Sainfoin:** A perennial forage legume, sainfoin is a non-selective plant in terms of climate and is very resistant to cold and drought. Although its economic lifespan is about 5 – 6 years, this period has fallen to 3 years in recent years due to insufficient improvement practices and weak resistance to diseases (Manga et al., 1995; İleri, 2014). The soil improvement property of sainfoin is higher than that of most other congeners, and sainfoin was used in the improvement of bombed soil in the USSR in the post-World War II period (Soya et al., 2004; İleri, 2014). After the first few years, the resistance of the plant to frost also increases. At the same time, the plant is more preferred for cattle animal breeding with its deep root system and mechanized farming suitability (Hybner, 2013). It is a very suitable feed plant for the Eastern and Southeastern Anatolia Regions, especially in the Central Anatolia Region and its protein content is quite high.

**Table 10.** The Cultivation Area and Production Amount of Sainfoin in Turkey by Years

| Years | Area (da.) | Production (Tonnes) | Years | Area (da.) | Production (Tonnes) |
|---|---|---|---|---|---|
| **1990** | 957.590 | 318.047 | 2006 | 1.176.029 | 124.843 |
| **1992** | 838.600 | 262.025 | 2008 | 1.401.295 | 143.367 |
| **1994** | 799.840 | 149.946 | 2010 | 1.570.810 | 1.508.930 |
| **1996** | 842.040 | 274.715 | 2011 | 1.536.445 | 1.571.606 |
| **1998** | 930.000 | 203.150 | 2012 | 1.963.349 | 1.459.570 |
| **2000** | 1.075.000 | 200.000 | 2013 | 1.914.391 | 1.630.572 |
| **2002** | 990.000 | 204.000 | 2014 | 1.949.088 | 1.646.256 |
| **2004** | 1.070.000 | 270.000 | 2015 | 1.914.036 | 1.655.985 |

**Source:** TurkStat, 2018.

When we examine the production of sainfoin in Turkey by years, as in most of the forage legumes, there has also been a remarkable production increase in this product since 2010. This increase was both the result of the compilation of only green grass data and the effect of state supports. In the last 6 years, if 2012 is ignored, the production of sainfoin used to increase every year, and it did not fall below 1.5 million tons in the last 3 years (Table 10). The plant in question is mostly grown in the Eastern and Central Anatolia regions of Turkey, and the largest producers are Erzurum (372.170 tons), Sivas (223.865 tons), Bayburt (121.289 tons), Van (107.777 tons), Kars (95.552 tons), and Muş (92.815 tons) and they have provided 61.5 % of the total production (TurkStat, 2017).

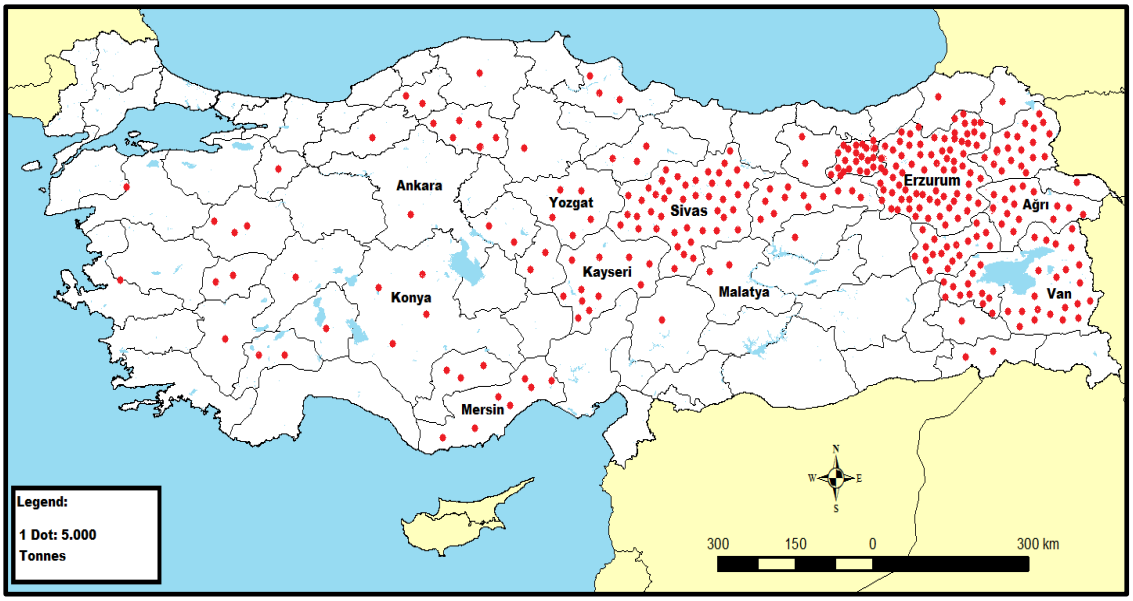



**Figure 6.** The Distribution of Sainfoin Production in Turkey According to the 2015 Data

### d. Alternative and Other Forage Legumes:

**Feed peas:** The striking element of the forage legume group is feed peas (*Risum arvense* L.). Feed peas, which has a wide adaptation ability, is a cool climate plant that leaves 5 – 15 kg/da nitrogen to the soil and does not require much nitrogen fertilizer (Mckenzie and Sponer, 1999; Long et al., 2012). Feed peas started to be cultivated economically in Turkey starting from 2014, and 70.422 tons of the product were obtained in the same year, and its amount was 84.821 tons in the following year (Table 11). It is mostly grown in coastal areas and also intensively in Trakya (88.5 % of the total production) among these (TurkStat, 2017). In the case of 2015, 32.495 tons of feed peas were cultivated in Çanakkale, 23.128 tons in Tekirdağ, 4.854 tons in Kırklareli, and 3.804 tons in Balıkesir.

**Bitter (Wild) vetch**: Bitter vetch *(Vicia ervilia*), which is one of the traditional forage legumes in Turkey since the past, is widely grown. Bitter vetch is an abstinent plant and is an ideal plant with especially its resistance to drought in the utilization of the areas where many plants cannot be grown (Ayan et al., 2006; Yolcu and Tan, 2008). The production of bitter vetch, of which use as an additive in bakery products has recently become widespread, remarkably declined after 2007. A total of 87.683 tons of its production in Turkey in 2007 decreased to 42.596 tons in 2008, 30.455 tons in 2014, and finally to 24.849 tons in 2015 (TurkStat, 2017). In Turkey, bitter vetch was produced in 28 provinces in 2015, and its production took place in many different ecologies. In the same year, the highest amount of bitter vetch was produced in Karaman with a maximum of 7.026 tons and the other major producers were Denizli (4.406 tons), Şırnak (3.738), Mardin (2.010), Niğde (1.785), Balıkesir (1.465), Mersin (1.235), Elazığ (1.177), and Muğla (1.110) (TurkStat, 2017). The production of other provinces is below a thousand ton.

**Table 11.** The Production Amount of Other Forage Legumes in the Selected Years

| Years | Green fodder crops production (Tonnes) | | | |
|---|---|---|---|---|
| | Fodder Pea | Wild vetches | Trefoil | Lupinus |
| **2005** | - | 25.000 | 45.216 | 490 |
| **2010** | - | 80.005 | 2.556 | 381 |
| **2011** | - | 51.091 | 3.160 | 417 |
| **2012** | - | 42.894 | 3.018 | 411 |
| **2013** | - | 54.566 | 2.528 | 411 |
| **2014** | 70.422 | 30.455 | 2.478 | 411 |
| **2015** | 84.821 | 24.849 | 2.378 | 409 |

**Source:** TurkStat, 2018.

**Trefoil:** Trefoil (*Trifolium* L.), unfortunately, has not acquired much place in the Turkish agricultural life, although it is an important forage, especially as a dry grass production and soil protection plant (Yolcu and Tan, 2008). In our country, red trefoil *(Tigolium pratense* L.) is the most grown variety of trefoil, which has varieties that can be easily grown in different climatic conditions, especially in the Transition Zones, and

white trefoil (*Trifolium repens)* is also grown. However, although it is possible to grow it in a very wide area of our country, especially in the Marmara and Black Sea Regions, the facts that it is not well known by farmers, can be affected considerably by the pollution (Galal, 2016: 314) and the inadequacies in improvement practices have prevented taking advantage of this plant which has important functions. Firstly, as of 2004, when the production data in the economic sense were also examined from the beginning of compilation, its cultivation area in Turkey has narrowed down year by year, and its production has decreased considerably. Although 10.000 tons of dry grass were obtained from the 2.000-hectare cultivation area in 2004, the cultivation area decreased to 344 hectares in 2010 and 405 ha in 2015 with a slight increase. (TurkStat, 2017). The entire production was only in Hakkari (2.378 tons) and Erzurum (100 tons) (TurkStat, 2017).

**Lupinus:** Finally, lupin bean (*Lupinus* L.), which has been cultivated economically for many years in Turkey, can be considered as the plant of which the production is the most stable among forage legumes. As can be seen in Table 11, if 2010 is ignored, its production has never fallen below 400 tons in the selected years.

**Chickpea Milkvetch:** Due to both its location and geographical conditions, Turkey is a country where a wide variety of forage legumes can be grown. In this respect, the attention should be given to high commercial value alternatives in the cultivation of forage legumes. Among these, chickpea (*Astragalus cicer* L.) the demand for which has increased all over the world in recent years, is an ideal alternative. Chickpea milkvetch is a plant that grows naturally in stony areas in Eastern Anatolia, but has a very high adaptation ability and has the advantages of all other forage legumes. It does not cause bloat in animals, and it is equivalent to alfalfa in terms of the nutritional value (Karakurt, 2001: 75).

**Bird's Foot Trefoil**: Another example that can be given within the scope of alternative forage legumes is bird's foot trefoil *(Lotus corniculatus)*. The gene pool of bird's foot trefoil is the Mediterranean basin in which Turkey is also included, and its species, most of which are endemic, are commonly observed in our grasslands and pastures (Le Houérou, 2001; Uzun et al., 2008). It has annual and perennial species and has a high level of adaptation. Since its resistance to salinity is considerably high, it provides a huge advantage for harvesting forage crops, of which land rehabilitation and nutritional value are high, in areas where the level of salinity is too high because of extensive irrigation, in particular in the Southeastern Anatolian Region of Turkey. It is also an alternative which is suitable for any kind of soil structure of which drainage is poor (Uzun et al., 2008). Especially in recent years, its culture has started to gain popularity in Turkey. Demonstration studies should be extensively focused on for the determination of the ideal yield and cultivation area.

**Production of Organic Forage Legumes:** Furthermore, a significant amount of organic forage legumes has been produced in recent years, especially in Turkey. The fact that the Eastern Anatolian Region where especially animal husbandry is a common economic activity has a huge share in the said plant production is promising for the planning of the field as an important center for both plant and animal production within the scope of organic agriculture in the following years. It is a preferable factor in a sustainable rural development that producers are involved in organic farming as well as in the production of forage plants, especially after the incentives. Finally, when the statistics concerning the organic forage legumes in 2014 are examined, it can be observed that 1.6 % of alfalfa production, 1.1 % of vetch production, 6.2 % of sainfoin production and 66.1% of bitter vetch production have been obtained from organic production in total in Turkey (Ministry of Food, Agriculture and Livestock, 2017). Yet, as it can be observed from the table, more than half of the organic forage legumes of 393.326 tons in total (66.4 %) produced in Turkey come from Van, Erzurum and Kars Provinces in the same year.

**Table 12.** The Product Varieties and Amounts of the Provinces in Which the Maximum Amount of Organic Forage Legumes Was Produced in 2014

| Provinces | Alfalfa | Sainfoin | Vetches | Wild vetches | TOTAL |
|---|---|---|---|---|---|
| **Van** | 104.017 | 25.732 | 168 | 2.291 | 132.208 |
| **Erzurum** | 47.564 | 24.108 | 8.287 | 2.016 | 81.975 |
| **Kars** | 1.387 | 17.362 | 28.188 | - | 46.937 |
| **Ağrı** | 22.764 | 11.905 | 4.774 | 2.665 | 42.108 |
| **Muş** | 15.778 | 3.517 | 1.329 | 4.924 | 25.548 |
| **Sivas** | 3.498 | 13.860 | 101 | 2.620 | 20.079 |
| **Bitlis** | 10.906 | 2.625 | 90,6 | 1.932 | 15.553 |
| **Bayburt** | 3.837 | 1.103 | 455 | 270 | 5.665 |

| | | | | | |
|---|---|---|---|---|---|
| **Erzincan** | 1.678 | 284 | 222 | 2.715 | 4.899 |
| **Ankara** | 2.346 | 206 | - | 444 | 2.996 |
| **Gümüşhane** | 1.224 | 181 | 77 | - | 1.482 |
| **Tunceli** | 977 | 134 | 202 | 109 | 1.422 |
| **Çanakkale** | 759 | - | 379 | 8 | 1.146 |
| **Turkey** | **223.246** | **102.090** | **47.836** | **20.154** | **393.326** |

**Source:** Ministry of Food, Agriculture and Livestock, 2018.

**Seed Production:** The seed production for legumes is, unfortunately, inadequate as is for forage legumes. The ideal amounts of seed for the production of forage legumes per decare are 2 kg for alfalfa, 5 kg for sainfoin and 8 kg for vetch. More seeds are used when planted by hand. When the cultivation area of the said forage legumes in 2015 is examined, we come to a conclusion that 13.190 tons of seeds for alfalfa, 9.521 tons of seeds for sainfoin and 34.921 tons of seeds for vetch are required. Although the required amount of seeds for these three main forage legumes is 57.632 tons in total, only 1.639 tons (2.84%) could be produced in the domestic production in the same year. This ratio is 23.7 % for 2010. 7.2% of the required seeds were imported in 2015 (General Directorate of Plant Production of the Ministry of Food, Agriculture and Livestock, 2017). The course of the seed production of alfalfa, vetch, and sainfoin is highly unstable during the years. A remarkable decrease in alfalfa production has not happened in recent years whereas a significant decline has happened in the seed production of vetch, notably in that of sainfoin compared to previous years. Nevertheless, the total amount of the imported seeds for forage legumes shows more regular increase compared to production, especially in recent years (Table 12). As a result, the use of seeds which have high quality and are suitable for the conditions in Turkey has been understood to be at a low level, which is one of the main problems in the agriculture in Turkey. Furthermore, significant amounts of the seeds of lupinus (240 tons), forage peas (231 tons) and trefoil (26.5 tons) have been imported.

**Table 13.** Seed Production and Import in Turkey by the Selected Years

| Years | Seed Production (Tonnes) | | | | Total forage crops seed import (Tonnes)* |
|---|---|---|---|---|---|
| | Alfalfa | Vetches | Sainfoin | Total | |
| 2000 | 381 | 1.886 | 621 | 2.888 | - |
| 2002 | 269 | 1.246 | 411 | 1.926 | 403 |
| 2004 | 446 | 1.891 | 942 | 3.279 | 1.115 |
| 2006 | 508 | 2.172 | 929 | 3.609 | 5.532 |
| 2008 | 517 | 2.024 | 698 | 3.239 | 1.420 |
| 2010 | 349 | 858 | 56 | 1.263 | 1.105 |
| 2012 | 670 | 876 | 2 | 1.548 | 2.763 |
| 2014 | 560 | 686 | 46 | 1.292 | 3.714 |
| 2015 | 634 | 974 | 31 | 1.639 | 4.134 |

**Source:** General Directorate of Plant Production of the Ministry of Food, Agriculture and Livestock, 2018.
*: Any kind of seeds for forage legumes are included in the import of the total amount of seeds for forage legumes.

Huge amounts of seeds are imported each year in Turkey where only very small amount of the required seeds is obtained by domestic production, and this costs us millions of Euros. As it can be seen from the table 14, only an amount of € 500.000 was exported whereas an amount of approximately € 5 million was imported in 2015. Alfalfa and its seed are at the top of the list in terms of both import and export. Lupinus of which production has become more common in recent years is the second most imported forage legume, and the list is followed by forage peas, vetch, trefoil, and sainfoin.

**Table 14.** The Status of Trade of Forage Legumes and Seeds in Turkey (2015)

| Product | Import (kg.) | Import (€) | Export (kg.) | Export (€) |
|---|---|---|---|---|
| **Alfalfa and seed** | 1.179.321 | 4.306.857 | 264.810 | 324.639 |
| **Wild vetches and seed** | 240.000 | 87.822 | - | - |
| **Forage pea and seed** | 231.650 | 186.361 | - | - |
| **Vetches** | 210.020 | 210.064 | 323.300 | 178.255 |
| **Trefoil seed** | 26.525 | 129.096 | 17 | 108 |
| **Sainfoin seed** | 1.000 | 5.482 | - | - |
| **TOTAL** | **1.888.516** | **4.925.682** | **588.127** | **503.002** |

**Source:** TurkStat, 2018.

Although there has recently been a remarkable inadequacy in seed production in Turkey, there has been significant progress in breeding domestic species, especially thanks to incentives and investments in forage legumes. 54 varieties of alfalfa, 11 varieties of forage peas, 8 varieties of sainfoin and 1 variety of vetch have been registered to the updated national list since 2017 (Variety Registration and Seed Certification Center, 2017).

## 7. CONCLUSION AND PROPOSALS

In consequence of the "2016 International Year of Pulses", some issues concerning the sector draw attention in this study in which certain products of the legumes grown in Turkey used as forage legumes are evaluated together with animal husbandry. What is more interesting is the remarkable difference between the activity of animal husbandry and meeting the forage need, which is a basic input of this activity. It is obvious that it is not possible to improve animal husbandry only by the supply of high-quality breeds. In order for animal husbandry to be intensified, grasslands and pastures should be rehabilitated in a sustainable manner and incentives and promotive investments should be taken into the agenda in relation to the production of forage legumes, especially due to their various advantages among forage plants as well as the rehabilitation of the current amount of animals. Unfortunately, the rehabilitation of animal breeds has long been taken into the agenda as a sole factor in the improvement of animal husbandry in Turkey, and animal feeding and supply of forage plants have remained in the background. Nevertheless, when the history of agriculture in Turkey is examined, it is known that farmers have not gained any habits towards forage production and have not taken any interest in this field. In this respect, the improvement of animal husbandry and achieving an increase in animal products in Turkey are only possible when forage plants, notably forage legumes are supplied. However, Turkey could not meet even 25 % of its forage need, and only 8% of the total cultivated areas was reserved for forage plants in 2015.

Nowadays, a significant part of the cultivated areas (17.2 %) is still let to lie fallow in Turkey. However, legumes can be used both in making use of the fallow areas and rehabilitating grasslands and pastures in the most ideal way according to the floristic characteristics of the country when the physiological characteristics of forage plants are taken into account. Thanks to the nitrogen fixation of the said herbal group, its rehabilitation capacity and the high fertility with which it provides the land for the successive plants create a remarkable increase in the yield of the second plant and provides multi-advantages. Although the reduction of fallow areas and the rotation of forage legumes provide sudden surplus production, animal husbandry in Turkey can tolerate this surplus production easily and forage legumes can be utilized in this field as well thanks to the advanced silage technology. Moreover, silage technology for forage legumes, which can be considered new in Turkey, must be commonly used, and R&D studies in this field must be focused on.

Strategic planning for the production of forage legumes should be done primarily on regional and then local scales in Turkey. In this context, the issue should be dealt with in a multi-dimensional manner for the Eastern Anatolia, Southeastern Anatolia and Eastern Black Sea Regions, and these regions, where especially animal husbandry is one of the main economic activities, are strategically important in terms of improving animal productivity. The Eastern Anatolia Region is the region where animal husbandry has been intensively performed throughout history in Turkey, and it draws attention for the production of forage plants in recent years although it still remains to fail to meet its needs. However, it has the capacity to meet its need for forage plants for animals by producing them and rehabilitating grasslands and pastures and also to raise a few more million animals than today's current number of animals easily. This situation can be easily achieved with a low budget by using alternative forage legumes such as chickpea milkvetch of which culture has not become commercially popular. The development of ovine breeding, notably Awassi sheep, which has adapted to the local conditions of the Southeastern Anatolia region, and an increase in productivity can only be possible with the extensification of the production of forage legumes specific to the local area. However, there has recently been a drastic decline in the land quality because of the inadvertent irrigation since the start of the Southeastern Anatolia Project (GAP) and immediate land rehabilitation is required in the area because of the worrisome levels of salinity as well as the fact that the region is the area where forage legumes are grown at least. The most ideal plant for the rehabilitation of the land where the levels of salinity are high is bird's foot trefoil among forage legumes. It is especially an ideal plant for the recovery of the salinated lands and a plant that can increase the productivity in ovine breeding. The rotation of edible legume, grain, forage legume, safflower will be very favorable for the Southeastern Anatolia Region.

Planning of the local production of forage legumes is of great importance not only for the improvement of

animal husbandry but also taking advantage of leguminous plants in general and providing sustainability in cultivated areas. This situation provides advantages with regard to the issue that Turkey is foreign-dependant in terms of seeds as well as providing savings in fertilizer consumption. Thus, as the amount of on the regional scale, rehabilitation of local seeds can also be performed with R&D studies that should be focused on in this field, and healthier improvements can be achieved. In this regard, Turkey is a part of the gene pool of many forage legumes which are commercially cultured nowadays and has many common wild species in its flora.

Finally, a series of initiatives taken to draw attention to the legumes all around the world and to raise awareness in this field within the scope of the 2016 International Year of Pulses is promising for the said agricultural activity. On the other hand, statistics on certain types of forage legumes (alfalfa, sainfoin, and vetch) should be started to be collected by the relevant agencies such as GPC, notably FAO, Eurostat and OECD especially within the scope of forage crops. The analysis of forage legumes can only be possible if the internal market, international cooperation, production volumes of countries and product design are analyzed together. It is of great importance to draw attention to prepare the numerical data to be collected with regard to forage crops, notably the production of dry and green grass of the relevant countries with regards to the said herbal group according to certain standards.

**REFERENCES**

Açıkgöz, E., (2001). "Yem Bitkileri", III. Printing, Uludağ Üniversitesi Güçlendirme Vakfı Yayın No: 182, VİPAŞ A.Ş. Publishing No: 58, pp. 584, Bursa.

Ak, İ. & Hanoğlu, H., (2013). "Ekolojik Hayvancılıkta Yemler ve Hayvan Besleme İlkeleri", Ekolojik – Organik Tarımda Hayvancılık (Ed. Prof. Dr. İbrahim Ak), Dora Basım – Yayın, pp. 141 – 164, Bursa.

Alçiçek, A. & Karaayvaz, K. (2003). "Sığır Besisinde Mısır Silajı Kullanımı", Animalia, 20 (3): 18 – 76.

Alçiçek, A., Kılıç, A., Ayhan, V. & Özdoğan, M., (2010). "Türkiye'de Kaba Yem Üretimi ve Sorunları", TMMOB Ziraat Mühendisleri Odası (ZMO), Türkiye Ziraat Mühendisliği VII. Teknik Kongresi, 11 – 15 January 2010, Vol. 2, pp. 1071 – 1080, Ankara.

Altın, M., Orak, A. & Tuna, C., (2009). "Yem Bitkilerinin Sürdürülebilir Tarım Açısından Önemi", Yem Bitkileri Genel Bölüm, Vol. I., (Ed. Rıza Avcıoğlu, Rüştü Hatipoğlu, Yaşar Karadağ), s. 11 – 28, İzmir.

Anonymous, (2006). Tarım ve Hayvancılık Desteklemeleri. T.C. Tarım ve Köyişleri Bakanlığı Gümüşhane İl Tarım Müdürlüğü (Çiftçi Eğitim ve Yayım Şube Müdürlüğü) Broşürü, 42 s.

Ayan, İ., Z. Acar, U. Başaran, Ö. Önal Aşcı and Mut, H., (2006). "Samsun ekolojik koşullarında bazı burçak (*Vicia ervilia* L.) hatlarının ot ve tohum verimlerinin belirlenmesi", OMÜ Ziraat Fakültesi Dergisi, 21, pp. 318 – 322.

Balci Akova, S., (2008). "Potential of Organic Animal Husbandry in Enez", Livestock Research for Rural Development (LLRD), Vol. 20, Colombia.

Batello, C., Brinkman, R., 't Mannetje, L., Martinez, A. and Suttie, J. (2008) Plant Genetic Resources of Forage Crops, Pasture and Rangelands, FAO Thematic Background Study, pp. 62.

Conrad, HR, Klopfenstein, T., (1988). "Role in livestock feeding – greenchop, silage, hay, and dehy, In: Alfalfa and Alfalfa Improvement (Agronomy Monograph 29), (Ed. A.A. Hanson, D.K. Barnes, R.R. Hill), American Society of Agronomy, Madison, WI, pp. 539-551.

Dumlu Gül, Z., Tan, M., (2013). "Baklagil Yem Bitkilerinin Silajlık Olarak Kullanılması", Atatürk Üniversitesi Ziraat Fakültesi Dergisi, Sayı: 44(1), s. 189 – 198, Erzurum.

FAO, (2018). http://www.fao.org/faostat/en/#data (11.10.2018)

Galal, T.M., (2016). "Impact of environmental pollution on the growth and production of Egyptian clover", International Journal of Plant Production 10 (3), pp. 303 – 316, Iran.

Hybner, R.M., (2013). Sainfoin *Onobrychis viciifolia* Scop. United States Department of Agriculture, Plant Materials Technical Note No. MT-91, pp. 6, USA.

İleri, O., (2014). Türkiye'de Doğal Olarak Yetişen *Onobrychis* Seksiyonuna Ait Bazı Endemik Korunga Türlerinin Karyolojik Özellikleri, Eskişehir Osmangazi Üniversitesi, Basılmamış Yüksek Lisans Tezi, pp. 56, Eskişehir.

Kabukçu, A., (1987). "Türkiye'de Hayvancılığın Önemi, Bugünkü Durumu, Geleceği Sorunları ve Gelişmesi İçin Öngörülen Önlemler", Doğu Anadolu Hayvancılık Sempozyumu, 19 – 20 December 1985,

pp. 83 – 91, Elazığ.

Karakurt, E., (2001). "Ankara Kıraç Koşullarında Nohut Geveni (*Astragalus cicer* L.) Hat ve Çeşitlerinde Ot Verimi ile Bazı Tarımsal Özellikler", Tarla Bitkileri Merkez Araştırma Enstitüsü Dergisi, Vol. 10, Issue: 1 – 2, pp. 75 – 82, Ankara.

Mahmood, F., Belhouchette, H., Nasim, W., Shahzad, T., Hussain, S., Therond, O., Fahad, S., Refat Sultana, S., Wery, J., (2017). "Economic and environmental impacts of introducing grain legumes in farming systems of Midi-Pyrenees region (France): A simulation approach", International Journal of Plant Production 11 (1), pp. 65 – 87, Iran.

Manga, İ., Acar, Z. and Ayan, İ., 1995, Baklagil yem bitkileri. Ondokuz Mayıs Üniversitesi, Ziraat Fakültesi, Ders Notu No: 7, pp. 342, Samsun.

McKenzie, D.B. and Sponer, D., 1999. White Lupin: An alternative to pea in oat-legume forage mixtures grown in new foundland. Can. J. Plant Sci., 79, pp. 43 – 47.

Miller, D.A. and G.H. Heichel, (1995). "Nutrient Metabolism and Nitrogen Fixation", *In* R.F. Barnes, D.A. Miller, and C.J. Nelson (eds), Forages. Volume 1, An Introduction to Grassland Agriculture, pp. 45 – 53, Iowa State University Press.

Özdem, M.A. (2012). "Dünya ve Türkiye'de Kuru Baklagiller", TEPGE Bakış, Copy: 7, pp. 9, Ankara.

Özyiğit, Y., Bilgen, M., (2003). "Arı Bitkisi Olarak Değerlendirilebilecek Bazı Baklagil Yem Bitkilerinde Farklı Biçim Dönemlerinin Verim ve Tarımsal Özellikler Üzerine Etkisi", Türkiye V. Tarla Bitkileri Kongresi, 13 – 17 October 2003, pp. 479 – 483, Diyarbakır.

Reckling, M., Hecker, J.M., Bergkvist, G., Watson, C.A., Zander, P., Schläfke, N., Stoddard, F.L., Eory, V., Topp, C.F., Maire, J., Bachinger, J., (2016). A cropping system assessment framework-evaluating effects of introducing legumes into crop rotations. European Journal of Agronomy, Vol. 76, pp. 186 – 197.

Sayar, M.S., Anlarsal, A.E., Basbağ, M., (2010). "Güneydoğu Anadolu Bölgesinde Yem Bitkileri Tarımının Mevcut Durumu Sorunları ve Çözüm Önerileri", Harran Üniversitesi Ziraat Fakültesi Dergisi, Vol. 14, Issue: 2, pp. 59 – 67, Şanlıurfa.

Serin, Y., Gökkuş, A., Tan, M., Koç, A., Çomaklı, B., (1998). "Sun'i Çayır Tesisinde Kullanılabilecek Uygun Yembitkileri ve Karışımlarının Belirlenmesi", Turkish Journal of Agriculture and Forestry, Vol. 22, No: 1, pp. 13 – 20.

Soya. H., Avcıoğlu. R., Green. H., (2004). Yem Bitkileri, Hasad Publishing, pp. 204 – 208.

Stute, J.K., Posner, J.L. (1995). "Legume cover crops as a nitrogen source for corn in an oat-corn rotation", Journal of Production Agriculture, 8, pp. 385 – 390.

Şahin, G., (2016). "2016 Uluslararası Bakliyat Yılı Hasebiyle Türkiye'de Mercimek (*Lens culinaris* Medik) Yetiştiriciliği", Atatürk University Journal of Graduate School of Social Sciences, Vol.: 20, Issue: 4, pp. 1665 – 1696, Erzurum.

TurkStat, (2018). https://biruni.tuik.gov.tr/medas/?kn=92&locale=tr (11.10.2018).

Uzun, F., Sulak, M., Uğur, S., (2008). "Gazal Boynuzu Türlerinin Ülkemiz İçin Önemi", Türk Bilimsel Derlemeler Dergisi, Issue: 2 (10), pp. 45 – 54, Ankara.

Uzun, A., Gün, H., Açıkgöz, E., (2012). "Farklı Gelişme Dönemlerinde Biçilen Bazı Yem Bezelyesi (*Pisum sativum* L.) Çeşitlerinin Ot, Tohum ve Ham Protein Verimlerinin Belirlenmesi", Uludağ Üniversitesi Ziraat Fakültesi Dergisi, Cilt: 26, Sayı: 1, pp. 27 – 38, Bursa.

Wery, J., Ahlawat, I.P.S., (2007). Analysing and improving the role of grain legumes in cropping system's sustainability: a system approach illustrated on chickpea in India and Europe. In: Karkwal, M.C. (Ed.), *Food Legumes for Nutritional Security and Sustainable Agriculture*, 1, pp. 820 – 836.

Wittver, S.H., (1977). Agricultural productivity and biological nitrogen fixation – An International View, *Genetic Engineering for Nitrogen Fixation*, Basic Life Science Volume: 9, (Eds.) Alexander Hollaender et al., pp. 515 – 529, New York.

Yolcu, H., Tan, M., (2008). "Ülkemiz Yem Bitkileri Tarımına Genel Bir Bakış", Tarım Bilimleri Dergisi, 14 (3), pp. 303 – 312, Ankara.