Turkish Studies

Volume 14 Issue 6, 2019, p. 2995-3008

DOI: 10.29228/TurkishStudies.25889

ISSN: 1308-2140

Skopje/MACEDONIA-Ankara/TURKEY

INTERNATIONAL
BALKAN
UNIVERSITY

EXCELLENCE FOR THE FUTURE
IBU.EDU.MK

Research Article / Araştırma Makalesi

Article Info / Makale Bilgisi

✍ Received/Geliş: 29.07.2019

✓ Accepted/Kabul: 15.10.2019

📅 Report Dates/Rapor Tarihleri: Referee 1 (04.08.2019)-Referee 2 (13.10.2019)

This article was checked by iThenticate.

AN ALTERNATIVE NEW PLANT FOR THE FARMING CULTURE OF USAK (TURKEY): COLZA (*BRASSICA NAPUS L.*)

Ahmet ATASOY* - İlkay HASKAN ATASOY**

ABSTRACT

This study is based on identification of the appropriate areas for colza cultivation in Usak province. The soil samples taken according to the ecological characteristics of colza plants were subjected to various analyses. Along with the soil analyses, farming fields, average temperature and precipitation maps of Usak province were used in the study. Farming fields of an area, average temperature, total precipitation, sand content, organic matter and soil reaction distribution maps (raster, Arc GIS 10.1) were generated from these drawings using analysis conversion tools (polygon to raster). These generated factor maps were reclassified (Reclass, Arc GIS 10.1) and overlapped through spatial data analysis (Spatial Analyst Tools, Arc GIS 10.1). As a result of all these procedures, 48.069 acres of land appropriate for colza cultivation were determined in Usak. In the first chapter of the study ecological and economical characteristics of colza plant are analyzed in accordance with the previous published studies. Baltali plain will lead to the development of other economic activities in surroundings as it becomes the leading area that colza cultivation develops. Baltali plain is situated in southern part of Mount Murat where the flora expanded most in Usak. In addition to the intense flora, with the beginning of colza cultivation in Baltali plain beekeeping will become widespread in the territory. These activities integrating each other will contribute to the rural development in the territory. Immediately afterwards, the methods followed in field identification are explained in details. All procedure steps are presented with evidences in findings and discussion chapter. The further contributions of colza to the regions when cultivated are also stated in final chapter.

* Assoc. Prof. University of Usak, Faculty of Arts and Sciences, Department of Geography, E-posta: ahmet.atasoy@usak.edu.tr

** Exp. Biologist, University of Usak, Faculty of Medicine, E-posta: ilkay.atasoy@usak.edu.tr

STRUCTURED ABSTRACT

This study is based on identification of the appropriate areas for colza cultivation in Usak province. The soil samples taken according to the ecological characteristics of colza plants were subjected to various analyses. Along with the soil analyses, farming fields, average temperature and precipitation maps of Usak province were used in the study. Farming fields of an area, average temperature, total precipitation, sand content, organic matter and soil reaction distribution maps (raster, Arc GIS 10.1) were generated from these drawings using analysis conversion tools (polygon to raster).

A significant part of the plants cultivated naturally and culturally such as sunflowers, cottonseeds, soy beans, peanuts, sesame, colza, safflowers, poppies and mole beans, olives, coconuts and dates includes oil in different proportions (Arioğlu, 2014). Oily seed production in the world which was 98.6 million tons in 1965 (olives, dates and coconuts are not included) increased to 554 million tons in 2016 depending on the increasing demand. Especially since 1966 oily seed production in the world significantly increased with 462 % rate. It is noteworthy that the major share in this production is colza (1208%) and soy bean (963%). In an evaluation made on the basis of countries (2016), world oilseed production is listed as USA with 22.9%, Brazil with 19.3%, Argentina with 10.8%, China with 10.1%, India with 6.7% and the remaining other countries with 3% (Bihter et al. 2017).

Colza began to be cultivated in Turkey as of 1988. However, while the annual cultivation area (average 7778 acres) was limited because the cultivation just started, the cultivated areas became very widespread (average 242.758 acres) between 2007 and 2017 as the cultivation increased (TÜİK, 2019). The regular increases in the basis of years indicate that this plant will be cultivated more commonly.

Geographical conditions of Usak province were evaluated in terms of colza (*Brassica napus* L.) cultivation in this study. The areas appropriate for colza cultivation were identified by overlapping various factors in the platform of geographical information systems. Average temperature, total precipitation, sand content of the soil, irrigated farming lands, organic content amount and pH data of the soil affecting the ecology of the plant were used. Arc GIS 10.1 programme was used in data processing and evaluation.

The data for irrigated farming lands were obtained from the Branch Office of Usak State Hydraulic Works Directorate. A physical map of Usak province was created by arranging 1 / 25.000 scaled digital topography maps of the General Command of Mapping for the purpose. Temperature and precipitation data (Banaz, Dumlupınar, Eşme, Güre, Kula, Sarıgöl, Selendi, Sivaslı, Ulubey and Usak) for 42 years (1975-2017) were obtained from the General Directorate of Meteorology. Average temperature and total precipitation raster maps were drawn via ArcGIS 10.1 Kriging (Geostatistical Analyst) by increasing the point numbers of precipitation and temperature to 2000 along with the comparison stations.

In order to identify the colza cultivation conditions, sand content of the soil was investigated in terms of the parameters such as organic

matter amount and pH. 140 soil samples taken from the lower (31-60 cm) and upper (0-30) parts of the land were subjected to various analyses in compliance with the common protocol in the laboratories of Uşak Provincial Directorate of Food, Agriculture and Livestock (Table 1, Figure 1).

Colza grows in many parts of Turkey depending on habitat. Temperature demand of colza cultivated in central parts especially for winter is between 2300-2500 °C and it is durable against lower temperatures (-18 °C). For summer colza is cultivated in the Egean and Mediterranean Regions. However, sudden temperature changes in summer remarkably damage this plant. Colza, which adapts to the soils apart from lightweight ones, has no drainage problems and adapts well to the farming fields. Moreover, deep soil level and high organic matter content in the soil are other environmental factors that make the colza cultivation effective. In addition, the fact that soil reaction was found between 6.5 and 7.5 pH ranges is another factor supporting this cultivation (Algan,1990; Süzer, 2001). Cultivation conditions of this plant were investigated in terms of the contents such as temperature, precipitation, irrigated agriculture, sand of soil, organic matter amount and soil reaction by considering the optimal cultivation conditions.

In this study where geographical information technologies are intensely used it was determined that 48.069 acres of fields in the borders of Uşak province are appropriate for colza cultivation (Figure 4, Table 4). The leading area for the most fertile colza cultivation is Baltalı plain. It was also determined that Selvioglu village, between Eskisaray and Kayaagil villages, surroundings of Ilyaslı village, North of Katrancılar village, Eldeniz town and the irrigated farming lands in the northeast of Kayalı village are appropriate for colza cultivation (Figure 4).

Keywords: Uşak, Plant, Colza, Agriculture, Appropriate Areas

UŞAK'IN (TÜRKİYE) TARIM KÜLTÜRÜNE ALTERNATİF YENİ BİR BİTKİ: KOLZA (BRASSİCA NAPUS L.)

ÖZ

Bu çalışma, Uşak ilinde kolza yetiştiriciliğine elverişli alanlarının tespit edilmesi esasına dayanmaktadır. Kolza bitkisinin ekolojik özelliklerine göre alınan toprak örnekleri çok çeşitli analizlere tabi tutulmuştur. Çalışmada toprak analizleri ile birlikte Uşak ilinin tarım arazileri, ortalama sıcaklık ve yağış haritaları kullanılmıştır. Bu çizimler coğrafi bilgi sistemlerinin analiz dönüştürme araçları (polygon to raster) kullanılarak, sahanın tarım arazileri, ortalama sıcaklık, toplam yağış, kum içeriği, organik madde, toprak reaksiyonu dağılışı haritaları (raster, Arc GIS 10.1) üretilmiştir. Üretilen bu faktör haritaları, mekânsal veri analiz aracılığı ile (Spatial Analyst Tools, Arc GIS 10.1) yeniden sınıflandırılarak (Reclass, Arc GIS 10.1) çakıştırılmıştır. Bütün bu işlemler sonucunda Uşak'ta kolza yetiştiriciliğine elverişli 48.069 dönüm alan tespit edilmiştir. Baltalı ovası, kolza tarımının geliştiği alanların başında gelmesiyle civarda başka ekonomik faaliyetlerinin de gelişmesini sağlayacaktır. Baltalı Ovası, Uşak'ta bitki örtüsünün en fazla genişlediği

Murat Dağı'nın güney kesimlerinde yer almaktadır. Sahanın yoğun bitki örtüsüne ilaveten, Baltalı Ovası'nda kolza tarımının başlatılmasıyla yörede arıcılık faaliyetinin yaygınlaşacaktır. Birbirini bütünleyen bu faaliyetler yörenin kırsal olarak kalkınmaya katkı yapacaktır. Çalışmanın ilk bölümünde kolza bitkisinin ekolojik ve ekonomik özellikleri daha önce yayınlanan çalışmalar doğrultusunda irdelenmiştir. Hemen akabinde alan tespitinde izlenen metot ve yöntemler ayrıntılı olarak açıklanmıştır. Bulgu ve tartışma bölümünde ise tüm işlem basamakları delilleriyle ortaya konulmuştur. Çalışmanın son bölümünde de tarımının yapılması halinde kolzanın yöreye sağlayacağı katkılar dile getirilmiştir.

Anahtar Kelimeler: Uşak, Bitki, Kolza, Tarım, Uygun Alan

Introduction

Colza obtained naturally (Fereidoon, 1990) is an oil plant known as *Brassica napus* L. from Brassicaceae species of Cruciferae family (Acar, et al, 2005, Hammond, 2008). It is multi-branched and taprooted and reaches up to 2 meters of height. Its blue and green leaves are narrow and long and the flowers are yellow (Tan, 2007). The leaves include 83.3% of water, 2.9% of protein, 1.7% of unsaturated oil, 11.2% of carbohydrate and 1.8% of fiber while they are green (Öztürk *et al.*, 2003).

A significant part of the plants cultivated naturally and culturally such as sunflowers, cottonseeds, soy beans, peanuts, sesame, colza, safflowers, poppies and mole beans, olives, coconuts and dates includes oil in different proportions (Arioğlu, 2014). Oily seed production in the world which was 98.6 million tons in 1965 (olives, dates and coconuts are not included) increased to 554 million tons in 2016 depending on the increasing demand. Especially since 1966 oily seed production in the world significantly increased with 462 % rate. It is noteworthy that the major share in this production is colza (1208%) and soy bean (963%). In an evaluation made on the basis of countries (2016), world oilseed production is listed as USA with 22.9%, Brazil with 19.3%, Argentina with 10.8%, China with 10.1%, India with 6.7% and the remaining other countries with 3% (Bihter et al. 2017).

Most produced plant in oil crops cultivation in the world is colza following soy bean and cottonseed. The plant is highly important because it has winter and summer species, short growing period and high yield per acres (150-250 kg/ac), it yields oil, it has earlier harvest time compared to other oil crops and it provides raw material for oil and feed factories and supports beekeepers through early blooming. Moreover, it is able to fight against weeds due to the shade temper that it provides by growing earlier than other herbaceous plants (Odabaşı and Taşkaya, 2004). The areas to cultivate this plant in Usak territory were tried to be determined because of these properties.

Colza began to be cultivated in Turkey as of 1988. However, while the annual cultivation area (average 7778 acres) was limited because the cultivation just started, the cultivated areas became very widespread (average 242.758 acres) between 2007 and 2017 as the cultivation increased (TUİK, 2019). The regular increases in the basis of years indicate that this plant will be cultivated more commonly.

If it enters winter with the rosette leaves, it becomes very durable against colds, it does not need watering, it ripens for the harvest earlier than other plants, it can easily be harvested through cereal combine harvester and it yields more than other cereals (average 250 kg/ac) in dry farming conditions, therefore colza farming becomes efficient. Positive results were obtained from the experiments on colza in various regions of Turkey (Öğütçü and Kolsarıcı, 1979; Başalma and Kolsarıcı, 2001).

Colza, which grows widely in the Mediterranean climate, is also used as biodiesel energy as well as an important food source (Sözer, 2001). The oil of this plant, which has approximately 40-50% of fat content, is very important for cardiovascular health because it regulates the fluidity of the blood

cell, cholesterol and triglyceride levels (Tan, 2007). The conducted studies presented that colza oil had almost the same quality with olive and peanut oils (Atakisi, 1991).

The colza plant which grows in environments with up to 2300-2500 °C of total temperature, can be cultivated in almost every type of soil except for the sandy and light soils. The temperature between 5-20 °C is necessary so that the colza, a cool season plant, can grow optimally. This plants which can not grow much in salty soils adapts more to the areas with the annual total precipitation between 300-2800 mm. It needs water up to 200-500 mm throughout the growing period. It has no drainage problems and also it grows very well in humic, deep, neutral or slightly alkaline and light acidic soils (Algan,1990; Süzer, 2001).

1. Method

Geographical conditions of Usak province were evaluated in terms of colza (*Brassica napus* L.) cultivation in this study. The areas appropriate for colza cultivation were identified by overlapping various factors in the platform of geographical information systems. Average temperature, total precipitation, sand content of the soil, irrigated farming lands, organic content amount and pH data of the soil affecting the ecology of the plant were used. Arc GIS 10.1 programme was used in data processing and evaluation.

The data for irrigated farming lands were obtained from the Branch Office of Usak State Hydraulic Works Directorate. A physical map of Usak province was created by arranging 1 / 25.000 scaled digital topography maps of the General Command of Mapping for the purpose. Temperature and precipitation data (*Banaz, Dumlupınar, Eşme, Güre, Kula, Sarıgöl, Selendi, Sivashi, Ulubey and Usak*) for 42 years (1975-2017) were obtained from the General Directorate of Meteorology. Average temperature and total precipitation raster maps were drawn via ArcGIS 10.1 Kriging (Goestratistical Analyst) by increasing the point numbers of precipitation and temperature to 2000 along with the comparison stations.

In order to identify the colza cultivation conditions, sand content of the soil was investigated in terms of the parameters such as organic matter amount and pH. 140 soil samples taken from the lower (31-60 cm) and upper (0-30) parts of the land were subjected to various analyses in compliance with the common protocol in the laboratories of Usak Provincial Directorate of Food, Agriculture and Livestock (Table 1, Figure 1).

Table 1: Average Values Of Soil Sample Results

Depth	pH	Organic Matter	Sand (%)
0-30 ^I	7.53	1.66	40.41
31-60 ^{II}	7.66	1.16	38.64
Average	7.59	1.41	39.25

^{I, II} The part with 0-30 cm consists of 70 sample data and the part with 31-60 cm consists of 70 sample data.

pH of the samples were determined by measuring the hydrogen ion concentration using pH-meter (Orion Research model 701) potentiometrically. Organic matter was analyzed through Lichterfelder method (Schlichting and Blume, 1966). Sand content of the soil (soil texture) was determined according to hydrometer method (Bouyoucos, 1952).

The analysis results were subjected to various analyses via geographical information systems. Digital and raster maps of the factors affecting the colza cultivation were created through digital data analysis. In order to make the comparison easily digital and raster maps were outnumbered and presented together.

Method of the study is based on overlapping the maps. All the data in shape file (*.shp) format were grouped and overlapped in specific weighs in this study in which spatial analyst procedure steps

are intensely used. Weighted points of the overlapping were ranked from 1 to 3. “1” indicates the most appropriate areas for colza cultivation, “2” indicates moderately appropriate areas and “3” indicates inappropriate areas (Table 3). Appropriateness points for the data used in overlapping during the study were determined and then the appropriateness of the limit value of each data group was determined by considering the literature values (Table 2).

Figure 1: Location Of The Study Field And The Map Of The Places Of Soil Samples.

Table 2: Methods To Determine Nutrient Element Range

Method	Parameter ranges							
pH, U.S. Salinity Laboratory Staff (1954)	Extra acid	Very strong	powerful	Acetic acid	Light acid	neutral	Light Alkaline	Medium Alkaline
	4.50-	4.51-5.09	5.10-5.59	5.51-6.00	6.01-6.59	6.60-7.39	7.40-7.89	7.90-8.40
Organic matter (%), Nelson - Sommei (1996)	Very little	Little	Middle	Good	High			
	0-1.0	1.01-1.99	2.00-3.00	3.01-4.00	4.01			
Sand Hydrometer	Sandy	Loamy	Clay Loamy	Clay	Heavy clay			
	30	31-50	51-70	71-110	111			

Table 3: Weighted Overlapping Data and Weight Points

Data Group	Attributes	Range according to the limit values according to the method	Reclassification Attributes	Class of conformity	Percent
Temperature (°C)	4.93 - 10.64	Insufficient	3	Inappropriate	% 16.6
	10.64 - 12.86	Enough	1	Optimal	
	12.86 - 16.49	Enough	1	Optimal	
Precipitation (mm)	184.67 - 433.46	Enough	1	Optimal	% 16.6
	433.46 - 646.70	Enough	1	Optimal	
	646.70 - 1317.54	Enough	1	Optimal	
pH (reaction)	6.69 - 7.09	Mild acid	1	Optimal	% 16.6
	7.09 - 7.48	Light alkaline	1	Optimal	
	7.48 - 7.88	Light alkaline	1	Optimal	
Organic matter (%)	0.77 - 1.16	Very little	3	Inappropriate	% 16.6
	1.16 - 1.55	Little	1	Optimal	
	1.55 - 1.94	Little	1	Optimal	
Sand (%)	30.31 - 37.52	Sandy	3	Inappropriate	% 16.6
	37.52 - 44.55	loamy	1	Optimal	
	44.55 - 53.58	loamy	1	Optimal	
Farmland	Irrigated agriculture	Irrigable	1	Optimal	% 16.6
	Dry farming	No watering possible	3	Inappropriate	

2. Findings and Discussion

2.1. Factors Affecting the Identification of Appropriate Area

Colza grows in many parts of Turkey depending on habitat. Temperature demand of colza cultivated in central parts especially for winter is between 2300-2500 °C and it is durable against lower temperatures (-18 °C). For summer colza is cultivated in the Eagean and Mediterranean Regions. However, sudden temperature changes in summer remarkably damage this plant. Colza, which adapts to the soils apart from lightweight ones, has no drainage problems and adapts well to the farming fields. Moreover, deep soil level and high organic matter content in the soil are other environmental factors that make the colza cultivation effective. In addition, the fact that soil reaction was found between 6.5 and 7.5 pH ranges is another factor supporting this cultivation (Algan,1990; Süzer, 2001). Cultivation conditions of this plant were investigated in terms of the contents such as temperature, precipitation, irrigated agriculture, sand of soil, organic matter amount and soil reaction by considering the optimal cultivation conditions.

Each conditions affecting the cultivation were converted to the map. Habitat conditions of Usak province in terms of colza cultivation was initially explained in this chapter of the study. The results obtained through factor overlapping were explained according to appropriateness criteria presented in Table 3.

Annual average temperature of Usak province in the Mediterranean climate region is 12.0 °C (Figure 2-II). The highest temperature values for the study field are observed in the South of Usak. The lowest temperature values are observed in Mount Murat (Atasoy, 2017). The average temperature distribution of Usak province in terms of colza cultivation is divided into three groups as between 4.92 and 8.77 °C, 8.77 and 12.63 °C and 12.63 and 16.48 °C. Low temperature values in this distribution is observed in Mount Murat with a high altitude. The average temperature is rather higher in the southern parts of this mountain. While the areas with the temperatures between 8.77-12.63 °C and 12.63-16.48 °C are appropriate for colza cultivation, the areas with the temperatures between 4.92-8.77 °C are inappropriate for the cultivation (Figure 3-II). Because the annual average temperature must be between 2300 and 2500 °C so that colza can be cultivated. Therefore, except for the higher parts of mountains, the annual total temperature is not an important problem for colza cultivation in other parts of Usak province (Figure 3-I).

Colza cultivation conditions become hard in the areas where the precipitation and moisture are low in amount. Therefore, colza cultivation was investigated in terms of precipitation conditions. Annual total precipitation amount is 504.2 mm in Usak in which this rate ranges between 300-1308.7 mm. While the areas with the lowest precipitation are observed in bottom valleys in shadows for air masses, the areas with the highest precipitation are observed in the higher parts of Mount Murat (Atasoy, 2017). The precipitation amount in the area was divided into three as between 196-571 mm, 571-945 mm and 945-1320 mm in order to investigate the colza cultivation (Figure 2-II). The precipitation amount for the first two parts is lower than 945 mm. Because especially the areas with more than 571 mm of total precipitation value would affect the colza farming positively, the areas with the precipitation between 196-571 mm were separated as inappropriate areas for colza farming in order to make the colza cultivation more productive. According to this separation, southern parts of Usak with rather lower precipitation rate are not appropriate for colza farming (Figure 3-II).

Although colza is a significant economic activity performed as both dry and irrigated farming, there may be rarely some problems in dry farming conditions. Colza plants which enter the winter weak due to insufficient and late precipitation in autumn are not durable against the low temperatures. In this case, it is necessary to irrigate the plant in order to go in the winter in rosette period (Baydar, 2005). Irrigated farming will increase the productivity more when we consider that Usak has unstable climate conditions and there is no chance of irrigation in dry farming conditions. Therefore, the areas of dry farming were selected as inappropriate areas for colza cultivation (Figure 2-III). According to this classification, irrigated farming conditions become an important factor that determines the colza cultivation areas. In re-classification irrigated farming areas revealed as appropriate areas (Figure 3-III); however, dry farming areas revealed as inappropriate areas (Figure 3-III).

Sandy soils with diameters between 2- 0.02 mm are formed with the effect of water and wind and they have loose structures. These water and air-permeable soils are heated and dried very quickly. The soils with too much silica and sand contents are poor soils. The sandy soils, which are formed by crushing and crumbling of the main stones such as granite and gneiss, can be fertile soils due to their mineral contents such as feldspar, mica and amphibol (Çepel, 1960). The soils with a very low water holding capacity do not allow plants to hang on to the soil and grow. For that reason, structure of the soil was investigated separately in terms of colza cultivation. The sand rates were determined as three groups between 30.31 - 38.07 %, 38.07-45.82 % and 45.82-53.58 % according to interpolation method on the map. The most sandy content during the disintegration is formed around Esme in which metamorphic rocks expand most. Towards the northeastern part sand content decreases (Figure 2-IV, Table 3). While sandy soils were selected as inappropriate for colza cultivation because they cannot hold the water, loamy soil were selected as appropriate (Figure 2-IV). According to this classification, all the areas in the west of Esme were selected as appropriate areas for colza cultivation (Figure 3-IV).

It was presented in many conducted studies that physical, chemical and biological properties of the soils developed positively depending on the increase in organic matter (Dexter, 1988; Ekwue, 1992; Yılmaz and Alagöz, 2000; Yılmaz and Alagöz, 2001). One of the most important factors that determines the development of plant in the soil is organic matter. Many elements leak to the soil along with the dissolution of organic matters. Since one of the most important ecological needs of the colza is organic matter, it was discussed as a different factor. A map of raster organic matter amount was created using interpolation method by digitizing the soil analysis results. According to the evaluation on this map, average organic matter amount of Usak province was determined as 1.4%. Organic matter amount was divided into three groups as between 0-77% and 1.16%, 1.16% and 1.55% and 1.55% and 1.94% (Figure 2-V). When these groups are compared with the class intervals reported for the organic matters, they are ranked as very little, little and little. This class is ranked as very little, less and less together with what they are looking for. Very little organic matter content corresponds to the soils in the west of Esme in which sandy soils expand. It rather increases in other parts towards the inner parts of Usak in which agricultural activities are intense. While the areas with very little organic matter content are selected as inappropriate for colza cultivation, the areas with little organic content are selected as appropriate areas (Figure 3-V).

Optimal colza cultivation conditions in terms of soil reaction were suggested by Süzer (2004). Accordingly, neutral, slightly alkaline and light acidic soils (pH 6.5-7.5) are the soils where the colza ideally grows. Therefore, soil reaction was another factor discussed in order to identify the colza cultivation in Usak. Soil reaction was analyzed on the soil samples taken from the field. The obtained results were transferred to the digital platform and they were subjected to digital data analysis method. Through this method, the soil of Usak were divided into three gorups as 6.69-7.09, 7.09-7.48 ve 7.48-7.88 in terms of soil reaction. When these three class intervals are compared with the class intervals reported for pH of the soil, they are classified as slightly acidic and slightly alcaline soils (Figure 2-VI; Table 3). Since slightly acidic and slightly alcaline soils are the soil in which colza grows optimally, the soils in each three groups are grouped as the most appropriate soils for this plant in the new classification (Figure 3-VI).

Figure 2: A map Of Factors Determining The Caper Cultivation (I- Average Temperature, II- Total Precipitation, III-Farming Fields, Iv-Soil Sands, V-Organic Matter, VI-Soil Reaction)

Figure 3: Re-Classified Factor Maps (I- Average Temperature, II- Total Precipitation, III-Farming Fields, IV- Soil Sands, V-Organic Matter, VI-Soil Reaction)

In this study where geographical information technologies are intensely used it was determined that 48.069 acres of fields in the borders of Usak province are appropriate for colza cultivation (Figure 4, Table 4). The leading area for the most fertile colza cultivation is Baltali plain. It was also determined that Selvioglu village, between Eskisaray and Kayaagil villages, surroundings of Ilyasli village, North of Katrancilar village, Eldeniz town and the irrigated farming lands in the northeast of Kayalı village are appropriate for colza cultivation (Figure 4).

Figure 4: The Areas Appropriate For Colza Cultivation In Usak Province

3. Conclusion and Recommendations

In this study conducted in order to identify the appropriate areas for colza cultivation in Usak it was found out that approximately 50.000 acres of irrigated farming lands are appropriate for colza cultivation. Baltali plain will lead to the development of other economic activities in surroundings as it becomes the leading area that colza cultivation develops. Baltali plain is situated in southern part of Mount Murat where the flora expanded most in Usak. In addition to the intense flora, with the beginning of colza cultivation in Baltali plain beekeeping will become widespread in the territory. These activities integrating each other will contribute to the rural development in the territory.

Colza is highly economic plant because it grows in a short period, it gives high yield, it is an oil plant, it provides raw material for oil and feed factories and it supports beekeeping through early blooming. Great economic developments will be achieved by expanding the colza cultivation in Usak territory.

Colza does not need too much irrigation. However, the fact that irrigated farming lands are planned as an important factor for colza cultivation is related with irregular autumn precipitation. If the rainfall is late in autumn, it must be irrigated in the beginning of October in order to protect the plant from the cold in winter. In other months there is not so much need for irrigation. The fact that there are appropriate areas for colza cultivation without the need for irrigation in this territory where irrigation is insufficient as compared to other coastal regions is another important potential. Between 720 and 1200 tons of colza will be produced by activating this potential.

In order to provide high yield of colza cultivation in identified areas, soil preparation, plantation time, seed, plantation type, maintenance, fertilization, crop rotation, weed control, colza diseases and pests, harvest and storage activities should be done in accordance with the opinion of experts.

REFERENCES

- Acar, M, Gizlenci Ş, Dok, M, (2005). Orta Karadeniz geçit bölgesinde kolza için en uygun ekim zamanının belirlenmesi, S. Ü. Ziraat Fakültesi Dergisi 19 (36): 110-115 (in Turkish with an abstract in English).
- Algan, N (1990). Kanola Tarımında Çesit Sorunu ve Agroteknik Yöntemler. İzmir, Turkey: Ege Tarımsal Araştırma Enstitüsü Müdürlüğü. (in Turkish).
- Arioğlu H H (2014). Yağ Bitkileri Yetiştirme Ve Islahı Adana, Turkey: Genel Yayın No:220, Ders Kitapları Yayın No: A-70:204. (in Turkish).
- Atakisi K (1999). Yağ Bitkileri Yetiştirme ve Islahı. Tekirdağ, Turkey: Tekirdağ Ziraat Fakültesi Yayın No: 148, Ders Kitabı No: 10. (in Turkish).
- Atasoy A (2017). Uşak İli Atlası. Uşak, Turkey: Tiydem Yayıncılık 14951: ISBN: 978-605-4510-82-5. (in Turkish).
- Baydar H, (2005). Isparta Koşullarında Kanola (*Brassica napus* L.) Çesitlerinin Verim ve Kalite Özellikleri, Süleyman Demirel Üniversitesi, Fen Bilimleri Enstitüsü Dergisi 9-3:2 in Turkish with an abstract in English).
- Bouyoucos G J, (1952). A Recalibration of the Hydrometer for Making Mechanical Analysis of Soil, Agronomy Journal” 43 (9) : 434.
- Çepel, N, (1960). Toprak Türü ve Bunun Arazide El Muayenesi İle Tayini, İstanbul Üniversitesi, Orman Fakültesi Dergisi 2: 107 (in Turkish with an abstract in English). İstanbul
- Dexter A R, (1988). Advances in characterization of soil structure. Soil Till. Res 11:199–238.
- Ekwue, E L, (1992). Effect of organic and fertilizer treatments on soil physical properties and erodibility. Soil Till. Res. 22: 199–209.
- Fereidoon S, (1990). Canola and Rapeseed, Van Nostrand Reinford, New York.
- Hammond E G (2008). Genetic Alterations of Food Fats and Oils. London, New York: in Fatty Acids in Foods and Their Health Implications:439-460, Ed. Chow, C. K. CRC Press.
- İşler N, (2019). Kolza (Kanola) tarımı, M.K.Ü. Ziraat Fakültesi Tarla Bitkileri Bölümü, (<https://docplayer.biz.tr/23639437-Kolza-kanola-tarimi>, Date reached: 13.02.2019)
- Odabaşı S, Taşkaya B, (2004). Kolza (kanola), Tarımsal Ekonomi Araştırma Enstitüsü TEAE Bakış, 7(11):1-4 (in Turkish with an abstract in English).
- Onat B, Arioğlu H, Güllüoğlu L, Kurt C, Bakal H, (2017). Dünya ve Türkiye’de Yağlı Tohum ve Ham Yağ Üretimine Bir Bakış, KSÜ Doğa Bil. Dergisi:20:149-153, (in Turkish with an abstract in English).
- Öğütçü Z, Kolsarıcı Ö, (1979). “Kışlık kolza (*Brassica napus* ssp. *oleifera*) çeşitlerinin Antalya, Edirne ve Antalya şartlarına adaptasyonu” Tarımsal Araştırma Dergisi 1:175-178 (in Turkish with an abstract in English).

- Öztürk Ö, Akınerdem, F (2003). Yağ Açıığının Kapatılmasında Alternatif Bir Yağ Bitkisi Kanola, Türkiye I. Yağlı Tohumlar, Bitkisel Yağlar ve Teknolojileri Sempozyumu, 22-23 Mayıs. İstanbul, Turkey. pp.217-221
- Sözer S (2001). Kanola Tarımı. Edirne, Turkey: Yayın No: 77-78. (in Turkish).
- Süzer S (2004). Kanola Tarımı. Edirne, Turkey: Trakya Tarımsal Araştırma Enstitüsü, Çiftçi Broşürü 54:2. (in Turkish)
- Tan A Ş (2007). Kanola (kolza) Tarımı. İzmir, Turkey: Tarım ve Köy İşleri Bakanlığı Ege Tarımsal Araştırma Enstitüsü Çiftçi Broşürü 134. (in Turkish)
- TUİK (2019). Türkiye’de kanola üretimi verileri. Ankara, Turkey. (in Turkish).
- Yılmaz E, Alagöz Z (2001). Humik asit uygulamasının topraklarda agregat oluşum ve stabilitesi üzerine etkileri. Antalya, Turkey: Türkiye 2. Ekolojik Tarım Sempozyumu. Antalya Turkey. pp. 134-143.
- Yılmaz E, Alagöz Z, (2000). Farklı kökenli organik materyallerin toprakta agregat oluşumu ve stabilitesi üzerine etkileri. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, Cilt 13 (2):223-229. (in Turkish with an abstract in English).

Acknowledgements

The soil analyzes of this study were carried out in accordance with the common protocol signed between Uşak University Faculty of Arts and Sciences and Uşak Provincial Directorate of Food, Agriculture and Livestock. On this occasion, I would like to thank to the Directorate of Uşak Food, Agriculture and Livestock.