



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**INTERNATIONAL CONFERENCE ON
FOOD AND AGRICULTURAL ECONOMICS**

PROCEEDINGS BOOK
(Full Texts-Abstracts-Posters)

27th -28th April 2017
Alanya Alaaddin Keykubat University, Turkey

ISBN
978-605-65814-6-5



ENVIRONMENTAL PROTECTION AND SUSTAINABLE DEVELOPMENT IN AGRICULTURAL AREAS: VETIVER SYSTEM

Yasemin Cımdık Akıncı

Karadeniz Technical University, Faculty of Forestry, Department of Landscape Architecture
61080 Trabzon, Turkey, Email: yasemincindik@gmail.com

Öner Demirel

Karadeniz Technical University, Faculty of Forestry, Turkey

Abstract

One of the most important objectives of soil protection is to reduce water, wind and soil erosion. Protecting soil and water is very important in agricultural areas with different slope grades. Soil sustainability (in terms of quality and quantity) provides economic contributions to agriculture. It has succeeded in planting of Vetiver grass (Vetiver grass *zizanioides* L.) used for erosion prevention in dune stabilization and especially in agriculture fields by holding the soil layer disappearing with superfluous flow especially in the southern hemisphere, slope and slopes in some of the world's geographical regions. The Vetiver System (VS), an effective and low-cost system, is used in more than one hundred countries for environmentally friendly soil and water applications. In addition, oil obtained from its roots and perfume industry and handicrafts are a high perennial herbaceous plant with a high economic output.

The Eastern Black Sea Region is a region where agricultural land is low and agricultural density is high because of its rugged topography. The Eastern Black Sea Region lands with high slope grades are faced with erosion (water and soil erosion), landslides and floods. In order to ensure the basic elements of life, the sustainability of water and soil, protection of rural and agricultural areas it is desired to reach the development of the additional Vetiver system in addition to environmental protection measures. Vetiver grass is an ecologically sustainable living system. In this study, the reasons for the necessity of using Vetiver grass in agricultural areas are revealed. In addition, the importance of implementation and trial work in the areas where water and soil erosion problems are experienced in Turkey is mentioned. The role of these developments in enhancing economic performance in agricultural areas is being discussed.

Keywords: Vetiver grass, agriculture, erosion, Vetiver System, sustainability

1. Introduction

Depending on the topography in the Eastern Black Sea Region, agricultural areas are generally located on sloping areas. For this reason, the land riding process is seen in very rare and flat areas from the technological point of view. Since the climate of the region is rainy at all seasons, the surface of the land is sensitive to soil erosion. With superficial flow, the soil can flow from the top (landslide). The main reason for the soil sliding, that is, landslides, is water. However, there are also many floods in the region due to heavy rainfall. In short, the Eastern Black Sea Region is a region where flood and landslide events occur frequently due to its topographical structure and climatic characteristics (Figure 1). The flood and landslide are a serious problem in the region.

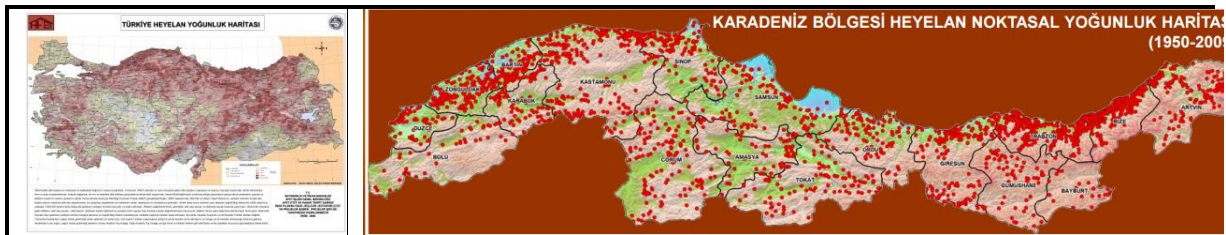


Figure 1. Landslide density map, Turkey (URL-1), Black Sea Region landslide point density map (Peker, 2011)

Decrease of forest existence and erosion, increase sudden floods and landslide hazards, particularly in the interior and coastal areas of the Black Sea region. There are mainly natural and unnatural factors affecting the landslides. Natural factors can be listed as climate characteristics, precipitation, geological structure, topography of the land and vegetation cover. Among the non-natural factors are; rapid population growths caused by migration, illegal structures that concentrate on steep slopes and slopes in urban areas, lack of adequate land use decisions and plans considering natural hazards in urban areas, lack of control of settlements and structures and road constructions (Ergünay, 2007).

The floods and landslides in the Eastern Black Sea region are damaging to agricultural areas too much (Figure 2). When the Eastern Black Sea Development Project (DOKAP) regions (Artvin, Giresun, G.hane, Ordu, Rize, Trabzon, Bayburt) are used for land use, forest areas are in the first place and agricultural places are in the second place (Table 1) (DOKAP, 2000).



Figure 2. Land decimation of agricultural lands in Rize (Disaster and Emergency Management, Yenice, AFAD, Rize, URL-2)

Table 1. DOKAP region, land use survey

Land use	Unit	Artvin	Giresun	G.hane	Ordu	Rize	Trabzon	Bayburt	DOKAP	Turkey
Agriculture	%	5.6	26.0	7.4	53.1	17.4	21.8	12.1	23.6	29.9
Fallow		0.6	2.0	3.0	4.0	-	-	5.8	1.6	5.5
Nonfarm		3.4	4.1	4.8	1.3	0.6	0.5	7.7		
Medows and ranges		11.0	19.1	21.5	12.1	29.2	31.5	40.5	21.7	18.7
Forest		57.8	41.7	32.5	24.2	45.5	41.2	6.9	37.4	29.1
Other		21.6	7.1	30.8	8.9	7.3	5.0	27.0	15.7	16.8
Total		100	100	100	100	100	100	100	100	100

Kaynak: DOKAP, 2000

Agriculture is an activity that depends on nature. It is not possible to lose this feature even though the technology and industry have developed (Bayraç and Doğan, 2016). Agriculture is economic and one of the main sources of our country. The amount of agricultural production varies depending on climatic characteristics, soil characteristics and disasters (flood, erosion etc). Therefore, ecological rehabilitation needs to be dealt with for the development and maintenance of agricultural lands exposed to landslides and floods in the Eastern Black Sea region and surface flow.

An additional Vetiver System has been developed for environmental protection measures to ensure the sustainability of water and land, the basic elements of life, to protect rural and agricultural areas (Chomchalow, 2000; Truong, 2000). The Vetiver System (VS) is an ecologically sustainable, simple and inexpensive system of living. This system, designed to protect soil and water, provides environmental, economic solutions for the repair of degraded areas (Figure 3). In this study, the reasons for the necessity of using Vetiver grass in agricultural areas are explained.



Figure 3. (1): water depollution (2): slope stabilization (3): essential oil and animal feed (URI-7) (From left to right: URL-3-4-5)

2. What is Vetiver System (VS)

The Vetiver System (VS), also known as Vetiver Grass Technology (VGT), is a simple and low cost technology used as a living facility for soil and water based and environmental protection. Technology was first developed by the World Bank in 1980, for soil and water conservation as part of agriculture. In the old days people or agricultural farms used vetiver as a wild grass for various purposes. Large grazing fields and perennial water bodies were covered with vetiver grass as natural vegetation (Huq, 2000).

Then non-agricultural uses were referred. Also, VS is used bioengineering and phytoremediation for environmental protection such as slope and embankment stabilization, reclamation of wasteland, rehabilitation of contaminated land, water purification, pollution control, prevention or mitigation of natural disaster, etc. (Chomchalow, 2000; Grimshaw, 2006).

The Vetiver System has many agricultural uses for: soil and water conservation, soil moisture improvement, groundwater recharge, recycling soil nutrients, pest control, mulch, forage, clean up of agricultural contaminated waste water, protection of farm infrastructure (canals, drains, roads, and building sites) (URL-6).

The VS is used to create live fences. It helps prevent soil and water loss, especially when planted in a dense, sequential manner. When planted frequent and sequential in paralel or in a sliding manner as the slope areas the tilt, is a system that creates intensive protection measures (Figure 4).



Figure 4. Vetiver land, (Trabzon, Maça (Esiroğlu))

3. Use of Vetiver grass in Agricultural Areas

Erosion and flooding cause the soil to break down and disappear over time. Disasters (landslide, flood, erosion, etc.) have a very large effect on the soil. The first of these is the decline in productivity in agriculture. The loss of productive soil for flora and fauna has negative effects. Conditions can not easily be returned back the lost soil. Therefore environmentally friendly projects are needed. In addition, soil protection in agricultural areas is not an action on its own. Appropriate land methods should be made in appropriate teams.

Vetiver (*Vetiveria zizanoides* (Linn) Nash.) or Khus of family Poaceae, is a perennial grass which can grow up to 1 to 2 metres high and form wide clumps (Figure 5). Vetiver's fibrous roots grow downward, 2-4 m in depth, and are strongly scented. The plant stems are erect and stiff and the leaves are 120-150 cm long and 0.8 cm wide and rather rigid (Smitha et al., 2014).



Figure 5. Vetiver grass, Trabzon, Maçka (Esiroglu), Turkey

The most important feature of Vetiver grass vegetation is basically the most important feature to be considered in erosion and flood controlling, the roots are large, strong and spongy masses. There are many uses area of the plant (Figure 6). As a living plant, it is used for flood and erosion struggle, cleaning of water and soil, rehabilitation, stabilization, agricultural purposes. As used a dry plant, handicrafts, perfumery with oil derived from its roots, and as animal feed.

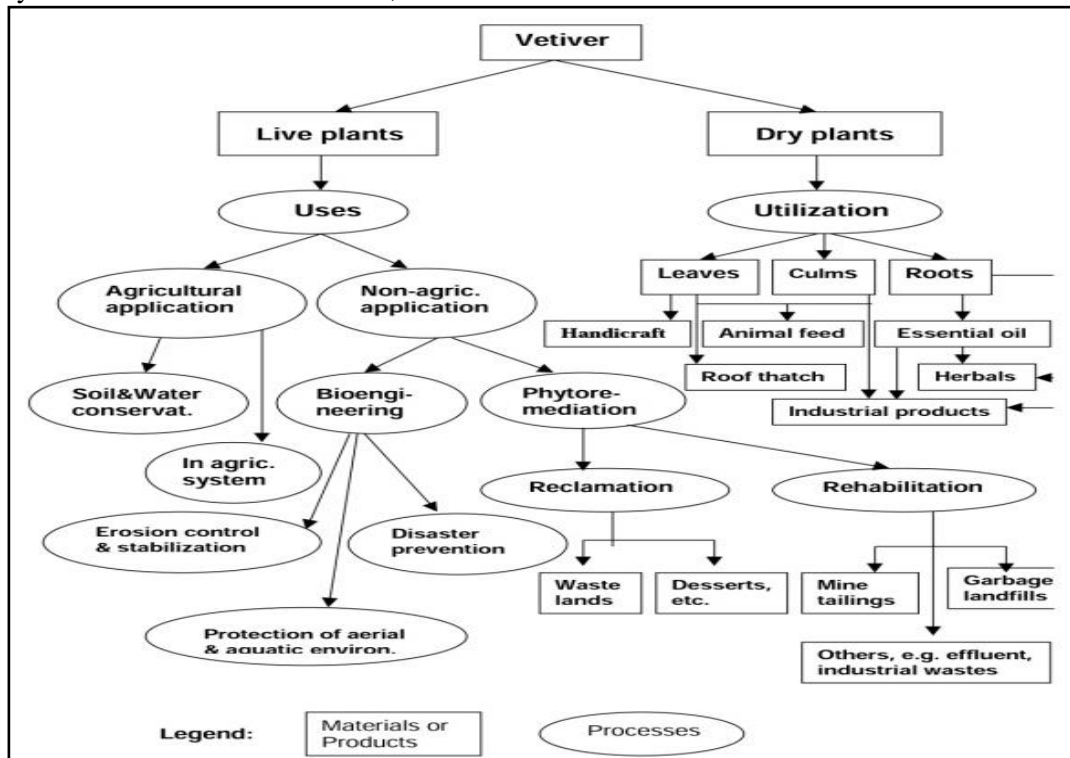


Figure 6. Vetiver usage areas and rates (by Chomchalow, 2000).

In agricultural areas vetiver grass is used to prevent soil and water erosion. Vetiver plants in the world have studies in sloping agricultural areas (Figure 7) (Truong and Loch, 2004; Simpson, 2009).



Figure 7. VS for agriculture (Dick Grimshaw, URL-7)

The Eastern Black Sea Region has agricultural lands, exposed to slopes and landslides. In a graduate study on erosion prevention in Trabzon/Turkey, it has been shown that plant roots attracted soil and showed frequent root development (Cındık, 2012). For this reason, the use of the plant to protect sloping agricultural lands was targeted.

Necessary materials

- taken transplantation vetiver plant (living)
- digging and planting tools
- Water if necessary (Black Sea receives rainfall at all seasons)

Site preparation and to simple application

- In the field to select the area to set up the vetiver hedges and clean
- stem to drainage, usually to block water and soil flow
- to create the planting holes and order
- 8-10 cm intervals to create a frequent cluster of plant roots to sew
- check plants within 3 weeks and replace missing parts
- after 3-4 years, To obtain a fence sets; tight, current resistant

4. Discussion and Conclusion

Soil has economic, social and urban functions for humanity. However, the conservation work for soil and water has been insufficient. Erosion; it is one of the main problems countries are exposed to in the 21st century. In order to prevent landslides and water erosion in a region that is topographically sloping and climatically raining in the countries of the world (Thailand, Bangladesh, India, etc), Vetiver grass have solution-oriented studies in agricultural areas.

The Eastern Black Sea region is affected by disasters as natural, geomorphological, human intervention and social factors. Especially the presence of sloping areas and the climatic flow of the soil cause the loss of fertile soils. Priority underlay must be completed to prevent soil fluctuation. For this reason, it is important that the vetiver grass plant is a perennial herbaceous plant.

The Eastern Black Sea region is highly dependent on hazelnut and tea cultivation. Vetiver could be used for preventing soil erosion and conserving soil moisture in tea fields (Haridas and Balasubramanian, 2008). Soils in good quality are ruined by erosion and landslides. Product yield and biodiversity decrease accordingly. There are many expensive methods for preventing and rehabilitating soil in developing countries. Vetiver grass is cheap and is a vibrant and environmentally friendly type of use. In the southern hemisphere countries (India, Pakistan, Bangladesh, Sri Lanka, Nepal etc.), especially for soil and water conservation purposes. Positive results have been obtained in terms of rapid root and crown development in the study of erosion prevention made by Cındık (2012) in the Eastern Black Sea region. Therefore, in agricultural areas where erosion and landslide of a plant to be tested is necessary for different purposes. If we think about the benefits of the plant scientifically to the country, it can contribute to the development of the rural infrastructure and the national economy in the Eastern Black Sea Region. It should be kept in mind that more plants and more projects need to be developed to ensure that a plant does not comply and that results are achieved. In Turkey, detailed, diverse and more experimental areas should be established in order to demonstrate the utility of Vetiver grass vegetation in agriculture.

References

- Bayraç, H.N. & Doğan, E. (2016). Türkiye’de İklim Değişikliğinin Tarım Sektörü Üzerine Etkileri. Eskişehir Osmangazi Üniversitesi İİBF Dergisi, Nisan 2016, 11(1), 23- 48.
- Chomchalow, N. (ed.) (2000). Manual of the International Training Course on the Vetiver System, ORDPB, Bangkok, Thailand.
- Cındık, Y. (2012). An Investigation of the Possibilities for the Prevention of Erosion Using *Vetiver grass (Vetiveria zizanioides (Linn.) Nash)*: The case of Esiroğlu Area in Maçka Province of Trabzon. Karadeniz Technical University, The Graduate School of Natural and Applied Sciences, Landscape Architecture Graduate Program, Trabzon, Turkey.

- DOKAP, (2000). Doğu Karadeniz Bölgesel Gelişme Planı (DOKAP) Nihai Rapor, Cilt II Ana Plan. Nippon Koei Co., Ltd., Recs International Inc.
- Ergünay, O. (2007). Türkiye'nin Afet Profili. TMMOB Afet Sempozyumu Bildiriler Kitabı, 5-7 Aralık 2007 İMO Kongre ve Kültür Merkezi, Ankara.
- Grimshaw, R. (2006). Vetiver System: Agreeen investment for sustainable development., The Fourth International Conference on Vetiver-ICV4, Caracas, Venezuela.
- Haridas, P. & Balasubramanian, S. (2008). Vetiver System for Soil and Water Conservation in Tea Plantations Including Selection of Appropriate Planting Material and Other Applications, Indian Vetiver Network, February, Cochin, First Indian National Vetiver Workshop, Vetiver System for Environmental Pratection and Natural Disaster Management.
- Huq, M.F. (2000). Vetiver-an economic miracle grass for small scale farmers in Bangladesh: The Proshika Experience. Proc. 2nd Int. Conf. on Vetiver (ICV-2), Thailand, pp. 436-438.
- Peker, S. (2011). Yer Seçiminde Jeolojik Faktörlerin Önemi. Doğu Karadeniz Bölgesi Heyelan ve Taşkınları Sempozyumu, sempozyum Sunuları, Şubat 2011, Trabzon.
- Simpson, L.A. (2009). A Manual of Soil Conservation and Slope Cultivation. Mainstreaming and Capacity Building for Sustainable Land Management Pims 3409 – Atlas Project Id 43949, Caribbean Agricultural Research and Development Institute (CARDI).
- Smitha, G.R. & Varghese, T.S. & Manivel, P. (2014). Cultivation of Vetiver [Vetiveria zizanioides (Linn)]. Published by : Dr. Jitendra Kumar, ICAR – Directorate of Medicinal and Aromatic Plants Research.
- Truong, P. (2000). Vetiver grass System: Potential Applications for Soil and Water Conservation in Northern California, Stiff Grass Technology Seminar, Yolo County Flood Control & Water Conservation District and Family Water Alliance at Woodland, 562-571.

URL-1.https://www.afad.gov.tr/upload/Node/3506/xfiles/96-2014060215311-heyelan_yogunluk_a1_olceksiz.pdf, Access: 6.03.2017

URL-2.<http://www.sondakika.com/haber/haber-rize-de-bir-koy-kayiyor-4-ev-bosaltildi-60-ev-7934908/> Access: 6.03.2017

URL-3.<https://get.google.com/albumarchive/114574765383989435582/album/AF1QipM0oKBR3evkq40NtWPMYZJI65QpiElqXArw3RtV>, Access: 08.03. 2017

URL-4.<https://get.google.com/albumarchive/114574765383989435582/album/AF1QipMqQlj2M5ipiUaEmxAm6MGPUZr1gtv2huywoBkN>, Access: 08.03. 2017

URL-5.https://get.google.com/albumarchive/114574765383989435582/album/AF1QipM7LhWbT2piygVVuGIjL9RlpyFU_MZsuuSXibrZ

URL-6. <http://www.vetiver.org/g/agriculture.htm>, Access: 08.03. 2017

URL-7.<https://plus.google.com/photos/112053823950476566695/albums/5909107910331328913?banner=pwa>, Access: 08.03. 2017