

The Sustainability of Agricultural Activities and Its Effects on Inland Waters and Living Areas

Hasan Kalyoncu
University of Süleyman Demirel, Faculty of Science & Arts,
Department of Biology, Isparta, Turkey
hasankalyoncu@gmail.com

İsmail Hakkı Kalyoncu
University of Selcuk, Faculty of Agriculture,
Department of Horticultural Science, Konya, Turkey
kalyon@selcuk.edu.tr

Abstract: Residues of some medicals and fertilizers used in agricultural areas can reach to some receptors through some processes such as irrigation and surface waters. These natural receptors are rivers, lakes and seas. The materials coming from agricultural areas have more destructive effects on the lakes and rivers since these are smaller. The most pronounced pollutants coming from agricultural areas to rivers and lakes are pesticides and fertilizers which are known as a source of nitrogen and phosphor. Chemicals in some areas where pesticide were used are mixed into rivers and lakes through that way and reach to water habitats and organisms. On the other hand, this causes to increase organic ratio, eutrophication and for ecological balance to be destroyed. Pathogens are transmitted to surface waters with human and animal wastes and then these contaminated surface waters threat human health. An important amount of pathogens is distributed to receptors through use of wastewaters for irrigation. In order for this negative effects to be removed, in order to save rivers and lakes, wild irrigation must be stopped, the direct approach of wastewaters into the rivers and lakes must be prevented, the use of fertilizers and pesticides must be controlled, mechanical and biological war must be strengthened. The sustainable ecological living areas can be constructed by taking the water sources and biological kinds under control with these precautions.

Key words: Agricultural activities, pollution, inland waters, sustainability

Introduction

Drinking water has been less and less for reasons, such as insufficient environmental awareness, fast increasing world population, excessive development of industry and technology. Beside these, pollution of water sources irresponsibly will cause problems unable to be solved (Haviland, 2002; Dağlı, 2005; Akin, 2007).

Increasing demand on the food with increasing population makes that the quality and quantity must be increased. As a result of these demand, the usage of fertilizer and pesticide are increased in time (Huber et al., 2000; Causape et al., 2004). The chemicals used agricultural areas are classified in two groups to be fertilizers and pesticides (Alloway, 1995). They are very important issue since they are toxic, decomposition of them is very difficult, and they can be deposited in living organisms and environment (Egemen, 2006). Pesticides and chemical fertilizers are mixed into rivers which are one of the ecosystems mostly affected from environmental pollution (Huber et al., 2000, Causape et al., 2004; Taş, 2006).

The pollutions caused by agricultural activities are firstly transferred into the rivers and then goes to lakes and seas throughout rivers. It can prevent the development of zoo and phytoplankton which have an important place on the feeding chain of aquatic livings even in the case of the existence of pesticides in trace level in the water (Aguilar et al., 1997).

This pollution is badly affecting not only livings living in pollution but also it can reach human through feeding chain (Yılmaz, 2004). It is important to note that the determination of existence of DDT (pesticide) on the penguins, seal and people living in poles where no pesticides have never been used shows the power of circulation of chemicals used in agriculture over the world (Egemen, 2006).

The harm given by the improper use with the increase of this improper use of pesticides and chemical

fertilizers will have reached to high levels (Öztürk and Tosun, 2004). The production and use of pesticides and chemical fertilizers continue to increase at present, and it must be taken under control in order to decrease the health and environmental problems (Atasoy and Rastgeldi, 2006).

Agricultural Activities And Pesticide

Since pesticides remain in nature for so long time without decomposition, they have no selectivity on the selected organisms and collected in some parts of food chain, they can cause destructions of some beneficial kinds and ecological balance and appearing of new kinds presenting resistance to these kind of products (Kambur et al., 2005).

It has been well known that pesticides can reach ecosystem of water in several ways. For example, some several medicines can contaminate into water with direct application of pesticides to the buggies during fighting against wild grass in or around the canals of drainage and irrigation or vector insects such as mosquitoes. Some pesticides reach to aquatic plants and insects through the fact that the medicines in some places where pesticides were used mix into to river or ground water by rain water. The pesticides mixture into ground or surface waters have limit values for livings according to some structural properties presented in some receptors. The concentrations exceeding these limit values badly effect the life of livings. The first step of bio concentration mechanisms in aquatic systems is consisted of plankton. An important part of plankton in aquatic habitats consists of algae. Since algae are primary producer, they play a functional role in habitats on which algae exist. Algae which are primary produces in aquatic environment form the base of organic production and they are quite sensitive organisms for physical and chemical changes in an environment where they exist. Algae are key targets for pesticide contaminations since they have echo physiological similarities (Kambur et al., 2005). The primary production presented by algae forms foundations of whole organic production in aquatic environment. Algae forming the first circle of chain of feeding in waters are organisms which are quite sensitive to the physical and chemical changes in environment where they exist (Round, 1984; Hutchinson, 1967).

Sensitivity of algae, which is an important group in either plankton or benthic organisms in fresh water, is different toxic materials are different. Algae have an important role in determination and improvement of water quality and in rehabilitation of waste water. On the other hand, algae remove some elements such as nitrogen and phosphorus, existing in quite large amount in aquatic environment, from environment using them as materials of feeding. Because of this, a change in quality and quantity of algae which is primary produces in aquatic environment cause a whole ecosystem to be destroyed (Turan, 2008).

It has been understood that fishes are harmfully affected from the low level residues of several pesticides mixed into water in several ways and attitudes of fishes are changed. It has also been reported that babies of some kind of fishes are too sensitive to pesticides. The residues of pesticides even in minimal level, in stagnant waters uses up oxygen in water and destroy the feeding environment for fishes (Anonymous, 2004).

The organisms dead by the effects of pesticides are deposited in the bottom of the water by sinking. CO₂ or poison gases raised during the decay prevent aquatic organisms coming near to these areas (Anonymous, 2004). Pesticides transferred to aquatic ecosystems presents some different effects on organisms in receptor environments. These effects cause death of fishes, other vertebrates and invertebrates and algae to be harmed, and also cause disappear from environment. In addition to this, pesticide residues cause chronic toxicity to be developed by food chain and drinking contaminated water (Turan, 2008). As a result of this, biological variety in ecosystems has been affected. Some increases in the pollutants cause some organisms to be increased too much while cause some organisms to be removed from environment or to be annihilated. Only the types which can tolerate pollution survive. Some damages, which cannot be reversed, appear as a result of destruction of the ecological balance (Kalyoncu et al., 2009).

The gills of fishes first met pesticides and, therefore, the most serious damages are taken place on that organ (Heath, 1987). On the other hand, it has some harmful effects on haematology depending on kind of fishes (Shakoori et al., 1991; 1996; Atamanalp and Güneş, 2002a; Atamanalp and Güneş, 2002b; Atamanalp and Cengiz, 2002; Atamanalp and Yanık, 2003). The specimens taken from liver have shown that some histopathological effects beside some changes on the colour and size (Atamanalp et al., 2002). The osmoregulation event which is very important event in either sea or fresh water fishes is badly affected by changes of permeability of the gills and skin (Heath, 1987). Attitudes of fishes exposed to chemicals present some differentiations from others. Especially some changes on the some staminal attitudes, such as feeding and adaptation, may cause the fish to loss health. The problems on the neural system appear to be problems on the central neural system as well as problems on the working systems of receptors (Heath, 1987). Pollutants have different effects in the each of different stages of pregnancy biology depending on the groups belonging to, active material contained, concentration and kind of fishes (Çelikkale, 1991; Heath, 1987; Dhawan and Kaur, 1996; Holcombe et al., 1976). It is well known that the s-triazine compounds, which comprise Atrazine and Terbutylazine, are usually termed recalcitrant, and especially the first one, due to its asymmetric substituent

groups, is particularly resistant to biodegradation (Varghaa et al. 2005). These two chemicals are furthermore herbicides which affects the photosynthetic electronic transport, inhibiting the algal growth in aquatic environment (Eullaffroy and Vernet, 2003), the primary level of the food web. In addition Atrazine even at low exposure concentrations ($5\mu\text{g l}^{-1}$) affected significantly aquatic organisms (Steinbergi et al., 1995).

Agricultural Activities And Chemical Fertilizers

When we have looked the harmful effects of fertilizers on environment, it has been thought that mostly nitrogen and phosphors containing fertilizers have given harm on the environment; especially it is well known that it causes the water quality in the watery areas are destroyed as a result of that nitrogen and phosphors containing pollutant are transferred into rivers in anyway and then it also causes eutrophication with increases on the amount of nitrogen and phosphors (Ceran, 2001).

The amount of nitrate mixed into drinking water and rivers through washing out process is increased as a result of usage fertilizers containing nitrogen in high level (Sencar et al., 1993). The compounds containing nitrogen has several effects in the view of water pollution, and the most harmful effect is known to be that of changing oxygen compositions, eutrophication, hygiene on the obtaining of drinking water and toxicity problems (Uslu and Türkmen, 1987).

Approach of phosphor to surface water causes some undesirable effects in aquatic systems as a result of increase in the primary production. Too much increase in green plants and algae in some rich parts in oxygen of water (eutrophication), increase in the blurrily of water, increase in the light input of aquatic macrophytes, not enough oxygen and occurrence of anaerobic conditions as a result of an increase of amount of dead plants in the bottom of water are important factors affecting the quality (Muslu, 1985).

Phosphor components broken up into orthophosphate by aquatic plants are important compositions of food materials. If too much phosphor is loaded, pH value of water and tampon systems are changed (Muslu, 1985). A layer on the water is produced by decreasing surface tension of the water. This layer reduces the transmission of light and oxygen transfer and effect biological activities destructively (Akman et al., 2000). The load of nitrogen and phosphor existing in the environment put pressure on the aquatic ecosystems. Although phosphor has some feeding properties for algae, the extremely high existence in the environment cause some algae to be removed from environment and some of them to be destroyed. This also results with extremely development of taxa tolerating the increase of feeding salts. This change taken place in aquatic ecosystem is not only effective on algae but also destructively affects other living groups (Kalyoncu et al., 2009).

Results And Suggestions

The use of chemical fertilizers and pesticides unplanned and in extremely high amount in agricultural areas affect destruction on all ecosystems. Some cases must be considered before the usage of chemical fertilizers and pesticides in order to completely prevent or minimize the destructive effects.

- It must be note that the pesticides used in agriculture must be easily separable in nature. Beside this, biological fighting methods must be taken over instead of pesticides produced synthetically.

- If applications of pesticide are un-exceptionally necessary, farmers must be educated and trained to apply enough and to avoid over use. The technical and sustainable production with plants, which is more economical and suitable for ecosystems, must be carried out for especially in areas near basins and sources of water.

- It is well known due to the human health and environment that the chemical fertilizers and pesticides used in agricultural areas are important source of pollutants and reaches to aquatic system with surface water. In order for types of kinds in the aquatic systems to be protected, attention must be applied for application of them in suitable time and dose. The effects of chemical components applied on the aquatic ecosystems must be studied and sustainable control must be carried out.

- The ecological agriculture together with advanced agricultural techniques must be applied. Technical and environmentalist agriculture must be carried out for ecological balance to be saved. Some types suitable against diseases and for dried climate must be produced and mechanical and biological techniques for pest management must be developed and then suggested for common use.

- Instead of too much water, enough water applications must be desired, wild and surface irrigations must be left. System must be turned to pressurized irrigation, irrigation time for plants must be determined. Irrigation policies must be put into the agricultural irrigation programs of governments.

- On the other hand, system must be changed from opened system to closed systems. The usage of water and fertilizer applied by farmers must be planned, controlled and sustainable.

- Refinery system for wastewater must be constructed legally in cities. Water and wastewater must be

transmitted through different waterworks and leakages from the system must be minimized. Purified water must be used in green areas and urban agricultural areas.

- Especially the problem of drainage must be solved by completing the foundation of irrigation. The regulation for price of irrigation must be made in the most suitable manner. Economical and efficient irrigation must be supplied and direct-indirect encouragement must be applied.

- More advantageous against erosion, desert condition, dried climate, more environmentalists, sustainable advanced agricultural techniques must be applied.

- As a result, harmful materials reaching to aquatic areas as a result of agricultural activities affect all of livings from algae to fishes living aquatic areas. The importance of agriculture for humanity is unquestionable. But, the aquatic systems are as important as agricultural areas. The chemicals reaching to aquatic areas coming from agricultural areas returns back to people with usage and drinking waters and causes series destructive effects in health. The fresh and clean water sources have gained more importance because of the changes on the global climate. The environmental pollution must be stopped by protecting aquatic ecosystems. The ecology must be kept to be sustainable and carefully followed.

References

- Akman, Y., Ketenoğlu, O., Evren, H., Kurt, L., Düzenli, S., (2000). Çevre Kirliliği (Çevre Biyolojisi). Palme Yayıncılık, Ankara
- Akın, G., Akın, M., (2007). Suyun Önemi, Türkiye’de Su Potansiyeli, Su Havzaları Ve Su Kirliliği. Ankara Üniversitesi Dil ve Tarih-Coğrafya Fakültesi Dergisi; 47, 2 ,105-118s.
- Alloway, B.J., (1995). Heavy Metals in Soils. Blackie Academic & Professional, London.
- Aguilar, C., Borrull, F., Marce, R. M., (1997). “Determination of Pesticides In Environmental Waters by Solid-phase Extraction and Gas Chromatography With Electron-capture and MassSpectrometry Dedection”, Journal of Chromatography, Jan., Vol. 771, pp. 221–231.
- Anonymous, (2004). Türkiye Çevre Atlası. Çevre ve Orman Bakanlığı, Ankara.
- Atamanalp, M., Güneş, M., (2002a). Tuzla Çayı’nda (Tercan-Erzincan) yaşayan *C. capota umbla* Heckel, 1843’ nın bazı hematolojik parametreleri (MCV, MCH ve MCHC) üzerine kentsel atıkların etkileri. Ondokuz Mayıs Üniv. Ziraat Fak. Dergisi, 17(3): 5-10.
- Atamanalp, M., Güneş, M., (2002b). Tuzla Çayı’nda yaşayan *C. capota*’ nın hemoglobin seviyesi, eritrosit ve toplam lökosit sayıları üzerine bir araştırma. Atatürk Üniv. Ziraat Fak. Dergisi, 33(3): 297-300.
- Atamanalp, M., Cengiz, M., (2002). Bir sentetik piretroit insektisit (cypermethrin)’ in subletal dozlarının *Capoeta capoeta capoeta* (Güldenstaedt, 1772)’ da hemoglobin, hematokrit ve sediment seviyeleri üzerine etkilerinin belirlenmesi. Ege Üniv. Su Ürünleri Derg. 19 (1-2): 169-175.
- Atamanalp, M., Keleş, M.S., Haliloğlu, H. İ., Aras, M. S., (2002). The effects of cypermethrin (a synthetic pyrethroid) on some biochemical parameters (Ca, P, Na and TP) of rainbow trout (*Oncorhynchus mykiss*). Turk. J. of Vet. Anim. Sci. 26: 1157-1160.
- Atamanalp, M., Yanık, T., (2003). Alterations in hematological parameters of rainbow trout, (*Oncorhynchus mykiss*) exposed to mancozeb. Turk. J. Vet. Anim. Sci. 27:1213-1217.
- Atasoy D., Rastgeldi, C., (2006). Şanlıurfada Pestisit Kullanımı GAP V. Mühendislik Kongresi Bildiriler Kitabı. 26-28 Nisan 2006, Şanlıurfâ.1462-1467s.
- Ceran, Y., (2001). Kimyasal Gübreler ve Sulak Alanlar, Çevre ve İnsan. T.C. Çevre Bakanlığı Yayın Organı, sayı: 50. 14-19 s.
- Çelikkale, M. S., (1991). Balık Biyolojisi, Karadeniz Teknik Üniversitesi, Sürmene Deniz Bilimleri ve Teknolojisi Yüksekokulu, Trabzon, s. 250-251.
- Dağlı, H., (2005). “İçmesuyu Kalitesi ve İnsan Sağlığına Etkileri” Bizim İller. İller Bankası Aylık Yayın Organı. Sayı 3: 16-21s.
- Dhawan A., Kaur, K., (1996). Toxic effects of synthetic pyrethroids on *Cyprinus carpio* eggs. Bull. Environ. Contam. Toxicol. 57: 999-1002.

- Egemen, Ö., (2006). Çevre ve Su Kirliliği. Ege Üniv., Su ürünleri Fak. Yayınları. No. 42, İzmir. 120 s.
- Haviland, William, A., (2002). Kültürel Antropoloji (Çev: Hüsamettin İnaç, Seda Çiftçi). No: 143. Sosyoloji Serisi: 3. İstanbul: Kaktüs Yayınları.
- Heath, A., G., (1987). Water Pollution and Fish Physiology, CRC Press, Boca Raton, Florida, 201-215.
- Holcombe, G. W., Benoit, D. A., Leonard, E. N., McKim, J. M., (1976). Long-term effects of lead exposure on three generations of brook trout (*Salvelinus fontinalis*). J. Fish. Res. Bd. Can., 33:1731-1734.
- Huber, A., Bach, M., Frede, H.G., (2000). Pollution of Surface Waters With Pesticides In Germany: Modeling Non-point Source Inputs. Agriculture, Ecosystems and Environment. 80, 191-204s.
- Hutchinson, G.E., (1967). A Treatise on Limnology. Vol. II. John Wiley and Sons.
- Kalyoncu H., Barlas, M., Ertan, Ö.O., (2009). Aksu Çayı'nın Su Kalitesinin Biotik İndekslere (Diyatomlara ve Omurgasızlara Göre) ve Fizikokimyasal Parametrelere Göre İncelenmesi, Organizmaların Su Kalitesi ile İlişkileri. Türk Bilim Dergisi, 2(1): 46-57.
- Kumbur, H., Özer, Z., Özsoy, H.D., (2005). Tarım İlaçlarının (Pestisitlerin) Çevresel Etkileri ve Mersin ili'nde Kullanım Düzeyleri. In: GAP, IV. Tarım Kongresi, 21-23 Eylül 2005, Şanlıurfa, 702-707s.
- Muslu, Y., (1985). Su Temini ve Çevre Sağlığı. İTÜ Matbaası, Cilt III, İstanbul.
- Öztürk, G., Tosun, N., (2004). Famoxadone ve Cymoxanil Etkili Maddeli Bir Fungisitinin Domates (*Lycopersicon esculentum* Mill.) Bitkisi Üzerine Fizyolojik Etkisi. Ege Üniv. Ziraat Fak. Derg. 41: 77-87s.
- Round, F.E., (1984). The Ecology of Algae. Cambridge University Press.
- Sencar, Ö., Gökmen, S., Yıldırım, A., (1993). Tarımsal Ekoloji. GOP Üni. Ziraat Fak. Ders Notları, Yayın No:1, Tokat.
- Shakoori, A. R., Iqbal, M. J., Mughal, A. L., Ali, S. S., (1991). Drastic biochemical changes following 48 hours of exposure of Chinese grass carp, *Ctenopharyngodon idella*, to sublethal doses of mercuric chloride. Proc 1. Symp. Fish & Fisheries, Pakistan. 81-98.
- Shakoori, A. R., Mughal, A. L., Iqbal, M. J., (1996). Effects of sublethal doses of fenvalerate (a synthetic pyrethroid) administered continuously for four weeks on the blood, liver and muscles of a freshwater fish, *Ctenopharyngodon idella*. Bull. Environ. Contam. Toxicol. 57: 487-494.
- Steinbergi, C. E. W., Lorenz, R. and Spieser, O. H. (1995). "Effects of Atrazine on Swimming behaviour of Zebrafish, *Brachidanio rerio*." Water Research 94: 981-985.
- Taş. B., (2006). Derbent Baraj Gölü (Samsun) Su Kalitesinin İncelenmesi. Ondokuz Mayıs Üniversitesi, Ordu Fen Edebiyat Fakültesi, Biyoloji Bölümü, 52750, Perşembe-Ordu. 15, 61, 6-15s.
- Turan Z., (2008). Bazı Pestisitlerin (Diazinon Ve Dıchlorvos) *Scenedesmus Acutus* (Meyen) Chodat' In Gelişimi Üzerindeki Etkilerinin İncelenmesi. Fırat Üniversitesi Fen Bilimleri Enstitüsü Biyoloji Anabilim Dalı yl., 26s.
- Uslu, O., Türkman, A., (1987). Su Kirliliği ve Kontrolü (Water Pollution and Control). T.C. Başbakanlık Çevre Genel Müdürlüğü. Eğitim Yayınları Dizisi 1, İzmir.
- Yılmaz, F., (2004). Mumcular Barajı (Muğla-Bodrum)'nın Fiziko-Kimyasal Özellikleri. Ekoloji, 13, 50: 10-17s.
- Varghaa, M., Takáts, Z. and Máriaiget, K., (2005). "Degradation of atrazine in a laboratory scale model system with Danube river sediment." Water Research