

Review article

Investigating the environmental- legal status arising from indiscriminate use of pesticides and fertilizers in Golestan Province

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ABSTRACT:

Golestan Province is formed from different and diverse ecosystems in terms of certain geographic locations and other environmental factors. Indiscriminate use of pesticides and chemical fertilizers, which are considered the most important factors threatening the environment are associated with various harmful effects in Golestan province (ranked first in the oesophagus and stomach cancer), including groundwater contamination, adverse effects on fish and other organisms, pesticides residues in agricultural products, livestock and food and the incidence of gastrointestinal diseases. In addition to environmental aspects, legal status of the use of pesticides as well as cases of conflict, inconsistent, overlapping and repetition in the relevant laws have been analyzed as a threat in the use of pesticides in the present article. Also, investigation was done on the management process and the executive performance of responsible and effective organizations as well as on the performance of indigenous people and local people who are now considered as effective and threatening factors in managing the use of pesticides. Finally, some recommendations are presented on the legal and operational issues.

Keywords:

Environmental- legal status, land and water resources, pesticides, fertilizers

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INTRODUCTION

Golestan province is considered as one of the agricultural hubs in the country, in a way that several different products are simultaneously grown in this province because of the appropriate climatic conditions, soil type and water resources. However, valuable natural resources of the province have been destroyed due to the devastating impact of indiscriminate use of pesticides and fertilizers, particularly unconscious, irregular, unnecessary, untimely and indiscriminate use of such chemical substances. One of the consequences of this situation is the chaos and imbalances in the ecological balance, the most unfortunate consequence of which is the contamination of water resources. In this study, the main factors threatening these valuable sources are discussed in terms of the environmental- legal aspects which include management and operational issues. Then, solutions necessary to reduce the threats and systematically organize the current situation have been presented. Considering the fact that resources of the province, particularly water resources are heavily exposed to threats of all-out destruction of the region (land) and all kinds of pollution in the watershed, the environmental, legal and managerial aspects related to the use of pesticides and fertilizers have been addressed in this article.

Environmental aspects of threatening factors

Indiscriminate use of chemical fertilizers, especially nitrogen fertilizers contaminates the soil and water resources of the province and is associated with disastrous consequences. For example, according to the Management and Planning Organization of the province in the crop year (2004-2005), a total of 60% of the total acreage is allocated to wheat and barley crops.

Since there is significant rainfall in these seasons leading to the leaching of fertilizers, particularly different kinds of nitrogen fertilizers and resulting eventually to the contamination of groundwater and surface water (Table 1). As the previous investigations on the use of these inputs showed the percentage of fertilizers use did not

Table 1. Statistics on the distribution of chemical fertilizers in Golestan province until 2015(tons)

Year	Nitrogen	Phosphate	Potassium	Macro	Total
1996	31929	17211	-	-	48503
1997	49494	51385	3470	-	104309
1998	50040	33904	6862	-	90806
1999	64026	39917	33114	2612	129669
2000	75274	59639	11876	7651	154440
2001	88832	39310	1176	15267	155170
2002	80093	48373	7628	8809	144903
2003	78987	36075	12007	16149	143218
2004	115320	44873	9054	27407	196654
2005	97585	48040	10762	28060	184447
2006	140000	48060	20135	31450	-
2007	111070	47265	20932	7694	186961
2008	107600	41600	6570	1600	157370
2009	115540	27100	1000	12100	155740
2010	96400	30250	3550	1000	131200
2011	58000	22000	300	8200	88500
2012	64328	14600	1289	1000	81217
2013	77933	21401	1635	-	100969
2014	65300	23092	9981	-	98373
2015	89057	26513	13455	-	129025

follow a specific pattern and many fluctuations and changes can be seen in the use of fertilizers and their unbalanced use in several years. On the other hand, a significant portion of phosphorous and cadmium from fertilizers accumulated in the soil, entered the food chain in many ways and created problems for the environment and humans. For example, Golestan province ranks first regarding the rate of oesophagus and stomach cancers in the country, to the extent that in 2007, the number of people who had been suffering from oesophagus and stomach cancers in the province was 634, from which 457 people live in rural areas and from them, 279 people are engaged in husbandry and agriculture. However, the document for the development of the agricultural sector has confirmed the contamination of underground and surface water and the penetration of the urban and household sewage into aquifers as well as raised and categorized the issue as one of the fundamental issues of the province.

The existence of many agricultural lands and the overuse of pesticides and chemical fertilizers have caused the annual volume of many agricultural wastewaters to enter the important water resources of the province and eventually the Caspian Sea.

These wastewaters contain large amounts of chemical residues to the extent that, according to the previous research, chlorinated pesticides have been found and approved in waters such as Gharehsou, Khajehnafas (Gorganrud) and NoKandeh. Based on the same research, the highest contamination rate occurs during the spring with (14.01 µg/L) and the average annual contamination rate of 11.08 µg/L has been detected in the Gharehsou River. According to the province's Ministry of Agriculture, the edge of rivers is suitable for farming, particularly for rice cultivation and people are encouraged to grow crops and horticultural products. That's why the use of pesticides and fertilizers are common in these areas of the province and a variety of chlorinated pesticides and phosphorus are used, which cause water contamination and thus enter the aquatic food chain. For example, dangerous herbicides such as Saturn and Machete that have the most harmful effects on blue-green algae, destroy all blue-green algae and are widely used. Moreover, Diazinon, Malathion and Machete have disproportionately negative impact on the zooplanktons, *Daphnia magnas*, baby fish and white sturgeons (Management and Planning Organization of Golestan province, 2006).

The Ministry of Health and Medical Education is the organization responsible for monitoring the quality of drinking water from the intake to the consumption stage as well as controlling the food quality. Unfortunately, there is no specialized laboratory to confirm the residues of pesticides and fertilizers in food including vegetables and fruits and the law enforcement process is not monitored (Legal and Parliamentary Affairs Office, 2004).

Accordingly, a lot of people are in trouble due to the consumption of contaminated food and have lost their health. For example, pesticide poisoned patients account for a total of 8.62 %, 5.17 % and 15.26 % of poisoned patients referred to Shohada Hospital in Gonbad, respectively in years 2005, 2006 and by the end of May 2007. Moreover, a total of 24.44% and 22.56% of patients

referred to 5th Azar Gorgan hospital suffered from the same problem, respectively in years 2001 and 2002. However, a number of patients lost their lives before being admitted to the hospital and numerous people have been infected with other diseases that are associated with contamination, pesticides and fertilizers, although the statistics is not recorded anywhere (Medical Record Unit, 2007).

Due to the overuse of pesticides and fertilizers in the province, there are large numbers of containers and bags containing these chemicals in the environment annually and are sometimes used for other purposes. So, such factors are threatening the region's environment due to their negative effects. According to Article 5 of the regulation for the prevention of water contamination (Saed and Tila, 2012a), the Environmental Protection Organizations are responsible for preparation of standards related to water contamination. However, issues such as violations and lack of management in the implementation of the regulation are the underlying causes for the continuity of the contamination. These standards have been developed precisely; however, they are based on the exact translation of the US EPA Standards, which are difficult to implement and incompatible with many conditions and factors in our country.

Legal aspects of threats

Rules and regulations play a major role in organization and prevention of contamination and destruction. On the one hand, lack of adequate laws and ambiguities in such laws, and on the other hand, lack of adherence to such rules and regulations are reasons contributing to contamination and destruction of the environment.

The Clause of Article 9 on Protection and Improvement of the Environment prohibits farmers from using the chemical pesticides to combat pests from the generality of Article 9 stating that any action that causes contamination, while agricultural wastewater containing chemical pesticides are one of the most major

contaminants of rivers in the studied area (Saed and Tila, 2012b).

In discussing the need to identify causes of contamination and the obligation of the related organizations, Articles 11 and 12 of the Preservation and Improvement of the Environment Act, have required the Environmental Protection Organization to monitor only the activities of workshops and factories and are not effective in other contamination cases (Saed and Tila, 2012c). In addition, the law enforcement is a time-consuming process and will also be extended after submitting an appropriate deadline. Moreover, activities are prohibited in the case of lack of any positive action; however, action must be taken by adopting longer deadlines regarding the drinking water. Article 46 of the equitable distribution of water (Saed and Tila, 2012d) and Article 2 of its executive regulation hold Iran's Environmental Protection Organization (IEPO) responsible to prevent the contamination of water resources (Plant Protection management, 2006).

If all the necessary tools, which can be used in the quality control debate, must be presented to the Ministry of Energy, Article 7 of the aforesaid regulation has allowed the temporary cultivation of crops in that part of the river bed with the permission of the regional water company and on condition of creating no problems for other farmers (Saed and Tila, 2012e).

Paragraph (d) of Article 12 of the Law for hunting and fishing is one the most important regulations, which ensures the enforcement of the above law. The paragraph stated that any act that leads to the water contamination and death of aquatic animals is a criminal act and considers punishments for the perpetrator (s) (Saed and Tila, 2012f).

Pesticide containers and chemical fertilizers bags are considered among the categories of agricultural wastes. According to the Articles 16, 18 and 19 of Waste Management Act (Saed and Tila, 2012g), the release and disposal of such wastes in the environment without

observing the related standards is a criminal act, which can be prosecuted. Moreover, the Ministry of Agriculture, which is responsible for monitoring the implementation of rules and procedures for inputs distribution does not exercise adequate oversight in this regard.

Also, according to Article 9 of the regulation on pesticides and chemical control and health monitoring (Islamic Parliament Research Center, 1999), all factories, workshops and health and trade centers and as well as all persons engaged in the purchase or use of pesticides and chemicals, who are required to destroy the empty containers properly and in compliance with environmental standards. According to the Plant Protection Law and relevant regulation, the Ministry of Agriculture is responsible to monitor all stages of licensing for vendors and manner of using pesticides as well as the time and type and composition of pesticides and etc. (Research center on oesophagus and stomach diseases, 2007).

The interesting point on the use of pesticides is in the Clause of the Article 6 in the same law, which requires the Plant Protection Organization to raise the public awareness regarding the type and composition of pesticides and how to fight, time and manner of protecting human and animals against poisoning as well as to issue health recommendations in each region regarding the pertinent issues (Plant Protection Organization 2016). Moreover, Clause 1 of the Act to amend paragraph 2 in Article 1 on the constitution and duties of the Ministry of Health, Treatment and Medical Education, (Islamic Parliament Research Center 1988), holds only the organization responsible for setting standards in terms of observing the health recommendations. However, there is an inconsistency in the implementation of such recommendations in the same Act, which also requires all organizations to observe these recommendations. Pursuant to paragraph (6) of Article (22), (Saed and Tila, 2012h) according to the protection and exploitation of aquatic resources Act of the Islamic Republic, any contamination and damage to aquatic resources are prohibited.

(Khorasgani, 1997)

Damage to aquatic resources may occur through industrial waste water, chemical, toxic and radioactive substances, chemical fertilizers and pesticides, etc. Therefore, the contamination, which is caused by any means and in any way is considered a criminal act.

Furthermore, judicial authorities are not well coordinated with the responsible agencies in implementing laws and regulations relating to the field and ignorance and inexperience of some judges are effective in creating such conditions. Unfortunately, some judges are not well decided in dealing with violations related to water resources (particularly contamination caused by fertilizers and pesticides) and pass a judgment by taking into account the specific considerations. Also, some judges, based on the false notion, don't think that the environmental crime is a crime and issue the judgment for the acquittal of the offender by arguing about the failure to fulfill the elements of a crime (Ghasemi, 2005).

Existing laws such as the Islamic Penal Code, laws related with equitable distribution of water, solid waste management laws, preservation and improvement act, environmental crimes regulations, regulations related with the prevention of water contamination are among preventive and penal laws used in case of the contamination control and punishment of individuals who are engaged in contaminating activities. However, the number of threats associated with the indiscriminate use of pesticides and fertilizers are increased day by day.

Managerial and operational aspects of threats

Management and performance process of various executive and staff organizations, which are dealt with below is very effective on the use of chemical fertilizers and pesticides.

Iran's Environmental Protection Organization (IEPO)

According to Articles (1, 6, 9, 12) of Law on the Protection and Improvement of the Environment (Saed and Tila, 2012i) and its executive regulation, IEPO is responsible for the task of protecting and improving the

environment as well as the prevention and prohibition of any form of contamination and destructive actions that cause imbalance in the environment. Also, the same organization is responsible for the prevention and inhibition of water contamination in accordance with Article 46 of the Act of equitable distribution of water as well as Article 3 and 4 of the related regulation. Moreover, according to Article 2 of the Law on the Protection and Improvement of the Environment, (Saed and Tila, 2012j) President of the Islamic Republic of Iran is the Chairman of the Supreme Council of Environmental Protection and the organization can take the necessary measures through this channel because the country's ministries of Agriculture, Health, Management and Planning Organization and chairman of Standard and Industrial Research Institute etc. are members of the Supreme Council (4 and 7). (Medical records, 2007) (Saed and Tila, 2012k).

Ministry of agriculture

According to the Plant Protection Act and related regulations, Article 3 and 22 of fisheries organizations in accordance with of the law on conservation and utilization of aquatic resources of the Islamic Republic of Iran and Article 8 of the Regulations relating to contamination and the spread of contagious and harmful diseases, (Saed and Tila, 2012l). Ministry of Agriculture can take necessary measures in order to reduce the contamination level of aquatic resources through the Plant Protection Organization. Moreover, the ministry is responsible to control the type and usage amount of chemical fertilizers and pesticides in orchards and agricultural lands of the province, delimitate the authorization to use change as well as to convert them to different uses, provide inputs, determine and policies regarding the planting, growing, harvesting in the province. (Management and Planning Organization of Golestan province, 2006)

Ministry of energy

According to Article 3 and Clause 1 of Article 4 of regulation on water contamination prevention, Ministry

of Energy is responsible to collaborate with IEPO, identify and investigate various sources of water contamination and delimitate the beds of river and lakes etc. by collaborating with the Department of Water Affairs in provinces (Saed and Tila, 2012m).

Ministry of health and medical education

Beside the duty to cooperate with IEPO under Article 3 and clause 1 of Article 4 of Regulation for preventing water contamination, (Saed and Tila, 2012n) the Ministry is obliged to inform judicial authorities of threats of public health through environmental health centers in every province in accordance with Article 688 of the Islamic Penal Code (Danesh, 2016). Also in accordance with Article 36 of the executive regulation on the waste management, the officers of the organizations, including the environmental health officers are allowed to identify, report and follow-up violations related to the rule i.e. the disposal process of agricultural wastes (Medical records, 2007).

Ministry of interior

According to Article 5 of the Executive Regulation of waste management, the Ministry of Interior is obliged to prepare and enforce executable waste management practices with the cooperation of other concerned authorities. Moreover, General-Governor Offices are responsible (Department of Planning) for financing and coordinating the implementation of development projects among different organizations and departments.

Ministry of Science, Research and Technology

The Ministry of Science, Research and Technology, especially universities are responsible for protecting the biotechnology-induced bio safety. Also, the Ministry can act effectively by doing research on the contamination arising from fertilizers and pesticides and providing appropriate solutions and cooperating with other organizations (Pirizekahi, 2004).

Judicial authorities

Judicial authorities are responsible for the

enforcement of laws and regulations dealing with offenders, but the previous studies showed that the authorities aren't well coordinated with the responsible authorities. Unfortunately, due to their ignorance and inexperience, some judges don't act decisively while dealing with violations regarding the fertilizer and pesticide contamination and issue judgments with some considerations in mind (Ghasemi, 2005). Although some judges, based on false notions, believe that the environmental crime is not a crime and thus, issue the judgment for the acquittal of the offender by arguing about the unjustified reasons. On the other hand, IEPO and Health and Medical Education along with the other relevant organizations are not quite courageous enough to lodge a complaint and submit a report to the judicial authorities on the use of fertilizers and pesticides.

Evaluating the competence and the role of other natural and legal persons

Indigenous and local peoples

Ignorance of local people, especially farmers regarding problems caused by the indiscriminate use of pesticides and fertilizers as well as lack of communication with agricultural experts and lack of awareness of the harmful effects of fertilizers and pesticides on human health and creatures are associated with the adverse effects. Rising the public awareness and responsibility of local and indigenous people and farmers regarding the shelf life of pesticides can significantly reduce their effects. The harvesting of crops, especially fruits and vegetables after the shelf life of leftover of fertilizers and pesticides bags etc. are very effective in reducing their effect. Furthermore, local authorities, especially municipalities, rural district council and demarches can produce the desired effect by accurate and timely information on the adverse effects of indiscriminate use of pesticides and chemical fertilizers as well as coordination with other relevant authorities (Management and Planning Organization of Golestan province, 2006).

Non-Governmental Organizations (NGO)

NGO's can take a significant step in promoting the efficiency and reducing the effects of pesticides and fertilizers by increasing local awareness and promoting the correct use of inputs, including fertilizers and pesticides, giving warnings to local people and other officials to reduce the contamination rate and the providing necessary training to local people on the effects of indiscriminate use of such chemical products.

CONCLUSION

Although, the use of pesticides in agriculture is beneficial for pathogen control, the pesticides themselves can cause disease and death in humans. The problems are caused by a variety of direct and indirect contact of human with pesticides. In fact, water and soil contamination by pesticides and chemical fertilizers is one of the issues, which have negative impacts on our environment. Although, there are many laws and regulations on distribution and use of pesticides and chemical fertilizers, due to the lack of enforcement and lack of proper management, we suffer from contaminations and the impacts resulting from the use of such chemicals in our environment. Therefore, based on the previous studies and the identified defects, the following recommendations can be offered for a good management and reducing the contamination caused by pesticides and fertilizers:

Structural and organizational recommendations-Plant Protection Organization in Golestan

Establishment of a regional organization with a clear structure and composition in order to adopt a coordinated policy in dealing with the problems of the province, planned organization and effective implementation of laws and monitoring the performance of the effective institutions. The composition and structure of regional organization mentioned above are as follows:

- Chairman of the regional organization with a standard decree

- A council consisting of chairman of the regional organization, political or planning deputy of police force of General-Governor Office, Director General of Environment, Agriculture, Water affairs, Water and Sewage Company, environmental health, natural resources, justice, the police commander in the province, governors and demarches. The regulatory authority scope of the organization includes monitoring the performance of the executive institutions in the province, monitoring the proper enforcement of regional laws, approval of the program to moderate the use of pesticides and chemical fertilizers.

Legal recommendations use of pesticides and chemical fertilizers in Golestan

- Adoption of a comprehensive law to manage the catchment areas of major rivers of the Province and finally the Caspian Sea, including a ban on paddy cultivation in neighboring rivers for conservation and utilization of water resources
- Setting standards on the balanced use of pesticides and fertilizers
- Setting punishments for offenders
- Setting local and regional guidelines and regulations to control agricultural and service activities
- Setting special rules to combat pests and plant diseases
- Financial and moral support of special agents to control areas and setting punishment for those officers who violate the related laws
- Administrative and management recommendations on the use of pesticides and chemical fertilizers in Golestan
- Preventing the cultivation of a monoculture agriculture for some consecutive years
- Prohibiting the use of pesticides in 500m of water resources
- Agricultural lands are mostly in small pieces of areas and are run by a yeoman in the province. That's why the new agricultural techniques cannot be implemented in this

property system. Moreover, the Agriculture Organization must convert the system into a condominium system and specify farmers' shares with regard to the ownership level in the condominium system. Next, the new agricultural techniques can be implemented using a proper management and planning.

- Development of agricultural research centers in the province, in a way that a research center is established in each area or city, where it operates mainly in the field of biological control and its main purpose is to prevent long-term use of chemical products to fight against agricultural pests.

Integrated Pest Management (IPM)

- In the chemical fight against pests, such pesticides should be used that act exclusively and impose no harmful effect on target organisms. Some pesticides, such as 60% diazinon and malathion are the pesticides with high toxicity, the use of which must be prevented as much as possible.

- Use a soil test before fertilizing must be considered as an important principle. Moreover, the fertilizer feeding process must be prohibited before the soil testing and the tests must be unconditionally done on phosphate fertilizers.

- A certificate must be prepared during a national comprehensive plan, in which the soil requirements of each region as well as the type and amount of fertilizer must be determined based on the soil requirements and the crop type.

- The combined use of chemical and animal fertilizers is recommended; because this method not only enhances the crop yield, but also reduces the nitrate contamination caused by the use of nitrate fertilizers.

- Comprehensive monitoring of the entry, storage and use of pesticides and chemical fertilizers by the ministries responsible.

- Pay careful attention to the elimination process of expired pesticides. The correct elimination method is also

very important.

General recommendations for Golestan citizens to use pesticides and chemical fertilizers

- Raising public awareness and use of public participation in particular, non-governmental organizations, which are considered as one of the key tools in the control and reduction of water resources contamination and management. Based on the 5th principle of the constitution, protection of the environment is a public duty, so not only every member of society as natural individuals is responsible in this regard, but also the governmental institutions as legal persons are obliged to do their duties.

- Training judges and other judicial administrative staffs are trained through in service training of personal in all executive organizations related to the problems caused by excessive use of fertilizers and chemical pesticides.

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