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# The Environmental Risk of Pesticides in Cotton Production in Aegean Region, Turkey

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**Abstract:** The Environmental Impact Quotients (EIQ) was calculated at 3 sites from 2002 to 2004 and the results were not correlated with application number and amount of active ingredients used. The EIQ values were found very different from year to year. Generally, the EIQ values were lower at the sites Odemis and Tire in comparison to Nazilli. The risk for non-human biota related to EIQ was higher than EIQ values for farmworkers and consumers.

**Key words:** Pesticide, environmental risk, EIQ, cotton, Turkey

## INTRODUCTION

Cotton production contains a large area especially south, east and west Turkey and Turkey is 6 biggest cotton producer in the world. The cotton area is about 711.000 ha and the production is about 2.489.000.

About 40% of the cotton has been picked within the Aegean region, 75% picked in the Cukurova region and 45% picked in Southeastern Anatolia. The remaining cotton in the fields will be picked within the next 30 days. Cotton area is expected to increase in southeastern Turkey for the next ten years as more land is opened to irrigation by the GAP (Dam and South Eastern Anatolia Project). Cotton production makes an important contribution to the Turkish economy. It is used for yarn, cloth and the ready-made clothing industry and is exported abroad.

The cotton production needs very intensive agricultural practice and is also very costly production in comparison to other crops in Turkey. The cost of picking and weed control are very expensive. Because of the climatic conditions and a long vegetation time of cotton plants cause the need to control pests, diseases and weeds in cotton. The pesticide usage in Turkey increased about 45% from 1970 to 2002[1]. The pesticide usage in Turkey is about 27834 ton as active ingredients and more than 40% are insecticides which are applied very often in cotton production[2]. The pesticides prices decreased very sharply because of the generic pesticide registration in last decade, so that the uncontrolled pesticide use in cotton production as well as in other crops increased. Many farmers have very small farm and the production of cotton. Pesticides may cause many problems during or after application. The used pesticides can be harmful for many non target organisms and pesticide applicators and farmworkers. Farmworker are under risk because of very intensive field work in the field. Especially, the insecticides give risk because of volatility of pesticides from plant or soil surfaces[3].The pesticides can enter the environment and contaminate river and sediments near or far application sites[4,5] and affect the physiological processes of plants. They also can be uptaken by plants and may enter the food chain[6]. Various methods have been proposed to focus on impacts of pesticides on ecological systems and depending on the agronomic context in which it was developed[7,8].

This method will be an example in cotton production and show the risk for environment in cotton production in Turkey.

## MATERIALS AND METHODS

The average yield of cotton in Aegean region is about 3000 kg $ha^{-1}$ and the recommendations of fertiliser and pesticide use in cotton production is made by cooperatives, pesticide seller or agricultural agencies of Government in this region. The technical itinerary was followed at 3 experimental sites that are 80 ha in Nazilli, 10 ha in Tire and 15 ha in Odemis, 2002-2004. All fields were irrigated at least 3-4 times during summer because of very hot summer in Turkey. The number of pesticide application varied from 6 to 10 and total active ingredients mass were also between 2.42 and 4.17 kg $ha^{-1}$.

The environmental impact quotients method[9] distinguishes three components, i.e. (a) farmworkers, (b) consumers and ground water, (c) non-human biota

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(fish, birds and beneficial arthropods). It is based on the following index:

$$EIQ_i = \frac{1}{3}\{[c(dt*5+dt*p)]+[(\frac{1}{2}(c*(s+p))*sy)+L] +[(f*r)+(\frac{1}{2}(d*(s+p))*3)+(z*p*3)+(b*p*5)]\}$$

Where, dt: is dermal toxicity, d: toxicity to birds, c: the chronic toxicity, s: soil half-life, z: toxicity to bees, f: toxicity to fish, b: toxicity to beneficial arthropods, sy: systemicity, L: leaching potential, p: plant surface half-life and r: surface loss potential.

For any field application the Environmental Impact Quotient (EIQ) is obtained by multiplying the index by the amount of active ingredients applied (kg $ha^{-1}$). For a particular crop protection program, the total of EIQ is the sum of every EIQ corresponding to each pesticide application.

## RESULTS AND DISCUSSION

The value of EIQ varied from years to years. (Table 1). The most significant differences were observed between years in Nazilli which is Cotton Research Institute located. In most cases, the EIQ value of insecticides were higher than acaricides and herbicides. In 2002, the EIQ value of insecticides were found very high in three locations and the highest EIQ value was calculated in Odemis. The EIQ values of all pesticides were obtained higher than in 2003 but lower than in 2002, respectively (Table 1). The EIQ values of acaricide of Tire in 2003 and Odemis in 2004 higher than insecticides and herbicides. This maybe because of the very dusty condition of this field which increases the acari populations.

Herbicide application is done only one time during a year as a pretreatment herbicide active ingredients trifluralin[10]. Seed treatment of with carboxin was excluded form the calculations. Normally most seed were covered with to protect the seed from soil infected diseases. If we added it, the EIQ values would have been increased.

The EIQ values for farmworkes decreased followed Nazilli, Odemis and Tire (Table 2). The highest value was calculated 539 in Nazilli, 251.4 for Odemis and 187.5 for Tire in 2002. Impact of consumers were very low and there was a small difference between experimental sites. The highest value reached up tot 42.9 in Odemis and the lowest is 31.5 in Tire. The components of EIQ was always larger for non-human biota and the values were between 362.75 (Odemis) and 492.5 (Nazilli) (Table 2).

In 2003, the EIQ value in Nazilli was higher than in year 2002 but values of Odemis and Tire were very low in comparison to year 2002 and 2004 (Table 2). The effect on consumers related to EIQ in 2003 were lower in comparison to other EIQ values. The EIQ values of non-human biota were higher than in 2002 and in 2004. In 2004, the EIQ values of farmworkers was low in Nazilli in comparison to 2002 and 2003. The values for non-human biota were similar to year 2002 (Table 2).

Table 1: EIQ of three main classes of pesticides (fungicides, acaricides and herbicides)

| | Nazilli | Odemis | Tire |
|---|---|---|---|
| Insecticides | | | |
| 2002 | 66.2 | 95 | 66.8 |
| 2003 | 158.3 | 28.7 | 26.6 |
| 2004 | 130.2 | 36.6 | 41 |
| Acaricides | | | |
| 2002 | - | 35 | 17.5 |
| 2003 | - | 17.5 | 35 |
| 2004 | - | 73 | 36.5 |
| Herbicides | | | |
| 2002 | 12.9 | 12.9 | 12.9 |
| 2003 | 12.9 | 12.9 | 12.9 |
| 2004 | 0 | 12.9 | 12.9 |

Table 2: EIQ on farmworkers, consumers and non-human biota

| | Nazilli | Odemis | Tire |
|---|---|---|---|
| Farmworkers | | | |
| 2002 | 339 | 251.4 | 187.5 |
| 2003 | 420 | 81 | 108 |
| 2004 | 301.8 | 172.4 | 150.4 |
| Consumers | 2002 | 38.5 | 42.9 |
| 31.5 | | | |
| 2003 | 24.5 | 51.9 | 25.5 |
| 2004 | 27.7 | 35.4 | 28.7 |
| Non-human biota | | | |
| 2002 | 551.65 | 535.55 | 469.8 |
| 2003 | 701.55 | 358.9 | 350.5 |
| 2004 | 492.5 | 362.75 | 397.5 |

## CONCLUSIONS

The results of this study emphasize potential pesticide environmental effect in cotton fields. Pesticide use in cotton production should be reduced or better managed and selected pesticides with low EIQ values. EIQ can be used as a decision support to rank or choose between alternative pesticide application options.

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## REFERENCES

1. Delen, N., E. Durmusoglu, A. Guncan, N. Gungor, C. Turgut and A. Burcak, 2005. The problem of pesticide use, residue and decreasing the sensibility to organisms in Turkey. 4th Tech. Cong. Turkey Agric. Eng., pp: 629-648.

2. Anonymous, 2002. ECPA Statistical Review.
3. Schweizer, A., C. Turgut and K. Hurle, 2000. Untersuchungen zur Verflüchtigung von Pflanzenschutzmitteln von Pflanzenoberflächen in Abhängigkeit von Temperatur und relativer Luftfeuchte. Zeitschrift für PflKrankh. und Pflschutz XVII, pp: 791-798.
4. Turgut, C., 2003. The contamination of organochlorine pesticides and heavy metals in surface water in Kücük Menderes River in Turkey, 2000-2002. Environ. Intl., 29: 29-32.
5. Turgut, C. and A. Fomin, 2002. Residues of selected pesticides in Kücük Menderes River in Turkey. Zeitschrift für PflKrankh. und Pflschutz XVIII, pp: 1053-1057.
6. Turgut, C. and A. Fomin, 2002. The ability of *Myriophyllum aquaticum* (Vell.) Verdcourt to uptake and translocate pesticides via roots as a requirement for using it in the sediment toxicity testing. J. Applied Bot., 76: 62-65.
7. Levitan, L., I. Merwin and J. Kovach, 1995. Assessing the relative environmental impacts of agricultural pesticides: The guest for a holistic method. Agric. Ecosyst. Environ., 55: 153-168.
8. Van der Werf, H.M.G. and C. Zimmer, 1996. Assessing the impact on the environment. Agric. Ecosyst. Environ., 60: 81-96.
9. Kovach, J., C. Petzoldt, J. Degni and J. Tette, 1992. A method to measure the environmental impact of pesticides. New Yorks Food Life Sci. Bull. 139. NY. State Agric. Exp. Stat., Geneva, NY. USA.
10. Tomlin, C., 1994. The Pesticide Manual. 10th Edn., British Crop Protection Council, Farnham, United Kingdom.