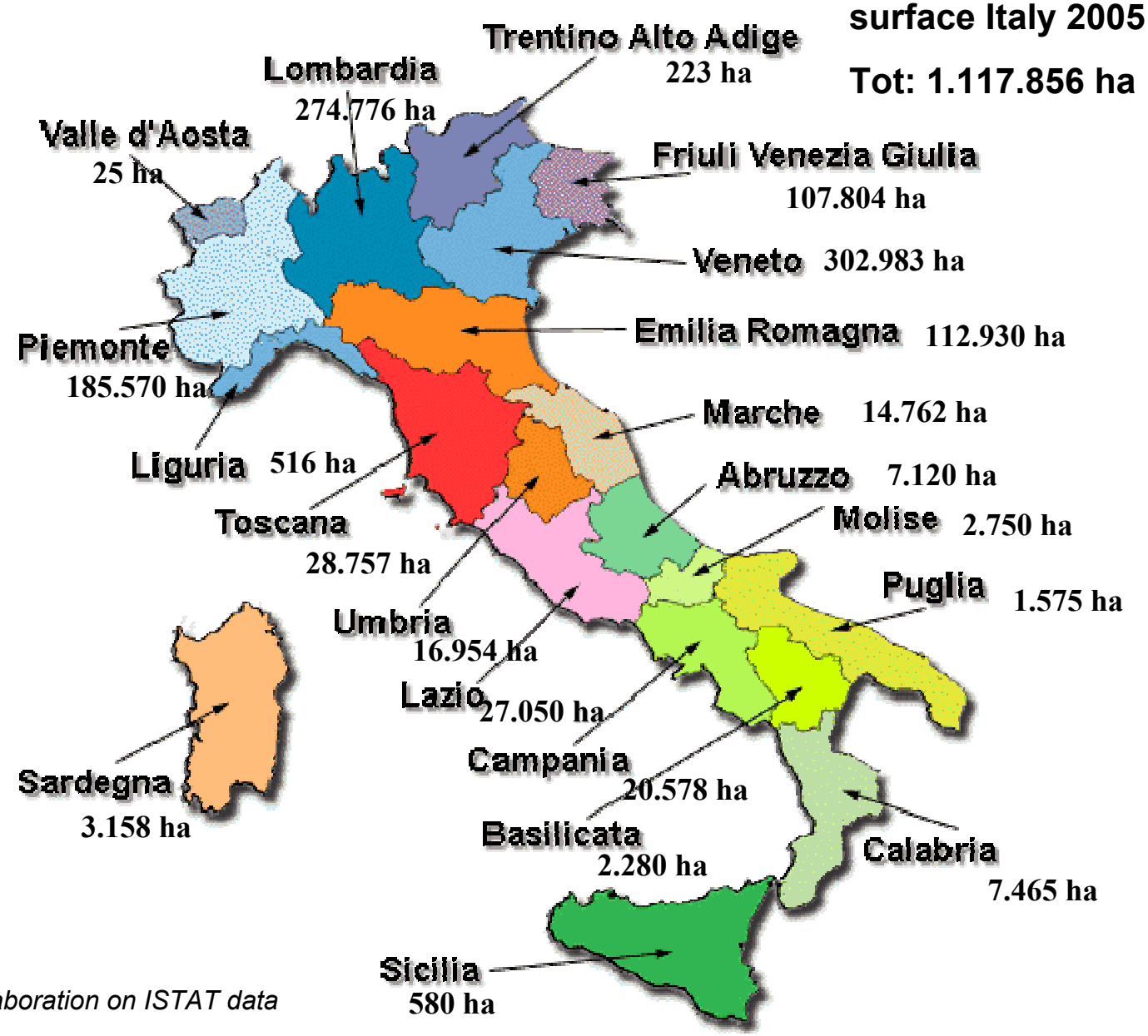
# FUMONISINS IN ITALIAN MAIZE:

# ANALYSIS AND CONSIDERATIONS

*Italian Mycotoxin Working Group*

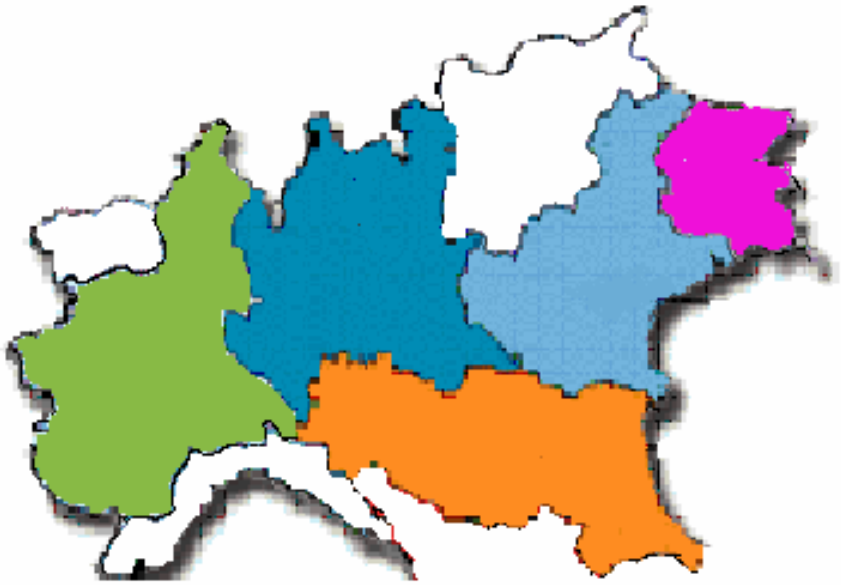
**Estimated Grain Corn surface Italy 2005 :**

**Tot: 1.117.856 ha**

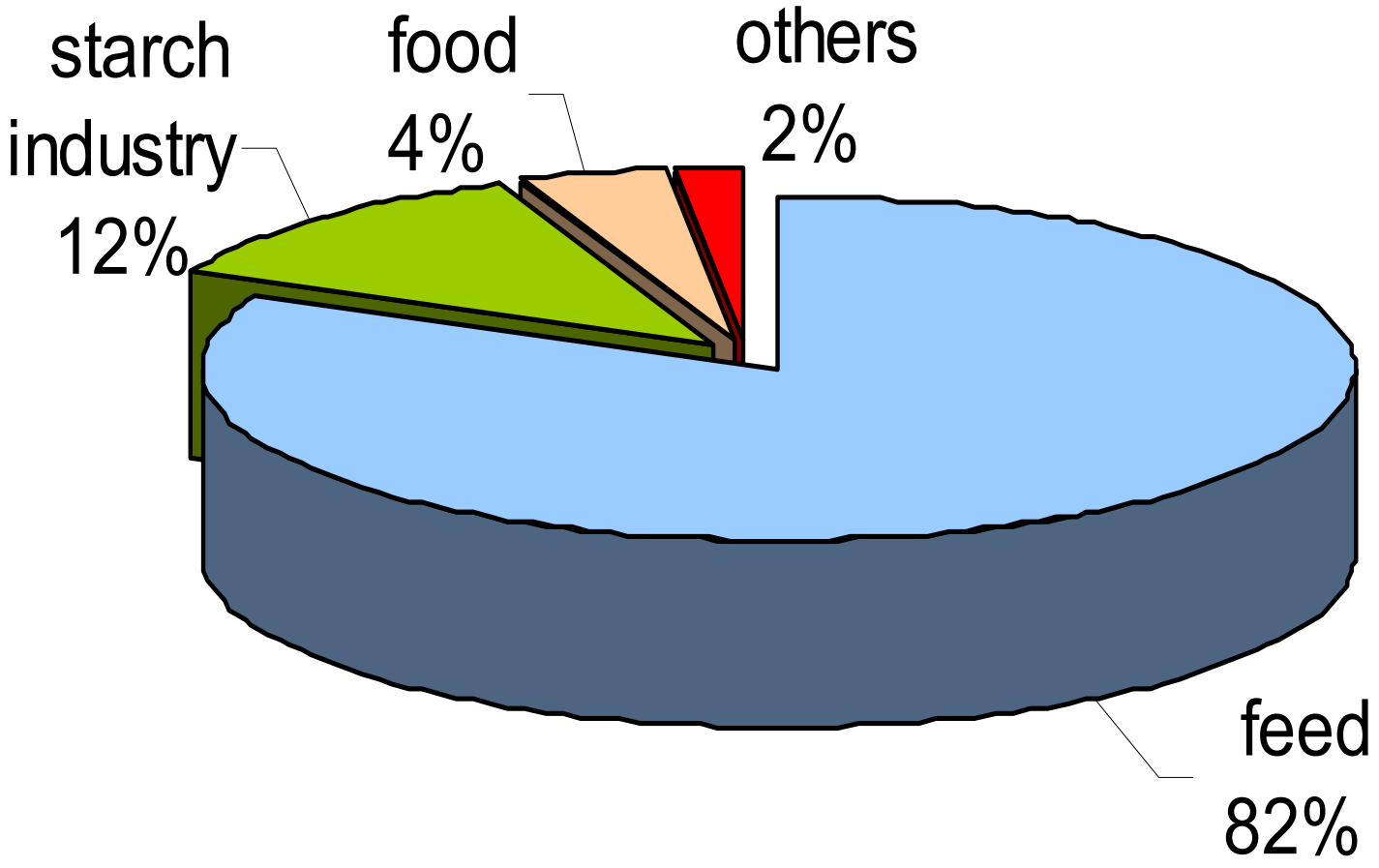



*Source: Our elaboration on ISTAT data*

91% of the Italian yield, are produced in Piemonte, Lombardia, Veneto, Friuli V. G., Emilia Romagna



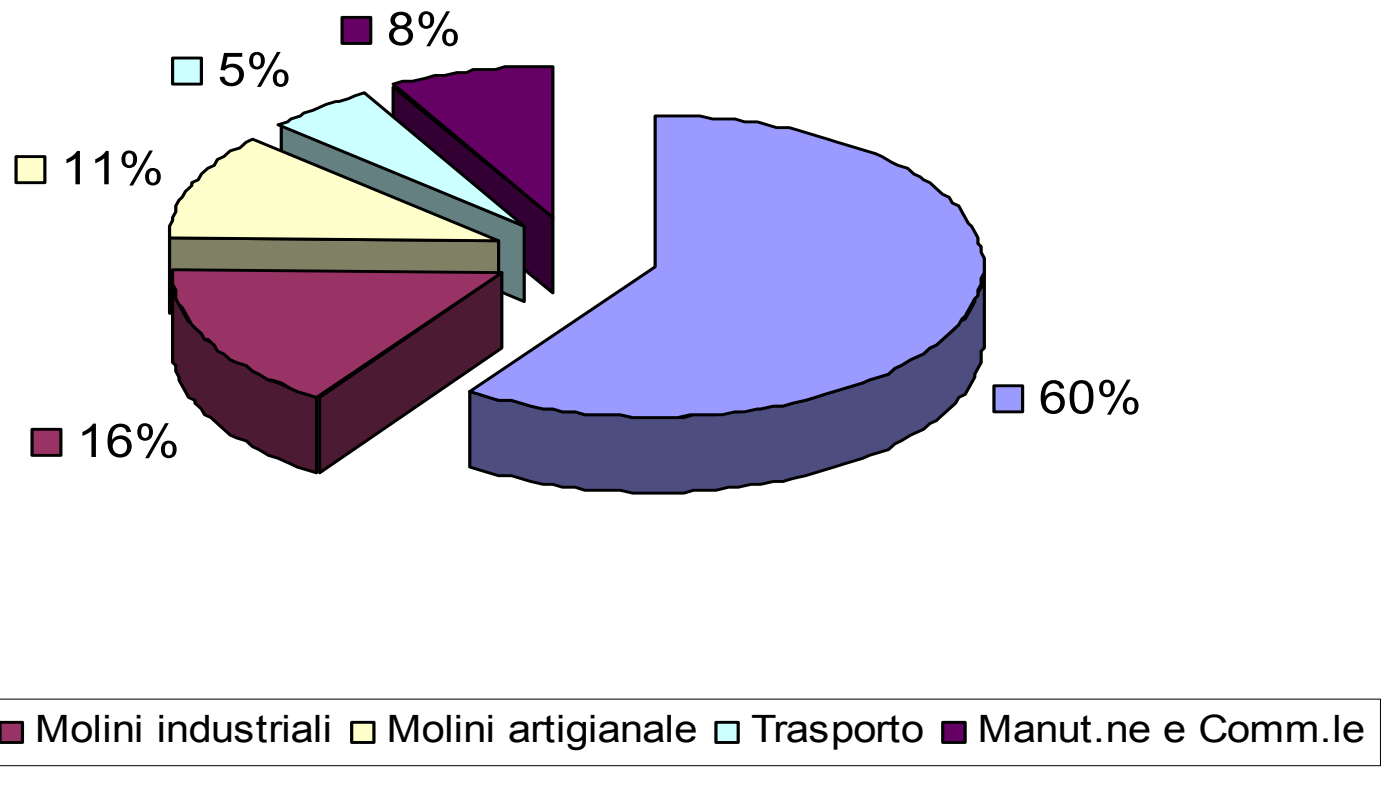
# The maize food chain in Italy




*Source: Aires*

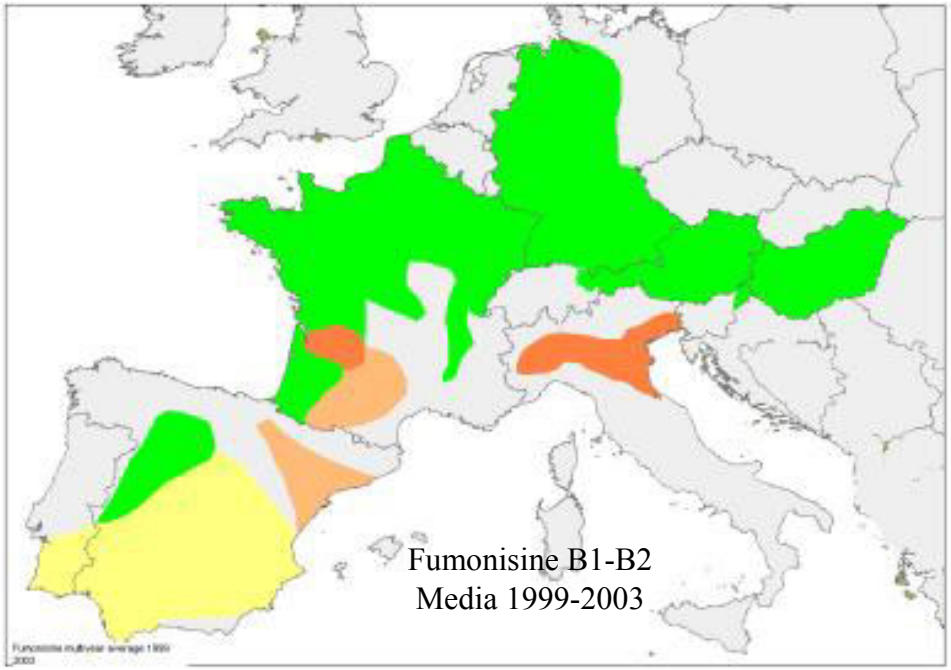
# ECONOMICS OF FOOD MAIZE IN ITALY

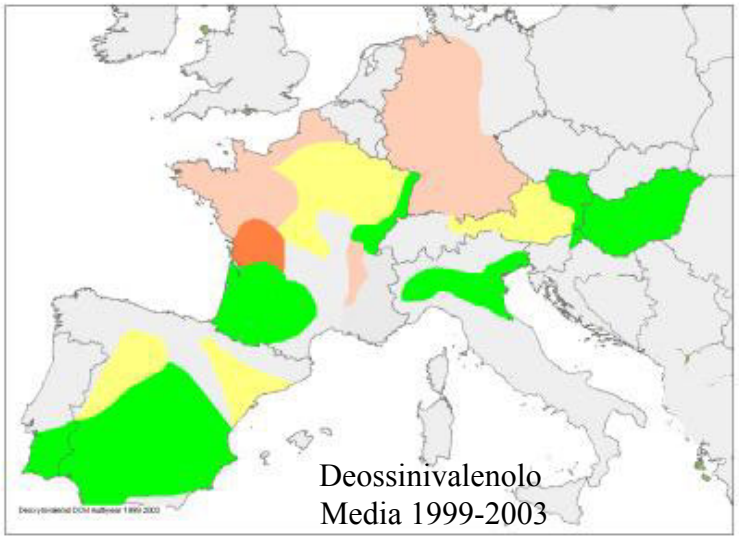
**In Italy products for human uses made from maize generate a business of 592 million €**




*Source: Aires.*

# *FUSARIUM*-TOXINS IN EUROPE



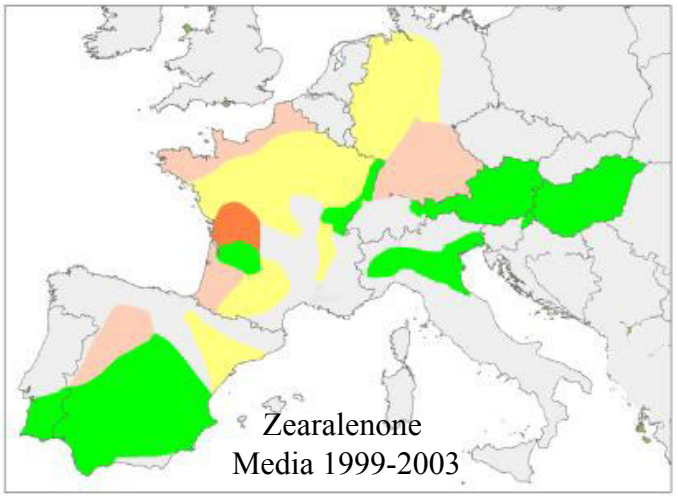




**DON and ZEA are higher Center-North Europe**

**Fumonisins are higherin South Europe**

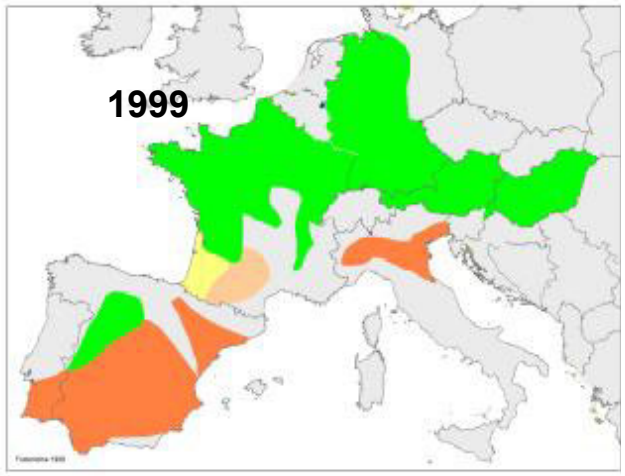
- **da 0 a 75% della media Europea 1999 - 2003**
- **da 75 a 125%**
- **da 125 a 250%**
- **più di 250%**
- **dati non sufficienti**

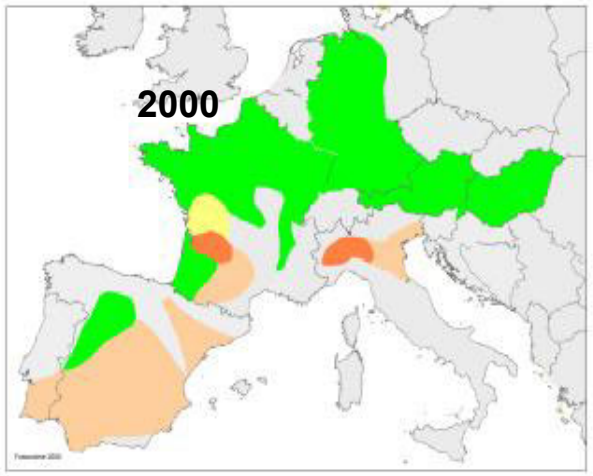
| Media di tutte le località 1999 - 2003 | |
|---|---|
| Zearalenone | 0.06 ppm |
| Deossinivalenolo | 0.82 ppm |
| Fumonisine B1 e B2 | 1.59 ppm |

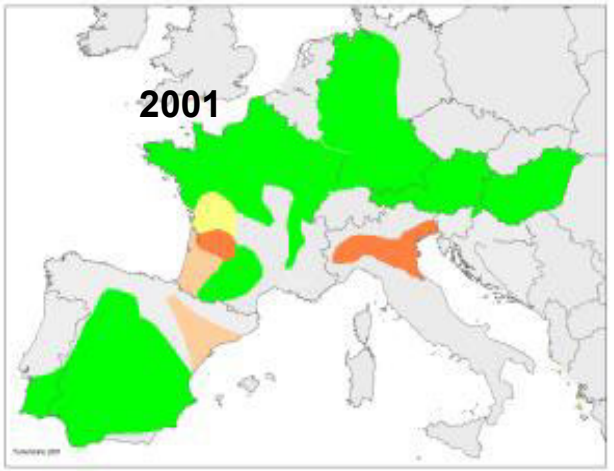


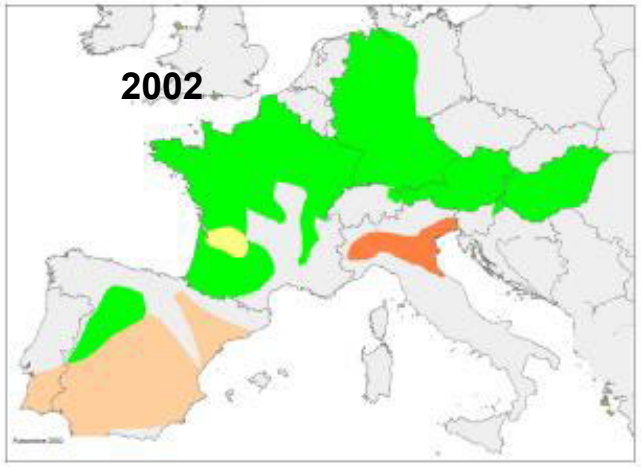

*Source: Indagine Europea di Syngenta Seeds*

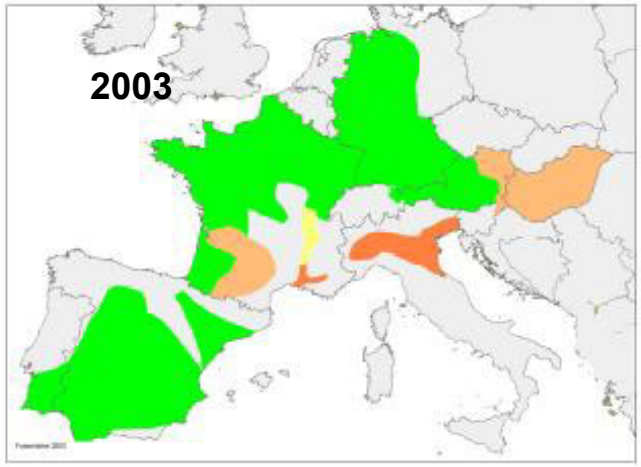
# *FUSARIUM*-TOXINS IN EUROPE




**1999-2003 Fumonisins distribution**

*Source: Indagine Europea di Syngenta Seeds*

# Survey N.1

| | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| **Mean** | 3347 | 1324 | 3103 | 2655 | 5173 |
| **<1000 ppb (%)** | 34,7 | 45,2 | 26,6 | 28,1 | 16,1 |
| **1000-5000 ppb (%)** | 48,0 | 52,9 | 63,8 | 58,8 | 38,7 |
| **>5000 ppb (%)** | 17,3 | 1,9 | 9,6 | 13,1 | 45,2 |
| ***N. of samples*** | *98* | *104* | *94* | *114* | *93* |

| | |
|---|---|
| **Area of sampling** | Po plain |
| **Source of samples** | Commercial lots from drying units and milling plains |
| **Sampling methods** | Following Dir. CE 76/371 |
| **Methods of analysis** | HPLC |
| **Scientific Reference** | Università Cattolica di Piacenza |
| **Literature Reference** | Pietri A. *et al.*, (2004), *"Occurrence of mycotoxins and ergosterol in maize harvested over 5 years in Northern Italy"*, Food Additives and Contaminants 21 (5): 479-487 |
| **Number of samples** | 503 |
| **Number of years** | 5 (1995, 1996, 1997, 1998, 1999) |

# Survey N. 2

| | 1999[a] | 2000[a] | 2003[a] | 2003[b] | 2004[a] |
|---|---|---|---|---|---|
| **<1500 ppb (%)** | 49,8 | 55,6 | 15,8 | 6,9 | 22,4 |
| **1500-2000 ppb (%)** | 24,5 | 6,1 | 5,5 | 3,8 | 12,5 |
| **2000-4000 ppb (%)** | 18,0 | 19,7 | 24,5 | 19,8 | 61,3 |
| **4000-6000 ppb (%)** | 5,6 | 11,1 | 8,7 | 25,2 | 2,3 |
| **>6000 ppb (%)** | 2,2 | 7,5 | 45,5 | 44,3 | 1,5 |
| ***N. of samples*** | *323* | *360* | *310* | *131* | *344* |

a= samples from drying units
b= samples from fields

| | |
|---|---|
| **Area of sampling** | Po Plain |
| **Source of samples** | a. Commercial lots from 60 drying units<br>b. Production from 44 experimental fields: network *"on farm"* 2003 |
| **Sampling methods** | "Dynamic" methods from grain in movement |
| **Methods of analysis** | ELISA Test, fluorimetric method, validated with a HPLC ring test |
| **Scientific Reference** | Regione Lombardia - Direzione Generale Agricoltura; CRA - Ist. Sper. per la Cerealicoltura, Sezione di Bergamo; Assincer; AIRES; Pioneer Hi-Bred Italia |
| **Literature Reference** | Verderio A. *et al.*, (2005), *"La diffusione delle micotossine nelle produzioni italiane di mais",* L'Informatore Agrario 61 (10)**:** 47-51 |
| **Number of samples** | 1468 |
| **Number of years** | 4 (1999, 2000, 2003, 2004) |

# Survey N. 3

| | 2002 | 2003 |
|---|---|---|
| **Mean** | 4797 | 5186 |
| **<1000 ppb (%)** | 20,4 | 31,5 |
| **1000-5000 ppb (%)** | 31,0 | 33,3 |
| **>5000 ppb (%)** | 48,7 | 35,2 |
| ***N. of samples*** | *113* | *108* |

| | |
|---|---|
| **Area of sampling** | Po Plain, Toscana |
| **Source of samples** | Farm field immediately pre-harvest |
| **Sampling methods** | Sample of 20 ears |
| **Methods of analysis** | HPLC |
| **Scientific Reference** | Università di Piacenza, Milano, Udine e Pisa; CRA - Istituto Sperimentale per la Cerealicoltura |
| **Literature Reference** | Battilani P. *et al.* (2005), *"Monitoraggio della contaminazione da micotossine nel mais",* L'Informatore Agrario 61 (6)**:** 47-49. |
| **Number of samples** | 221 |
| **Number of years** | 2 (2002, 2003) |

# Survey N. 4

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|
| **<1500 ppb (%)** | | 60 | 27,4 | 9,5 | 11,0 | 24,4 |
| **1500-3000 ppb (%)** | | | 24,7 | 12,8 | 23,0 | 21,5 |
| **3000-6000 ppb (%)** | | | 17,9 | 21,8 | 30,0 | 26,1 |
| **>6000 ppb (%)** | | | 30,0 | 55,9 | 36,0 | 28,0 |
| ***N. of samples*** | *64* | *124* | *72* | *68* | *106* | *152* |

a= average of the period 1999-2004

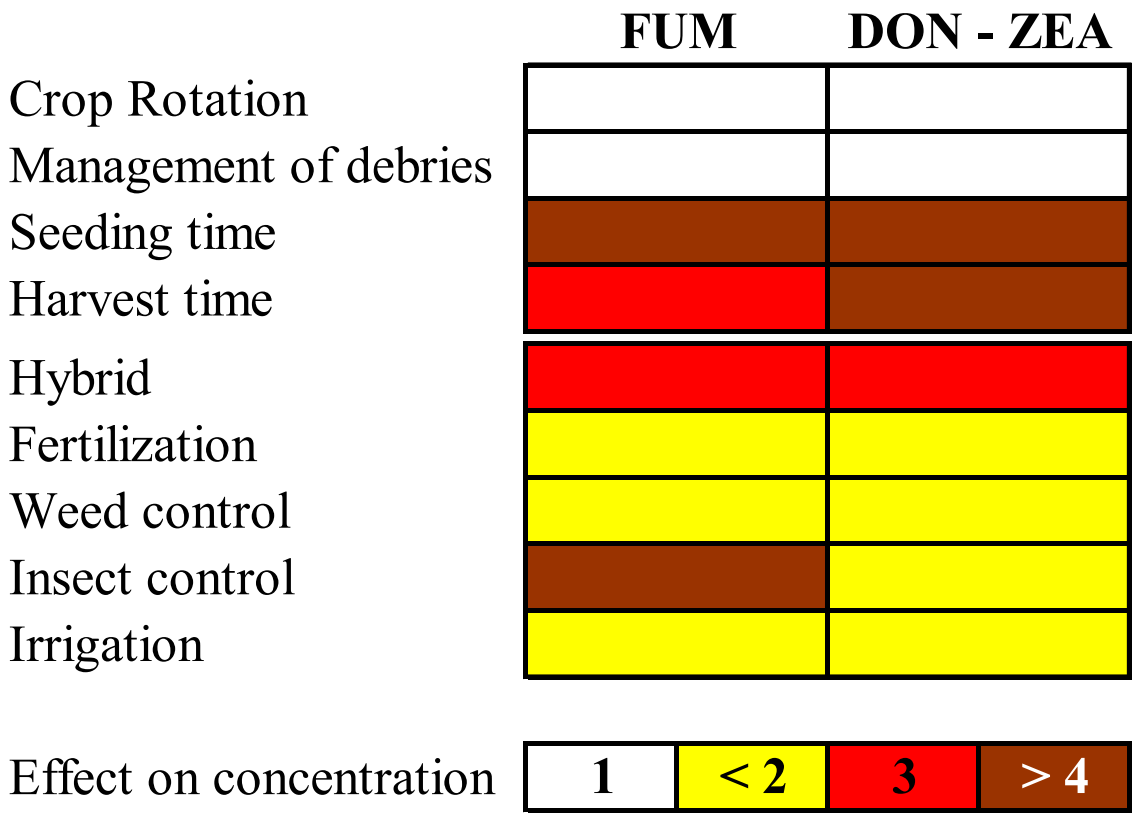
| | |
|---|---|
| **Area of sampling** | Po Plain |
| **Source of samples** | Field production from *Syngenta seeds* research network |
| **Sampling methods** | "Dynamic" sampling at harvesting |
| **Methods of analysis** | ELISA Test |
| **Scientific Reference** | *Syngenta seeds* Italia |
| **Literature Reference** | Tanzi F., (2005), "*Funghi e micotossine su mais - Indagine Europea di Syngenta Seeds*", Atti della "Giornata del mais 2005", Bergamo, Italia |
| **Number of samples** | 586 |
| **Number of years** | 6 (1999, 2000, 2001, 2002, 2003, 2004) |

# Survey N. 5

| | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|
| **<1500 ppb (%)** | 78,1 | 63,1 | 22,0 | 42,4 | 68.7 |
| **1500-2000 ppb (%)** | 6,9 | 5,6 | 11,3 | 11,9 | 21.9 |
| **2000-4000 ppb (%)** | 13,8 | 18,8 | 30,8 | 27,1 | 9.4 |
| **4000-6000 ppb (%)** | 1,3 | 10,0 | 32,7 | 18,6 | 0,0 |
| **>6000 ppb (%)** | 0 | 2,5 | 3,1 | 0,0 | 0,0 |
| ***N. of samples*** | *160* | *160* | *159* | *59* | *32* |

| | |
|---|---|
| **Area of sampling** | Piemonte |
| **Source of samples** | a. Commercial lots from 12 drying units<br>b. Production from 8 experimental fields<br>c. Production from 40 farm fields |
| **Sampling methods** | a. From drying units: "Dynamics" methods from grain in movement<br>b. From fields: sample of 200 ears from 5 subplots |
| **Methods of analysis** | HPLC |
| **Scientific Reference** | Università di Torino |
| **Literature Reference** | Reyneri A (2003). La presenza di micotossine nel mais coltivato in Piemonte. Regione Piemonte, pp. 32.<br>Reyneri A. et al. (2004). Impiego di tecniche agronomiche per contenere le micotossine nella granella di mais. L'Informatore Agrario, 6:45-50. |
| **Number of samples** | 538 |
| **Number of years** | 5 (2000, 2001, 2002, 2003, 2004) |

# Effects of cultural practices on mycotoxin contamination




*Source :researches conducted in Italy*

# Mais BT and Fumonisins

| Anno | non bt Maize | bt Maize |
|---|---|---|
| 1997 | 19.759 | 2.021 |
| 1998 | 31.632 | 5.448 |
| 1999 | 3.902 | 1.394 |
| average | 18.431 | 2.954 |

Source: A. Pietri et al. " Terra e Vita " n. 6-2005

# Pre-harvest control strategies in three milling industries (A:C)

| | A | B | C |
|---|---|---|---|
| Main maize products | flour, grits | homini grits | grits |
| GAP | | | |
| - hybrids | yes | yes | yes |
| - seeding time | no | yes | yes |
| - fertilization | no | yes | no |
| - insect control | yes | yes | yes |
| - irrigation | yes | yes | no |
| - moisture at harvest | no | yes | yes |
| GMP | yes | yes | yes |
| Rate of fumonisins reduction[(1)] | 1.5-2.5 | 2.0-3.0 | 2.0-2.5 |
| Premium price (€/t)[(2)] | 6 | 15 | 5 |

*Source : A. Reyneri*

# Researches conducted in Italy of the fate of fumonisins and other mycotoxins: milling industries (A:E)

| | A | B | C | D |
|---|---|---|---|---|
| Years | 2000-2005 | 2005 | 2002 | 2004-2005 |
| Lots (n,) | 19 | 11 | 2 | 46 |
| Sampling methods | Dynamics sampling during processing | Dynamics sampling during processing | Following Dir. 98/57 CE | Dynamics sampling during processing |
| Methods of analysis | HPLC - ELISA | ELISA | HPLC | HPLC - ELISA |
| Fraction analysed | | | | |
| - Unprocessed grain | √ | √ | √ | √ |
| - Germ | √ | | √ | √ |
| - Flour | √ | √ | √ | √ |
| - Grits | √ | √ | √ | √ |
| - Feed meal | √ | | √ | √ |
| Reference[1] | 48 | [2] | 12 | [2] |

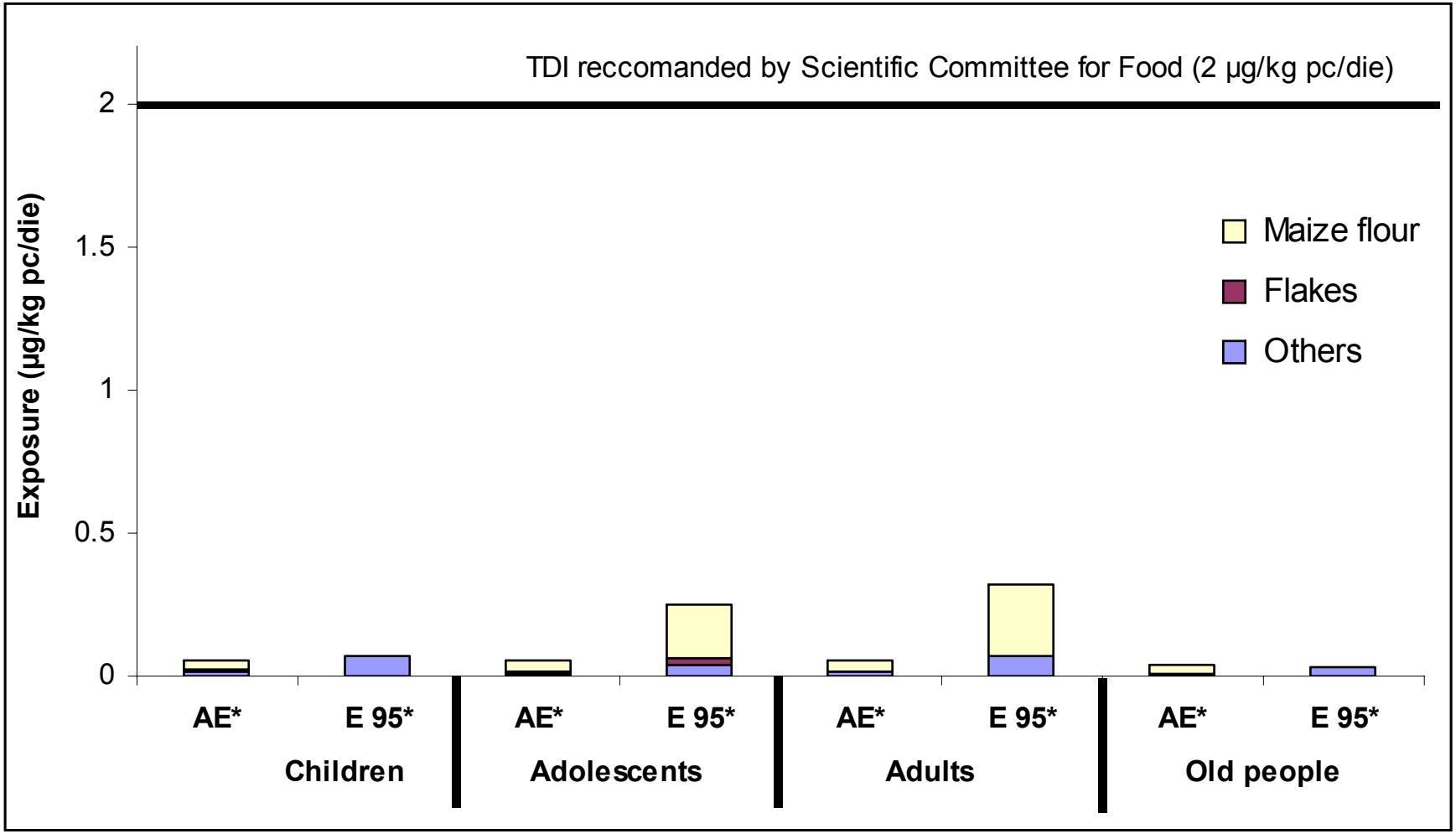
[1] cfr. Reference in Annex 1

[2] Unpublished

# Fumonisins distribution in maize milling products (± standard error)

| Fraction analysed | Fumonisins (index value:media unprocessed maize = 100) | | | |
|---|---|---|---|---|
| | A | B | C | D |
| Unprocessed maize | 100 | 100 | 100 | 100 |
| Germ | 90±20 | | 190±4 | 78±4 |
| Flour | 43±6 | 79±10 | | 76±14 |
| Grits | | 42±6 | 12±2 | 32±4 |
| Re-milled Grits | 13±2 | | 9±0 | |
| Feed meal | 338±104 | | 168±35 | 271±46 |

# Exposure to fumonisin B1 (µg/kg pc/die) for population groups of Italian population




** AE: Average exposure*
** E 95: Exposure 95 percentile*

# Comparison among the different TDI and thresholds for *Fusarium*-toxins

| | TDI µg/kg BW | TDI in µg for a person of 75 kg | Final Products limits currently proposed µg/kg | | Amount di F.P. to be eaten to reach the TDI |
|---|---|---|---|---|---|
| **DON** | 1.0 | 75 | bread | 500 | 150 g |
| | | | pasta | 750 | 100 g |
| **ZEA** | 0.2 | 15 | bread | 50 | 300 g |
| **FUMONISINS** | 2.0 | 150 | maize based foods for direct consumption | 400 | 375 g |

# Final Considerations

- Maize is the main Italian crop by volume and almost 10% of the harvest enter the food chain.
- Fumonisin are present at variable rate depending on the year and on the region considered, but on the average, most of the Italian maize is above 2000 ppb.
- Italian farmers don't have today, and it not expect they will have by 2007, the tools to keep their maize below 2000 ppb with a reasonable probability.
- The milling process does not reduce the unprocessed corn contamination consistently and equally for all the milling fractions and for all the milling diagrams. The milling industries are particularly concerned for the future of grits and flour production, which will hardly achieve the proposed maximum levels, and for the survival of typical artisanal products as polenta, with a greater involvement of the organic agiculture products;

# Final Considerations

- The DG-SANCO approach is correctly based on the precautionary principle. Nevertheless, both the European SCOOP task 3.2.10 “Collection of occurrence data on *Fusarium* toxins in food and assessment of dietary intake by the population of EU member States” presented on September 2003 and the Italian study reported in this document shows that the average intake of fumonisins is far below the TDI for most exposed consumers and even without a regolamentation.
- An Industry sector with more than 2000 employees and a turnover of 513 millions € could be unable to face the current proposed fumonisin limits.
- If the Italian food maize will enter the feed market the Italian maize producers (over 200.000 producers) could face a decrease on corn price close to 20% meaning a total loss of over 200 million €.
- We agree that very high contaminated maize lots should be kept out of the food chain but a limit of 2000 ppb will keep out of business many Italian farmers and industries without improving consumers health

# Hence

We ask for a better tuning of fumonisins limits and implementations time to guarantee both consumers and producers health.

Italian Mycotoxin Work Group