1 **About Gene Flow, Weediness and Non-Target Insects of GM crops. A workshop given in Tehran along the lines of a United Nations Workshop in Gent, Belgium**

2 **Myth 1: Genetic Engineering is absolutely new, it has no parallel in nature, it is absolutely new to evolution**

3 **The seemingly big difference between hybrid breeding and gene technology, numerous backcrosses needed in conventional breeding to eliminate unwelcome genes obtained through hybridization, this is not necessary with Gene Technology**

4 **The example of breeding modern rice traits: each blue square marks Unpredictable genome alterations and how their accumulation at every single step in conventional breeding, from presentation of Ingo Potrykus, the creator of the Golden Rice**

5 **On the molecular level, according to Arber there is no basic difference between natural mutation and genetic engineering, two original publications of Werner Arber give the details**

6 **Whereas natural mutation works at random, GE works in a targeted way, and results will be distributed much faster to the fields**

7 **Baudo: Detailed studies in gene expression profiles from both transgenic and non-transgenic wheat suggests: The presence of transgenes did not significantly alter gene expression and therefore transgenic plants can be considered substantially equivalent to untransformed parental lines.**

8 **Baudo: The graphs show comparison in genomic disturbance: GM crops are less disturbed (black dots) than classic breeds**

9 **Explanation of the graphs in Baudo**

10 **Shewry: Field trials with wheat demonstrate that transgenic wheat is NOT intrinsically more or less table than those wheat traits produced with conventional breeding**

11 **The relative stability of subunit expression in the lines can also be represented visually using LDA. [.....] However, the clusters formed by the points pertaining to lines are of similar area in all four lines and hence, most importantly, the points within the clusters (site by year combinations) remain in fairly close proximity given that the LDA aims to separate the line by site by year data as much as possible. This finding is therefore consistent with the component HMW subunits of the lines showing similar levels of stability of expression across sites and years. More text p. 133**

12 **Unintended changes in breeding methods, From the National Research Council NAP 2004: It demonstrates the gradual increase of unintended genetic changes in various breeding methods, mutation breeding having the highest degree of unintended changes**

13 **An early example of marker free construction of transgenic plants: Construction of selectable hybrid gene without marker**

14 **Natural transgenic plant: Festuca, a widespread grass received a functional nuclear gene from Poa (not hybridizing with Festuca).**

15 **‚Products developed through biotechnology processes do not PER SE pose risks to human health and the environment. Anonymous Nature text 1992: Editor in chief John Maddox,**

16 **Cartoon S. Harris, The New Yorker: We are dealing with life, and organisms do reproduce, thats the difference to many other newly introduced technologies**

17 **A fair comparison to traditional breeding reveals several grave incidences in food safety – due to rigorous testing of GM plants. Nothing similarly risky ever happened with genetically engineered crops**

18 **Myth 2: Conventional crops are close to nature**

19 **Our annual corn: artificial origin, Mangelsdorf 1986 demonstrates breeding experiments leading to annual corn.**

20 **Our conventional wheat: artificially tripled genome with alien chromosome fragments yellow: from Barley.**

21 **Rapid spread of wheat in Europe, replacing the traditional oat meals**

22 **Protoplast manipulation allows for jumping over the natural species barriers**

23 **Gamma radiation of durum wheat: untargeted bombardment of the genome to crank out new mutations: much less targeted and fine tuned than genetic engineering. Cobalt source on 8m high post, done in field experiments...See also the FAO databases on Radiation Mutation: http://www-naweb.iaea.org/nafa/pbg/index.html AND http://www-mvd.iaea.org/MVD/default.htm**

24 **Dogs, Humans, most domesticated animals are already now heavily genetically manipulated, we have changed**

the course of evolution dramatically with modern medicine

25 **Myth 3: GM crops cause more environmental problems**

26 **Potential massive pesticide reduction in EU, if Bt crops would be introduced**

27 **Brookes suggests that over the period 1996-2006, there has been a significant net environmental gain directly associated with the application of the GM HT technology. This level of net nvironmental benefit has been increasing as the area planted to GM HT soybeans has expanded.**
Brookes et al. 2008 p. 65

28 **Brookes et al. 2008:**
d) Summary of impact
In the countries where GM HT maize has been most widely adopted, there has been a net decrease in both the volume of herbicides applied to maize and a net reduction in the environmental impact applied to the crop (Figure 16). More specifically:
• In 2006, total herbicide ai use was 8.3% lower (10.9 million kg) than the level of use if the total crop had been planted to conventional non GM (HT) varieties. The EIQ load was also lower by 10.8%;
• Cumulatively since 1997, the volume of herbicide ai applied is 3.9% lower than its conventional equivalent (a saving of 46.7 million kg). The EIQ load has been reduced by 4.6%.

29 **Brookes et al. 2008:**
f) Summary of impact
The overall effect of using GM HT cotton technology (Figure 17) in the adopting countries in 2006, has been a reduction in herbicide ai use70 of 20% and a decrease in the total environmental impact of 21%. Cumulatively since 1997, both herbicide ai use and the associated environmental impact has fallen by 14% respectively.

30 **Brookes et al. 2008:**
c) Summary of overall impact
In the two North American countries where GM HT canola has been adopted, there has been a net decrease in both the volume of herbicides applied to canola and the environmental impact applied to the crop (Figure 18). More specifically:
• In 2006, total herbicide ai use was 21.3% lower (1.43 million kg) than the level of use if the total crop had been planted to conventional non GM varieties. The EIQ load was also significantly lower by 39%;
• Cumulatively since 1996, the volume of herbicide ai applied was 12.6% lower than its conventional equivalent (a saving of 7.89 million kg). The EIQ load had been reduced by 24%.

31 **Brookes et al. 2008:**
g) Summary of impact
Across all of the countries that have adopted GM IR maize since 1996, the net impact on insecticide use and the associated environmental load (relative to what could have been expected if all maize plantings had been to conventional varieties) have been (Figure 19):
• In 2006, a 22.5% decrease in the total volume of insecticide ai applied (1.1 million kg) and a 22.6% reduction in the environmental impact (measured in terms of the field EIQ/ha load);
• Since 1996, 5% less insecticide ai has been used (8.3 million kg) and the environmental impact from insecticides applied to the maize crop has fallen by 5.3%.

32 **Brookes et al. 2008**
h) Summary of impact
Since 1996, the net impact on insecticide use and the associated environmental 'foot print' (relative to what could have been expected if all cotton plantings had been to conventional varieties) in the main GM IR adopting countries has been (Figure 20):
• In 2006, a 37% decrease in the total volume of insecticide ai applied (28.7 million kg) and a 38.8% reduction in the environmental impact (measured in terms of the field EIQ/ha load);
• Since 1996, 22.9% less insecticide ai has been used (128 million kg) and the environmental impact from insecticides applied to the cotton crop has fallen by 24.6%.

33 **Real Health Problems. But not discussed,**
Since it does not concern transgenic crops

34 **Real health problem, But not discussed,**
Since it does not concern transgenic crops

35 **Real health problem, But not discussed,**
Since it does not concern transgenic crops

36 **The myth about the killing of monarch butterfly larvae**

37 **Monarch butterfly, a popular beauty in the US**

38 **Larvae of monarch butterflies: forced feeding of Bt pollen smeared artificially to the milkweed leaves, image from an alarmist article from the Scientific American 1999**

39 **The result of the Nature article:**
uncritical slogans in all newspapers
Losey in Nature 1999

Bt pollen can kill 40% of monarch larvae
within 4 days

40 **The original text intro of Losey et al. from Nature which called for more research**

41 **Subsequent field research revealed, that the situation is not dramatic:**
Survival rates: no difference between Bt and non-Bt maize, results of extensive field research by science consortium

42 **Early, but largely ignored research: Averages of two years (1997-1998) of development times (days) of a specific stage for Rhopalosiphum padi feeding on transgenic and isogenic corn leaves**

43 **Transmission electron micrograph of a sporulating Bacilluns thuringiensis**

44 **Primary and terciary structure of Cry-Toxins**

45 **Mode of action of Cry-Toxins**

46 **Phylogenetic relationships: Unrooted phylogenetic trees of domains I, II, and III of 79 known subgroups of Cry proteins obtained by parsimony method.**

47 **Candolfi et al. 2004: Non-targed insects overall in comparison, best performance Bt maize, worst pesticide sprayed maize, but statistically not significant**

48 **Candolfi et al. 2004: Beneficial impact of Bt maize on soil dwelling insects. Pesticide impact on days 12, 28, 48 significanly negative, but not permanent over season**

49 **Candolfi et al. 2004: Heliotis (Lepidoptera) etc.: impact on target pests significanly negative.**

50 **Hansen et al. 2000: With Bt maize event 176 from Novartis more impact on Monarch larvae, since Bt protein more toxic, event 176 today ruled out**

51 **Hansen et al. 2000: With Bt maize event 176 from Novartis more impact on Monarch larvae, since Bt protein more toxic, event 176 today ruled out**

52 **Romeis et al.2004: New study: no Bt toxicity with lacewings fed in laboratory**

53 **Laboratory experiments demonstrate no significant impact on larvae of green lacewing when using realistic toxicity levels of Bt proteins**

54 **Mean longevity of first instar green lacewing fed with different concentrations of Cry1Ab toxin dissolved in a 2M sucrose solution**

55 **Wolfenbarger et al. 2008: New Meta Study, no detrimental effects of Bt proteins on Non-target Insects**

56 **Wolfenbarger et al. 2008: New Meta Study, no detrimental effects of Bt proteins on Non-target Insects, Table 1: Summary of meta database used in analysis**

57 **Wolfenbarger et al. 2008: Conclusions/Significance: Overall, we find no uniform effects of Bt cotton, maize and potato on the functional guilds of non-target arthropods. Use of and type of insecticides influenced the magnitude and direction of effects; insecticde effects were much larger than those of Bt crops. These meta-analyses underscore the importance of using controls not only to**
isolate the effects of a Bt crop per se but also to reflect the replacement of existing agricultural practices. Results will provide researchers with information to design more robust experiments and will inform the decisions of diverse stakeholders regarding the safety of transgenic insecticidal crops.

58 **Figure 2. The effect of Bt crops on non-target functional guilds compared to insecticide-treated, non-Bt control fields. Bars denote the 95% confidence intervals, asterisks denote significant heterogeneity in the observed effect sizes among the studies (*,0.05, ** ,0.01, *** ,0.001), and Arabic numbers indicate the number of observations included for each functional group.**

Figure 3. Effects of Bt maize vs. control fields treated with a pyrethroid insecticide on predatory arthropods. Bars denote the 95% confidence intervals, asterisks denote significant heterogeneity in the observed effect sizes among the studies (* ,0.05, ** ,0.01, *,0.001), and Arabic numbers indicate the number of observations included for each functional group.**

59 **Conclusions/Significance: Overall, we find no uniform effects of Bt cotton, maize and potato on the functional guilds of non-target arthropods. Use of and type of insecticides influenced the magnitude and direction of effects; insecticde effects were much larger than those of Bt crops.**
These meta-analyses underscore the importance of using controls not only to isolate the effects of a Bt crop per se but also to reflect the replacement of existing agricultural practices. Results will provide researchers with information to design more robust experiments and will inform the decisions of diverse stakeholders regarding the safety of transgenic insecticidal crops

60 **Fraudulent slide of GENOK at Lima Peru biosafety class, the real caption covered by oral false interpretation.**

61 **The real table 2 with the caption showing that these numbers are reference numbers, NOT the number of negative incidences of Bt crops reported. A clear case of fraudulent scare mongering of the Norwegian Organization GENOK, who claims to be the only independent scientific agency reporting truthfully about the REAL risks of GM crops, see http://english.genok.org/news_cms**

62 **No tillage agriculture enhances soil fertility**

63 **Conservation tillage adoption in the US 1990-2002**

64 **Time neede for Bobwhite Quali Chicks to satisfy daily insect requirements**

65 **Tillage System versuls fuel consumption per acre**

66 **Locke et al. 2008: Summary: Conservation tillage mitigates soil loss in cropland because plant residues help protect the soil, but effects on pesticide movement in**
surface runoff are not as straightforward. Effects of soil disturbance on surface runoff loss of chlorimuron and alachlor were evaluated tilizing runoff trays. Soil in the trays was either disturbed (tilled) and kept bare or was not tilled, and existing decomposed plant residue
was left on the surface. Rainfall (25 mm, 20 min) was simulated 1 d after alachlor (2.8 kg ha1) or chlorimuron (54 g ha1) application, and runoff was collected. Runoff fractions were analyzed for herbicide and sediment. Total alachlor loss from bare plots was greater than that in no-tillage plots (4.5% vs. 2.3%, respectively). More than one-third of total alachlor lost from bare plots occurred in the first l of runoff, while no-tillage plots had less runoff volume with a more even distribution of alachlor concentration in the runoff during the rainfall simulation and subsequent runoff period. In contrast, more chlorimuron was lost from no-tillage plots than bare plots (12% vs. 1.5%) even though total runoff volume was lower in the no-tillage plots (10.6 mm vs. 13.6 mm). This was attributed to dense coverage with partially decomposed plant residue in no-tillage plots (1652 kg ha1) that intercepted chlorimuron. It was likely that chlorimuron, a polar compound, was more easily washed off surface plant residues and transported in runoff.

67 **The no-tillage area was separated in different plots according to the degree of erosionwith different depths of the A horizon. Clay content andbulk density were the main variables in the less degraded notillage plots. Cluster analysis was applied to construct anaverage linkage distance dendrogram. Overall, the positive influence of no-tillage is clearly visible.**

68 **10-years monitoring in England, comparison of conventional (blue) versus transgenic (red) crops that produce mature plants at the end of the first growing season.**

69 **British Farm Scale Experiments**

70 **Significant differences of flowering oilseed rape (solid and dashed lines) and number of pollinators (open and grey bars) in favour of non-transgenic plants**

71 **Mean abundance of total pre-harvest weeds higher in transgenic maize than all other non-transgenic maize fields, despite of different other herbicides, results in favour of transgenic maize**

72 **Sugar yield in favour of transgenic beet, compared with non-transgenic traits. The results show that altered management of GMHT sugar beet can provide alternative scenarios of those of the recent Farm Scale Evaluation trials. Without yield loss they can enhance weed seed**
banks and autumn bird food availability compared with conventional management, or provide early season benefits to invertebrates and nesting birds, depending on the system chosen. Conventional weed control does not have the flexibility to enable these scenarios that benefit both agriculture and environment, although there may be some options for increasing weed seed return in autumn.

73 **Bt exudates from maize roots**

74 **First Nature note of Stotzky related to the fact of Bt exudating from maize roots, unnecessarily alarming**

75 **Subsequent field experiments by the same authors show no significant effect. Bt-Exudates from maize roots: no long time problem, despite of initial concerns**

76 **Another extensive field study: Bt-Exudates: no detection in soil after multiple years of transgenic Bt cotton use**

77 **Questions of co-existence**

78 **Percentage of double resistant oildeed rape volunteers detected after cropping three herbiscide resistand varieties in adjacent fields**

79 **Brassica species crossing**

80 **Ammann et al. 2000: Dutch-Swiss-Irish coding system: mainly based on morphometric herbarium data**

81 **Flannery 2005: new, more complex coding system for gene flow present a gene flow index model implemented using the principal arable crops in Ireland as**
a model dataset. The objective of this research was to establish a baseline gene flow data set for Ireland's primary conventional crops through the provision of a simple numerical index. This Gene Flow Index (GFI) incorporates four strands of crop-mediated gene flow (crop pollen-to-crop, crop pollen-to-wild, crop seed-tovolunteer and crop seed-to-feral) into a format that permits the calculation of a crop's gene flow potential. Responsive to regional parameters, we have applied the model to sugar beet, oilseed rape, potato, ryegrass, maize, wheat and barley. We propose that the attained indices will highlight those crops that require additional measures in order to minimize gene flow in accordance with anticipated coexistence guidelines.

82 **Flannery 2005Abbreviations, terms and definitions imployed during GFI analyis**

83 **Flannery 2005: Components of proposed Gene Flow Index upper half of the table 3**

84 **Flannery 2005: Components of proposed Gene Flow Index lower half of the table 3**

85 **Evidence of landscape level gene flow in transgenic bent-grass**

86 **Scotts pays penalty of 500'000$**

87 **Mais-Koexistenz Spanien (2003)**

88 **GM percentage intermixed:**

89 **FAL-Studie: Koexistenz bei Mais**

90 **Maize Field I study SIGMEA wider fields, individual sampling plants**

91 **Maize Field I and II from gene flow experiment SIGMEA Wider Fields in Switzerland: spots caused through sowing machine turned around, caused change in flowering synchroni-zation: higher outcrossing, but all results well within the legal threshold of the EU**

92 **Gladis and Hammer: Multiple Origin of Feral Crops**

93 **Gene Pool Concept of Harlan and de Wet 1971**

94 **Another alarmist paper from Nature: Quist-Chapela Nature**

95 **Withdrawal of Philipp Campbell of paper Quist-Chapela**

96 **Miller et al. 2008 Is biotechnology a victim of anti-science bias ?**

97 **Section on Quist-Chapela from Miller et al. 2008**

98 **Teosinte, left: the wild maize of Mexico, Kernels in one row, right: hybrids with cultivated maize**

99 **Greenpeace campaign in Mexico, protest without proof of Bt maize gene flow**

100 **Help fundamentalists, donate brain, cartoon Klaus Ammann**

101 **Greenpeace Statement Oaxaca**

102 **Hard life of Mexican farmers is not so romantic**

103 **Respect for Cosmogony of Mexican Maize farmers is important: Maize godess, Archaeological Museum in Mexico City**

104 **Cosmogony of Mayas, Archaeological Museum in Mexico City: Mexican farmers believe that humanity has grown out of holy Maize plants.**

105 **Landrace from Switzerland: Jumping Genes cause the red stripes in kernels. DNA a dynamic system, already discovered by Barbara McClintock, Nobel Price laureate**

106 **Barbara McClintocks Classic: Instability at selected genomic loci in maize**

107 **Zero result of Mexican gene flow in Oaxaca, based on 150000 samples analyzed**

108 **The paper published in 2005 and its major conclusions**

109 **It is fact, that maize and teosinte hybridize since centuries, and this has not changed the stability of the landraces, demonstrated by the local differences in genomics of maize and teosinte in Mexico**

110 **Maize and teosinte distribution in Mexico, well known and interactions frequent, but not affecting stability of the landraces of maize**

111 **Centers and non-Centers of agricultural origins after Harlan, the definition takes into account more elements than Vavilov used for his center definitions: I Plants (living) : biosystematic analysis, including genetics, cytogenetics, chemotaxonomy, numerical taxonomy, morphology, ecology, geography, and so on, of the crops and their near relatives (essentially the Vavilovian approach).**
2) Plants (past): archeobotany, palynology
paleobotany, carbon-14 dating.
3) Men (living) : linguistics, oral tradition, techniques of use and cultivation, attitudes toward the crop in culture, religion, magic, witchcraft, and so on.
4) Men (past): history, art, archeology (artifact and refuse left by man).
5) Other sources: geology, hydrology, erosion and siltation patterns, soil analyses, limnology, animal remains, and so on, for supporting evidence of changes in climate, vegetation, and fauna, as well as for circumstantial evidence of agriculture

112 **Biodiversity centers are more stable against disturbance due to higher species numbers**

113 **Against onesided views, Bulgarian cartoon**

114 **Regulation of GM crops and the developing world**

115 **European safety attitude: a problem for many countries in the developing world**

116 **For a full information packet of the PUBLIC RESEARCH AND REGULATION INITIATIVE go to www.pubresreg.org and see also the page on the ASK-FORCE**

117 **ASK-FORCE Caddys-Fly paper Rosi-Marshall: An alarmist paper claiming that Bt proteins could be harmful to aquatic organisms, but the paper is deeply flawed and critizised in the ASK FORCE, PNAS and also in Ttrends in Biotechnology. Go to http://pubresreg.org/index.php?option=com_smf&Itemid=27&topic=9.0**

118 **Status of research and application of crop biotechnologies in developing countries, FAO-report. It demonstrates that the dominance of multinational companies in the seed market of developing countries is a myth**

119 **Europe trailing behind other continents in GM crop research activities, because GM research is strongly discouraged in many European countries, there is a clear brain drain happening in the last years**

120 **Research activity developing countries example biofortification**

121 **Cohen Developing world: Source of Genetic resources: 85% local public**

122 **Harvest Plus Biofortification Project Coverage, An international Research Initiative for creating biofortified crops in the developing world**

123 **Biofortified Sorghum: SuperSorghum project homepage**

124 **SuperSorghum project Consortium Members**

125 **Sorghum bicolor distribution main growers**

126 **Low in protein quality must be enhanced**

127 **High diversity of landraces of Sorghum bicolor**

128 **Global map of annual Sorghum cultivated around the world**

129 **Deu et al. 2003: Distribution of cultivated Sorghum races**

130 **De Wet 1971: Distribution of wild varieties of Sorghum bicolor**

131 **Distribution of cultivated Sorghums in Africa**

132 **Sorghum bicolor secondary origin as of today**

133 **Pattern of domestication Sorghum, not to be mixed up with the real center of origin of Sorghum, which stems**

most probably from the green Sahara thousands of years ago

134 Harlan 1971: Centers and non-centers, details see No. 111

135 Zhukovsky‘s alterations of Harlan‘s Centers and non-centers, cit in Harlan 1971, see slide 111

136 Hammer et al. 2003: Plants under human influence, complex situation, the weeds and their feral population in the middle

137 Hammer et al. 2003: Original gene pool concept

138 Ejeta et al. 2005: Adaptation of gene pool concept to Sorghum

139 Hammer et al. 2003: Complex reality, applies to Sorghum also

140 Moore et al. 1995: Major grass crops. Lined up in circles to demonstrate close genomic relationship, a chance for modern breeding

141 Ilic 2003: Schematic diagram of simplest evolutionary model for events that took place in an orthologous region of rice, sorghum and maize genomes after their divergence from a common ancestor

142 Sorghum bicolor flowering, typical wind pollination syndrome, but most cultivated Sorghums with selfing, strong inbreeders, fertilization done before anthers shed.

143 Distant depending hybridization rate, results with high percentage because receiving fields are pollen sterile – not reflecting agricultural reality

144 Ammann, Sorghum Biology 2008, Some important factors influencing vertical gene flow in Sorghum

145 Ammann, Sorghum Biology 2008, More important factors influencing vertical gene flow in Sorghum

146 Sorghum field from Oklahoma, internet

147 The flawed rat experiments of Irina Ermakova, comments see ASK-FORCE www.pubresreg.org

148 Irina Ermakova, example from ASK-FORCE http://pubresreg.org/index.php?option=com_smf&Itemid=27&topic=13.0

149 Irina Ermakova, uncritical approval from the GM opponents

150 Jeffrey Smith and his extremist interpretations

151 Jeffrey Smith and his extremist interpretations

152 Nature Biotechnology

153 Armed with peer reviewed literature