AGRICULTURAL BIOTECHNOLOGY INTERNATIONAL CONFERENCE

ABIC 2004

12-15 September, Cologne, Germany

ECOLOGICAL IMPACT OF GMOS

Klaus Ammann

University of Bern, Switzerland

the impact of agricultural biotechnology on biodiversity

a review

Full version 23. August 2004

Klaus Ammann, Botanic Garden, University of Bern

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with active Contents, Table of Figures, references with links, and an index of keywords

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http://www.botanischergarten.ch/Biotech-Biodiv/Report-Biodiv-BiotechShort-4.pdf

ECOLOGICAL IMPACT OF TRADITIONAL AGRICULTURE

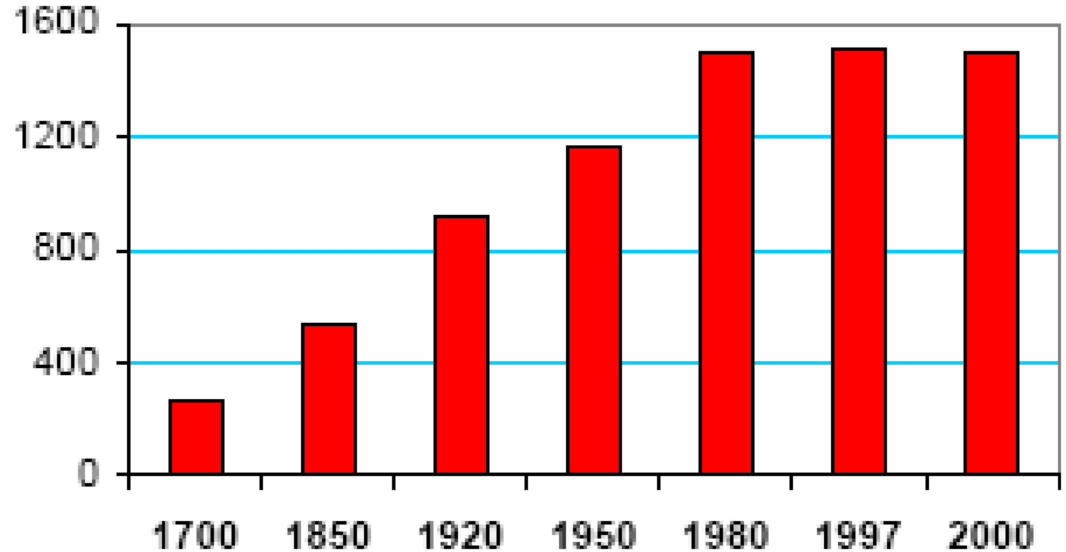

Figure 4: Land converted to arable and permanent cropland, in a time axis from 1700 to now, in million hectares (FAOSTAT, 2003)

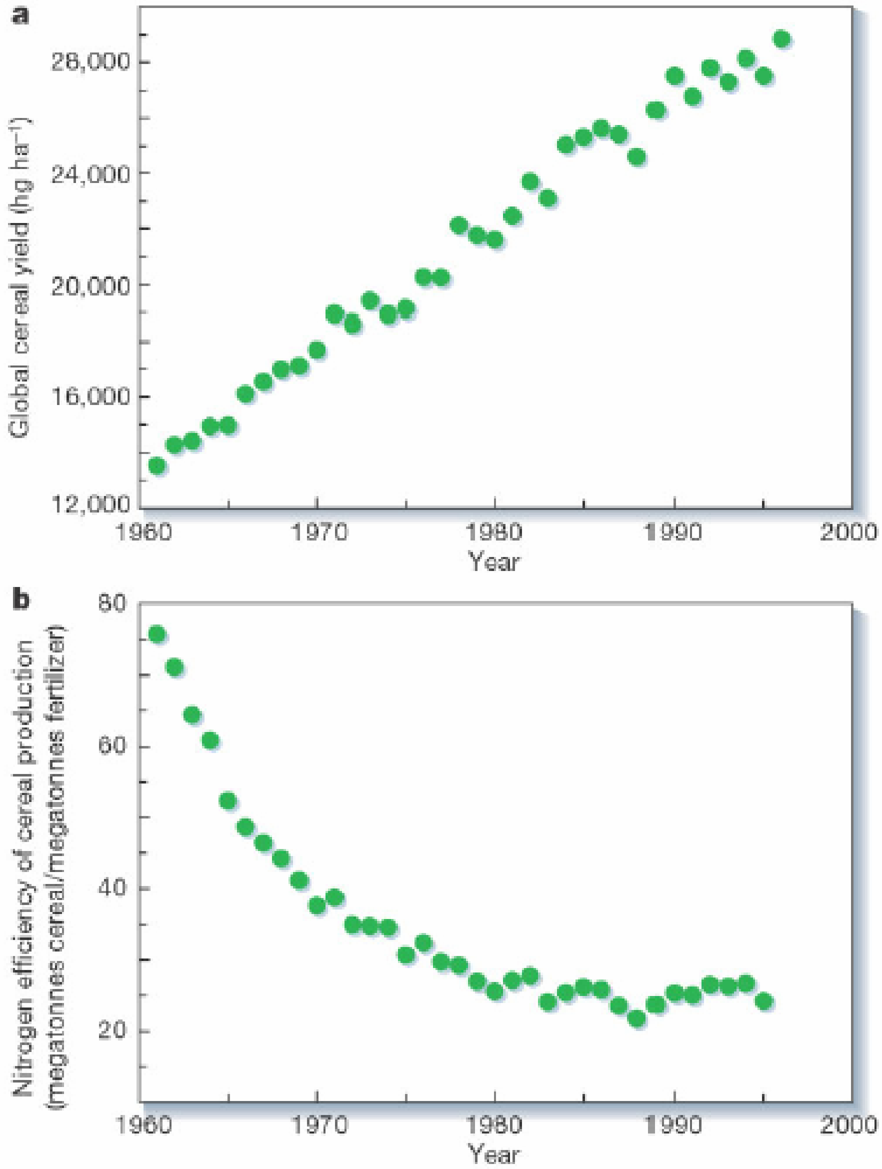

Figure 7: Diminishing returns of fertilizer application imply that further applications may not be as effective at increasing yields. a, Trends in average global cereal yields; b, trends in the nitrogen-fertilization efficiency of crop production (annual global cereal production divided by annual global application of nitrogen fertilizer) (FAOSTAT, 2003)

IMPACT ON NON-TARGET INSECTS

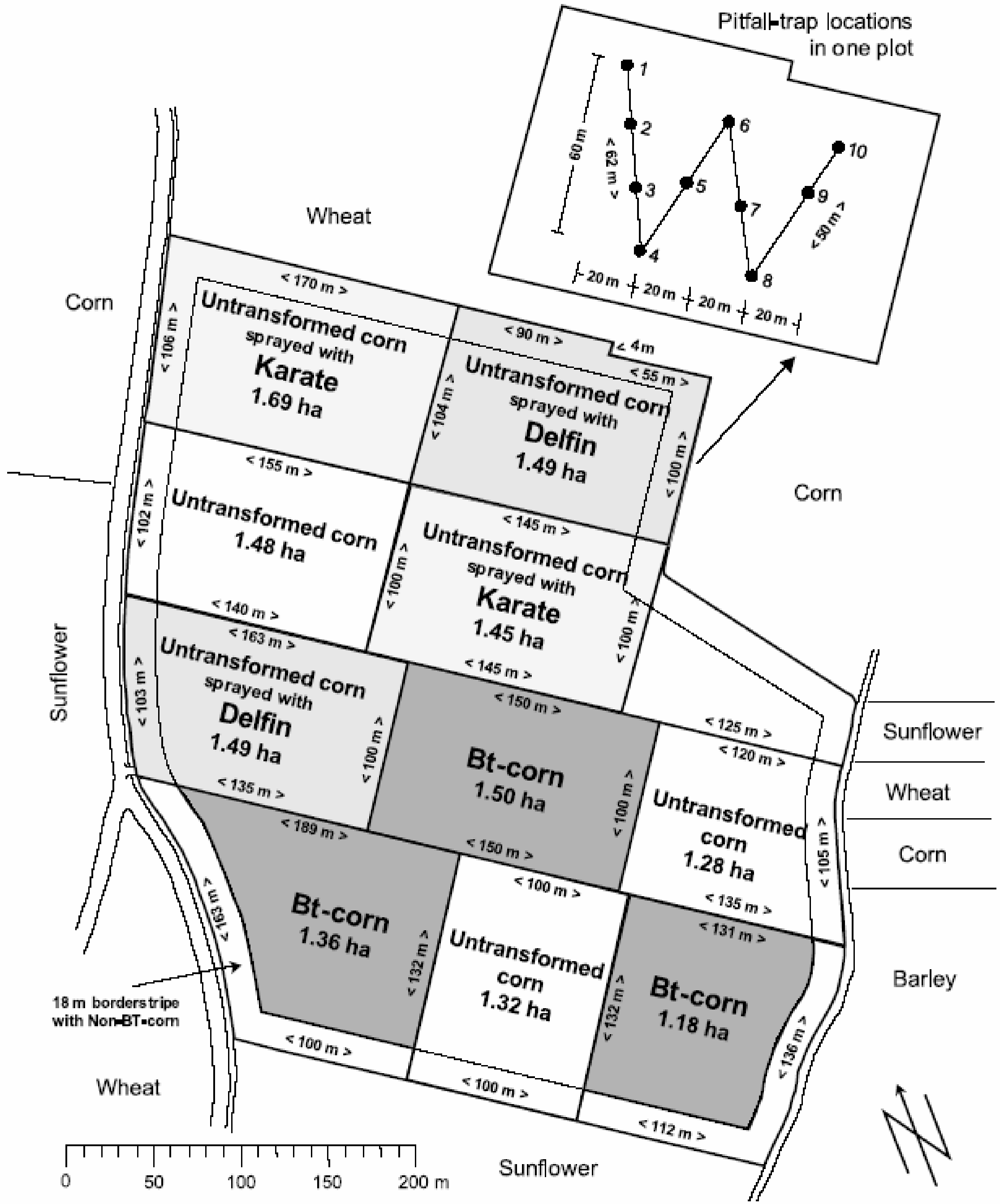

FIGURE 1. Plot layout and treatment allocation.

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)

A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170

http://www.botanischergarten.ch/Bt/Candolfi-Biocontrol-2004.pdf

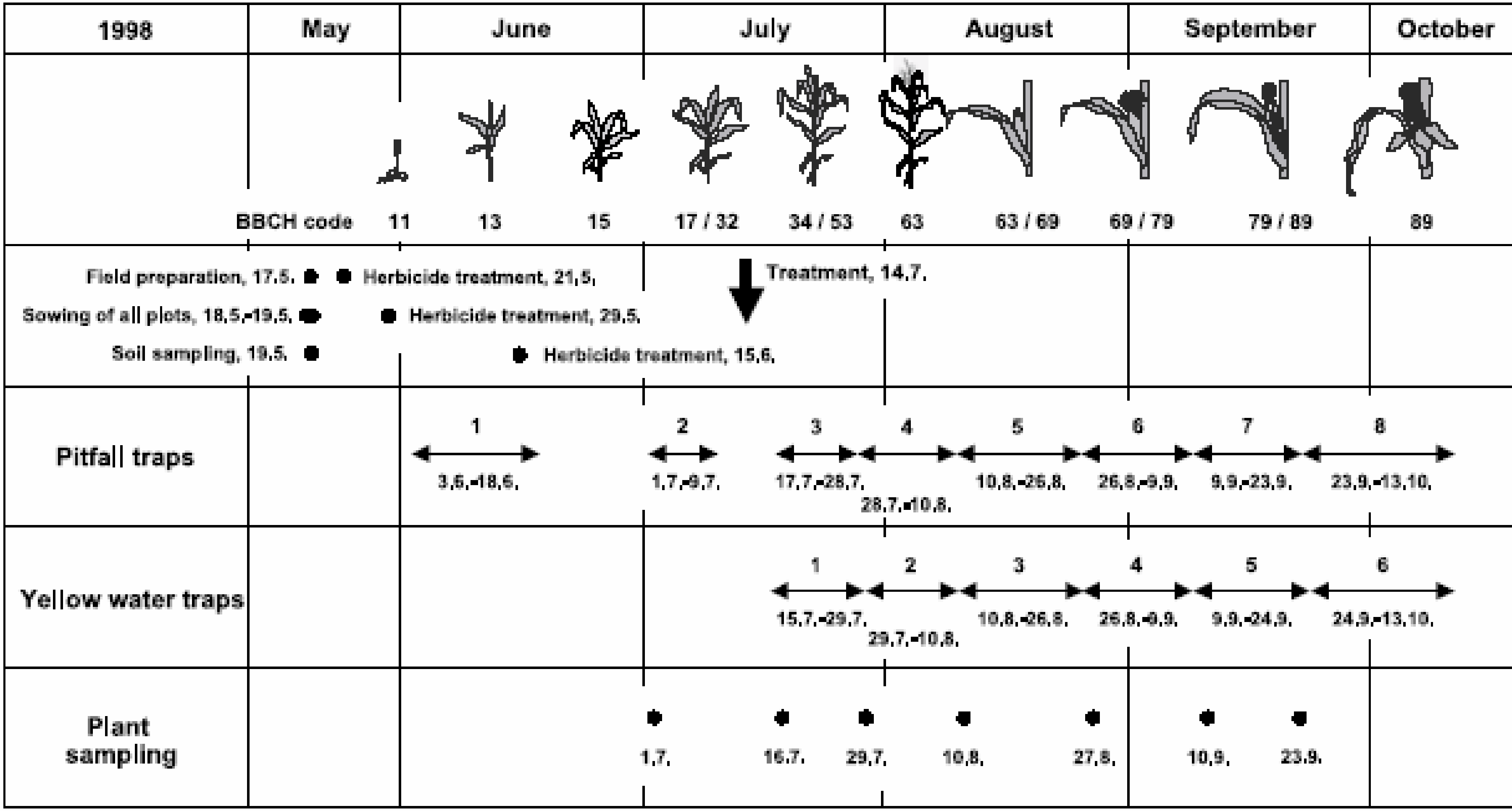

FIGURE 2. Trial schedule.

Candolfi, M.P., Brown, K., Grimm, C., Reber, B., & Schmidli, H. (2004)
A faunistic approach to assess potential side-effects of genetically modified Bt-corn on non-target arthropods under field conditions. Biocontrol Science and Technology, 14, 2, pp 129-170
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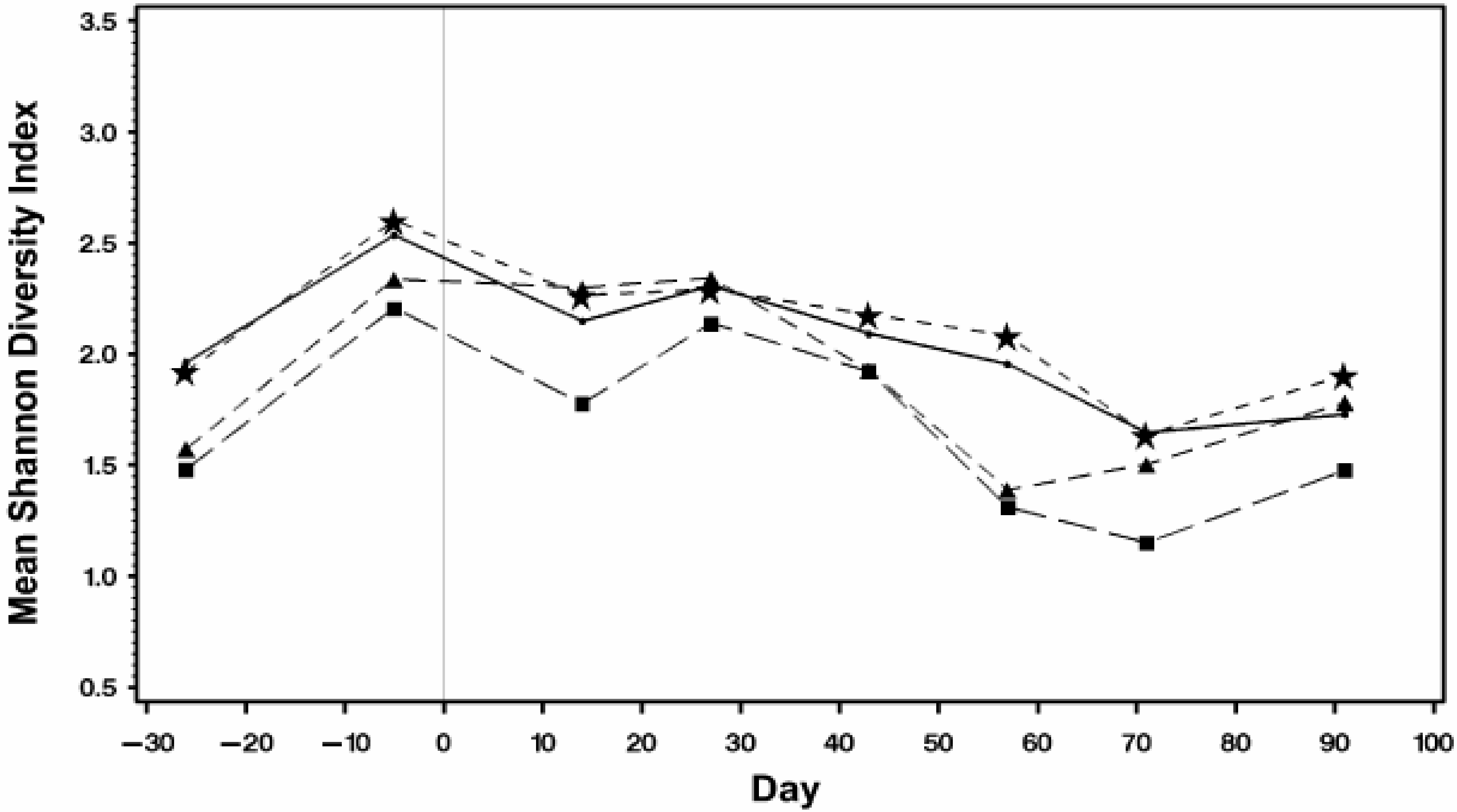
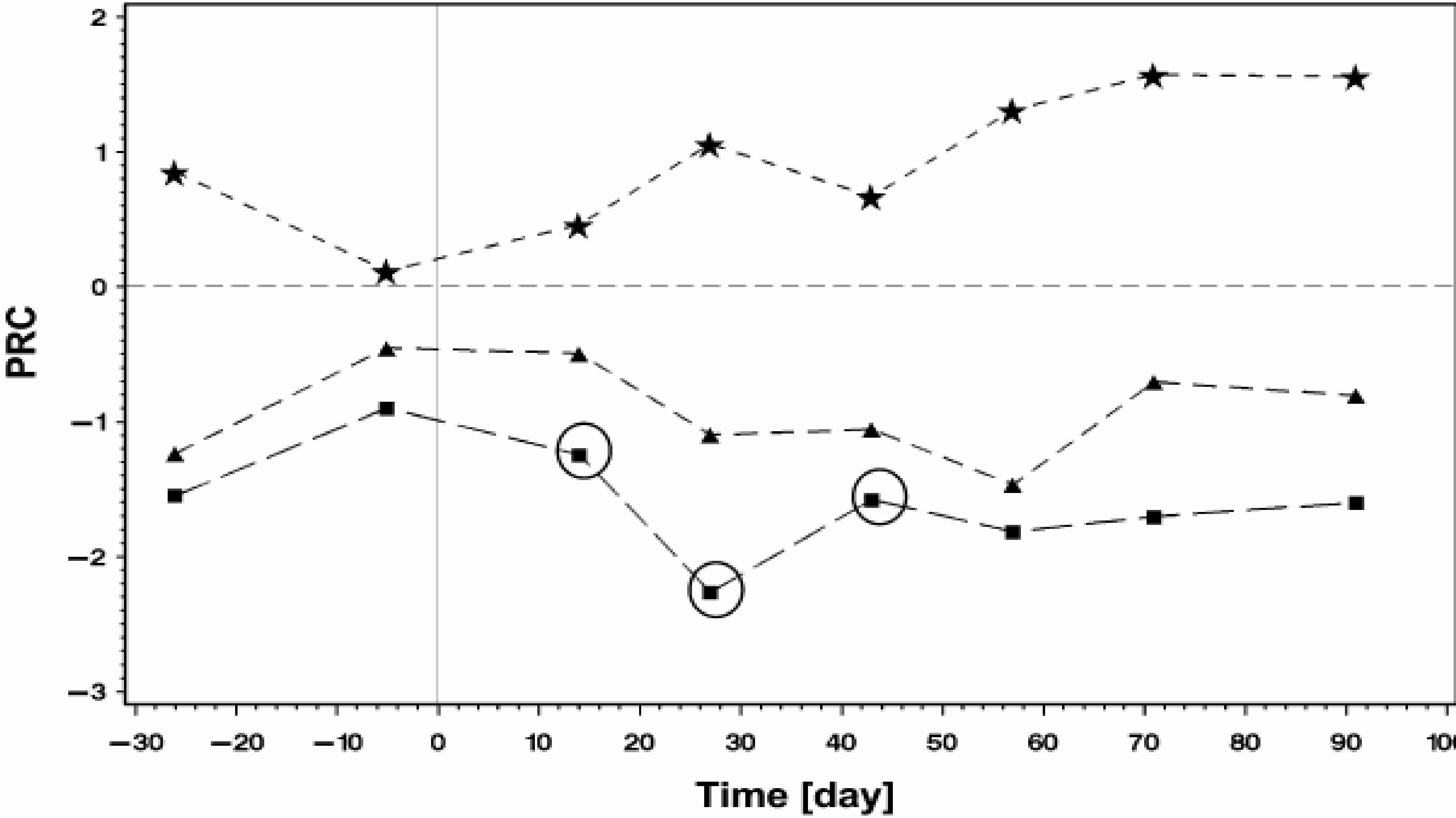


FIGURE 3. Shannon diversity indices of soil dwelling taxa per trap collected with the pitfall traps throughout the sampling season: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments were observed (Tukey test, $P = 0.05$).



Contributions to Principal Response Curves for the 14 taxa contributing strongest to the PRC:

FIGURE 4. Principal response curve analysis for soil dwelling organinsms: zero line of the *y*-axis = untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. Statistically significant treatment effects when compared to control are circled (goodness of fit $R^2 = 0.74$, goodness of prediction Crossvalidation/Jacknife $R^2 = 0.62$).

Contributions to Principal Response Curves for the 14 taxa contributing strongest to the PRC:

Taxa	**Contribution to PRC**
Diplopoda	+ 0.2163
Sminthuridae (Collembola)	– 0.2121
Entomobryoidea (Collembola)	– 0.1864
Phalangium opilio (Opiliones: Phalangiinae)	+ 0.1450
Harpalus rufipes (Coleoptera: Carabidae)	– 0.0910
Acari	– 0.0881
Pterostichus melanarius (Coleoptera: Carabidae)	+ 0.0689
Harpalus aeneus (Coleoptera: Carabidae)	– 0.0679
Oedothorax apicatus (Araneae: Linyphiidae)	+ 0.0642
Elateridae (Coleoptera)	– 0.0548
Chilopoda	+ 0.0510
Poecilus cupreus (Coleoptera: Carabidae)	– 0.0427
Linyphiidae juvenile (Araneae)	– 0.0261
Isopoda	– 0.0227

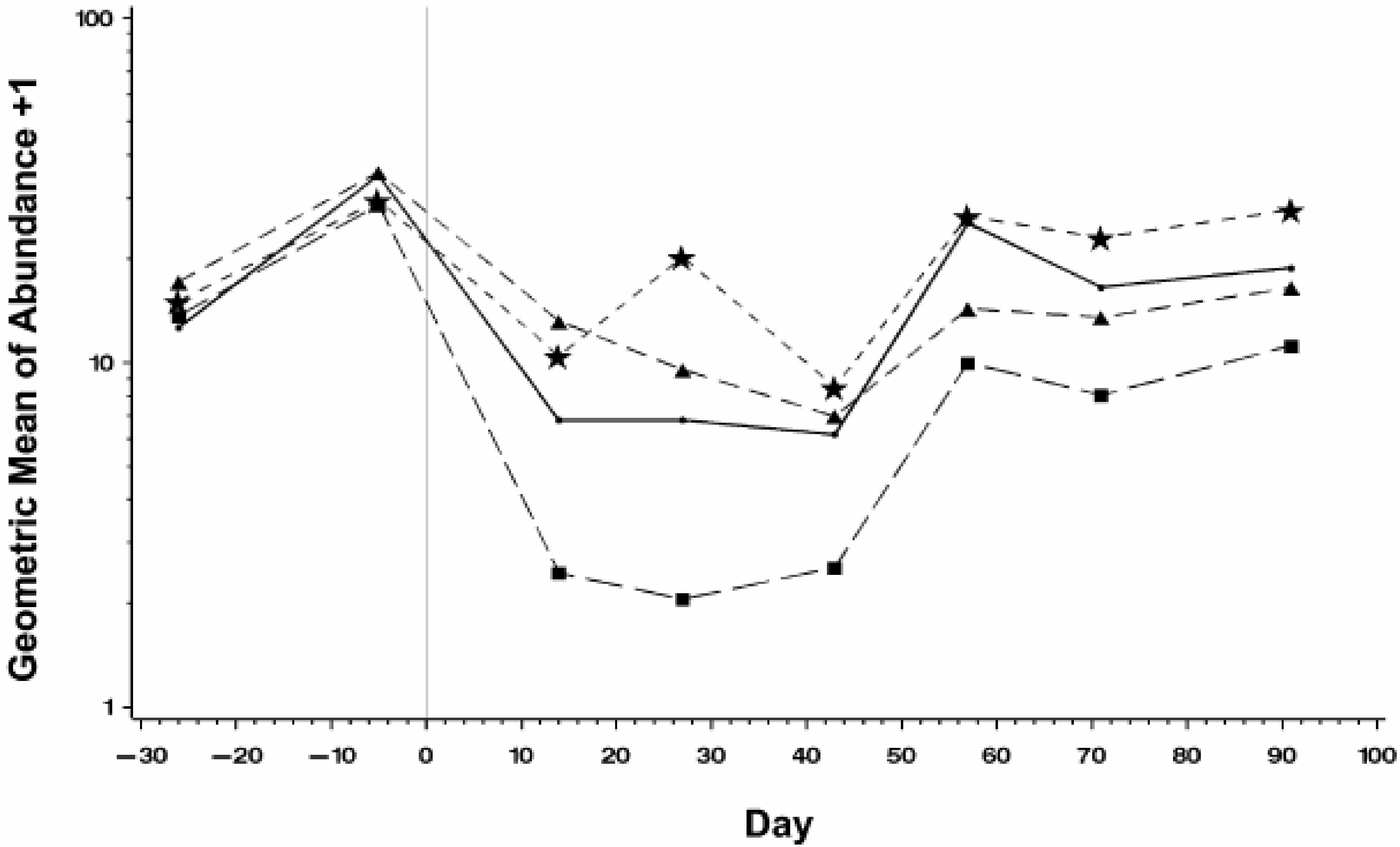


FIGURE 5. Population density of *Phalangium opilio* (Opiliones: Phalangiinae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments and the control were observed (Tukey test, $P = 0.05$).

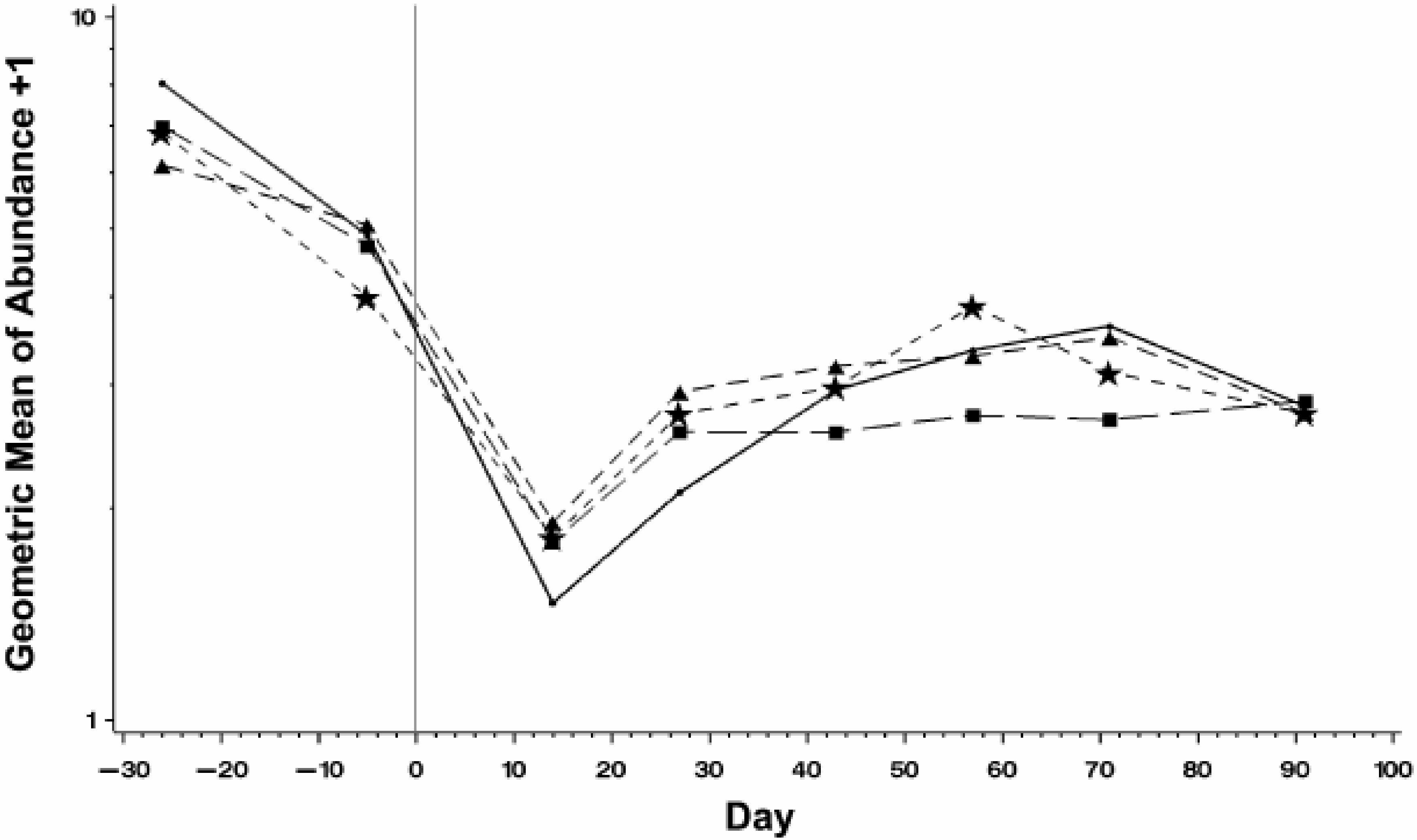


FIGURE 6. Population density of *Alopecosa* sp. (Araneae: Lycosidae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments and the control were observed (Tukey test, $P = 0.05$).

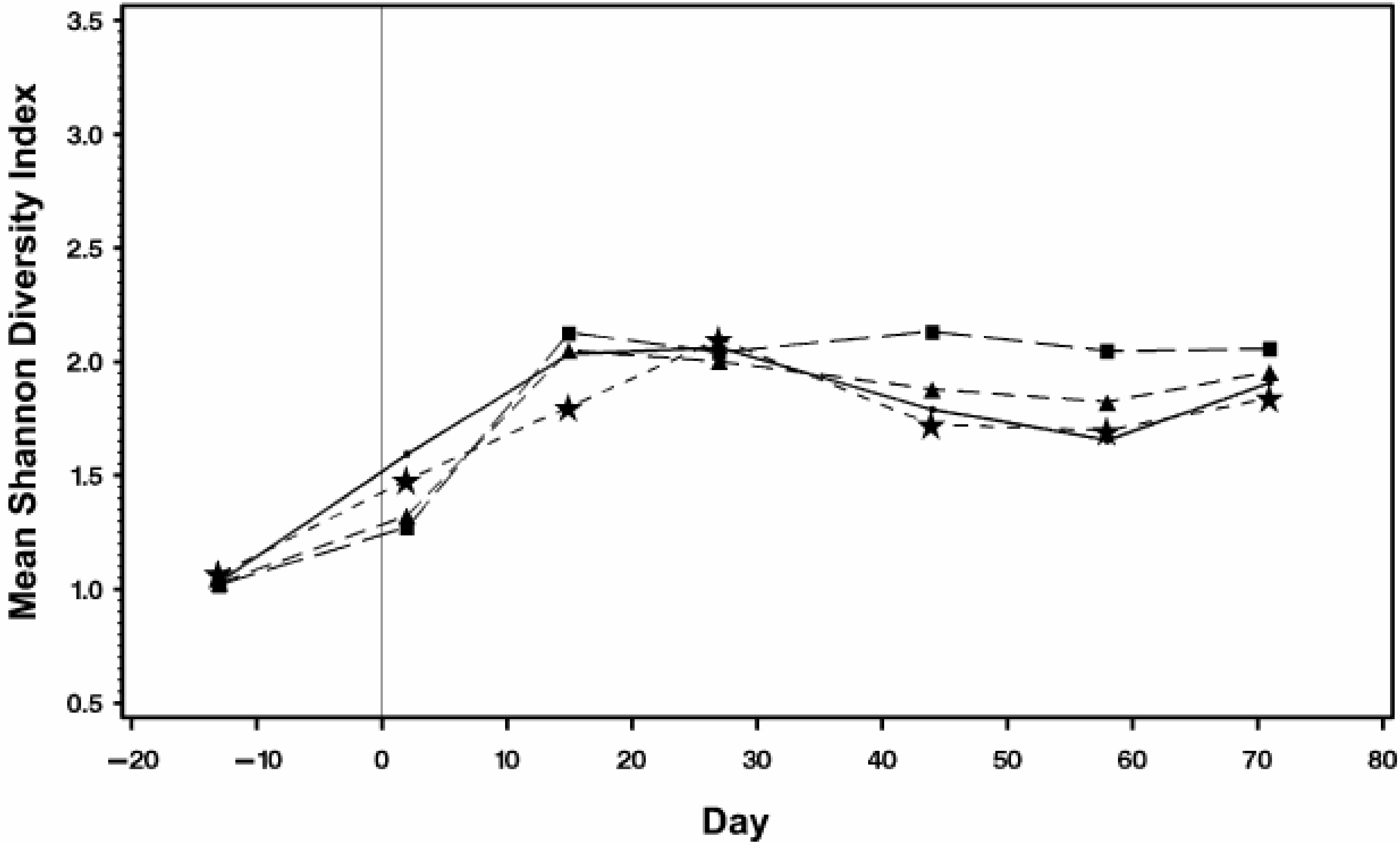


FIGURE 7. Shannon diversity indices of taxa recorded on corn plants throughout the sampling season: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. No statistically significant differences between treatments and the control were observed (Tukey test, $P = 0.05$).

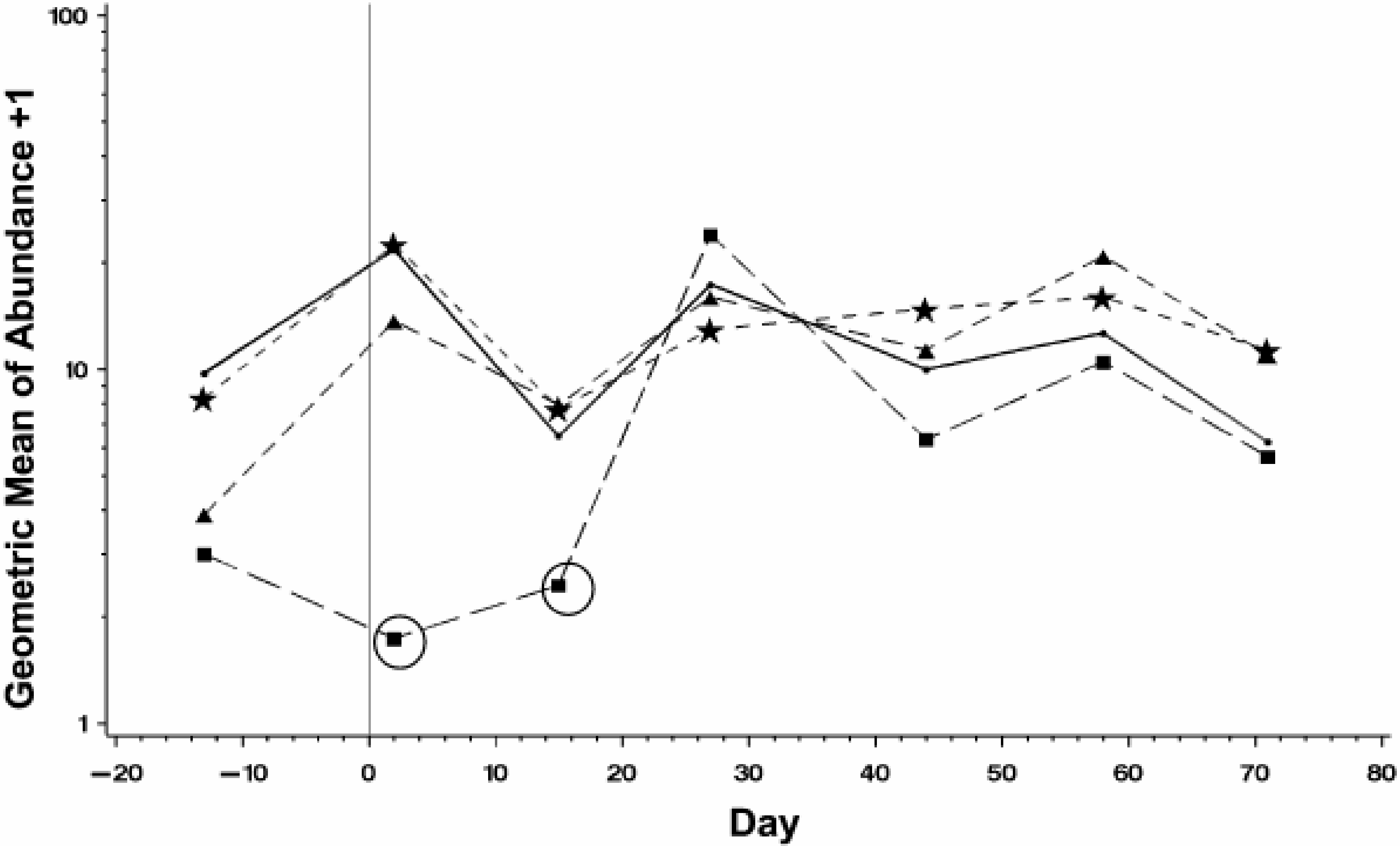


FIGURE 9. Population density of *Orius* sp. (Heteroptera: Anthocoridae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. Statistically significant treatment effects when compared to control are circled (Tukey test, $P \leq 0.05$).

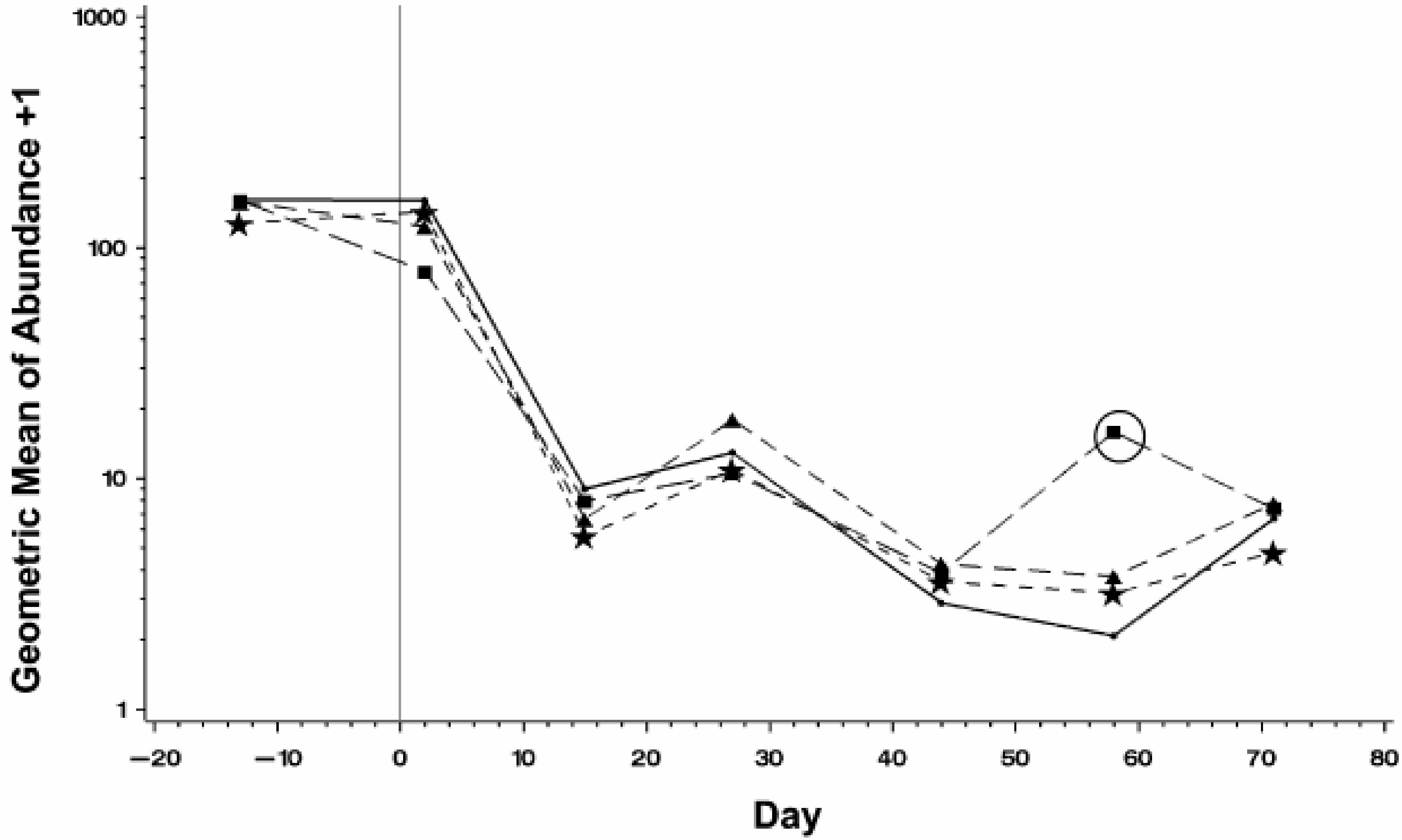
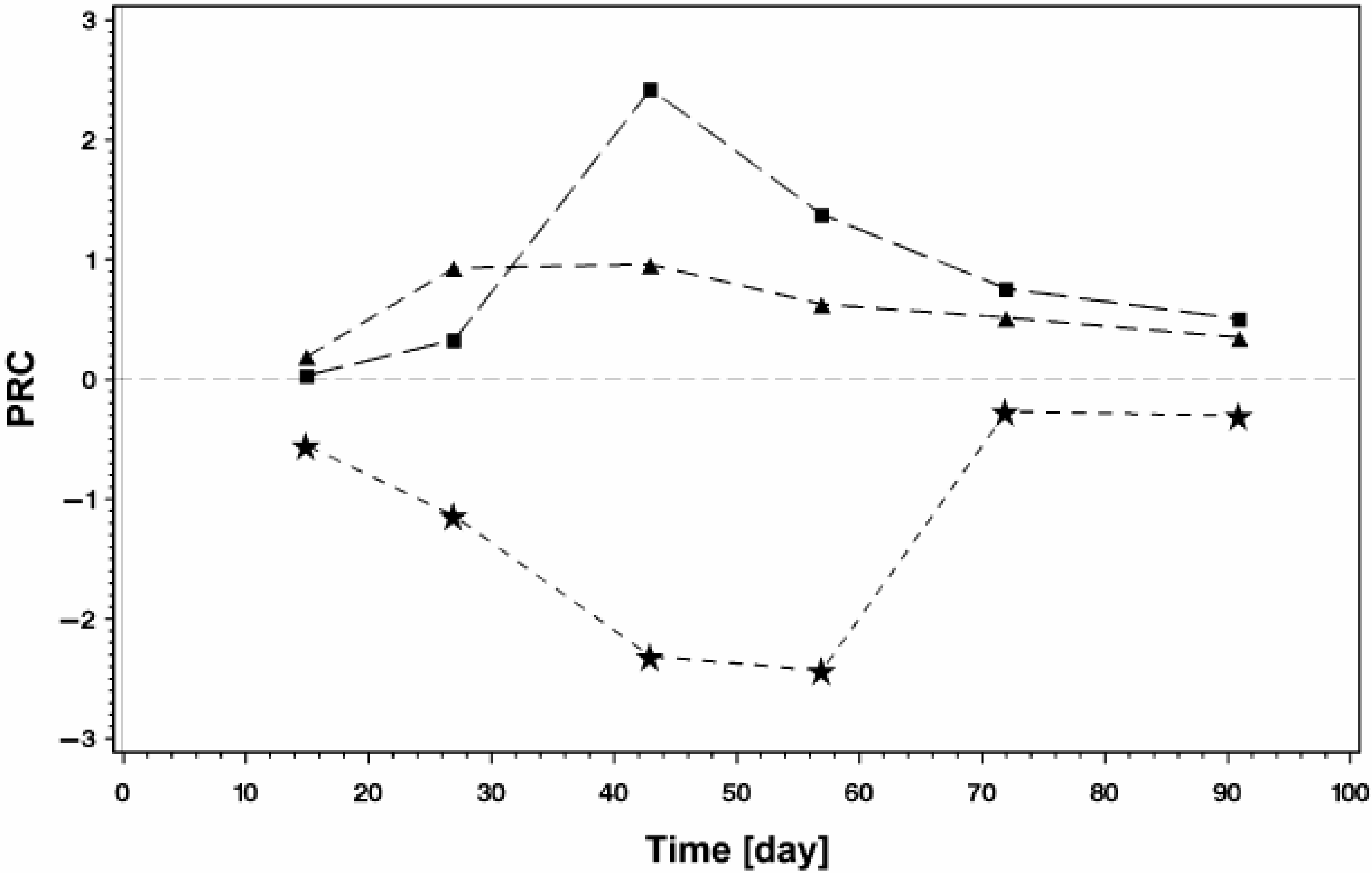


FIGURE 10. Population density of *Rhopalosiphum maidis* (Homoptera: Aphididae). Plotted are the geometric means of abundance +1 per trap against time: (●) untransformed corn (control); (★) Bt-corn; (▲) untransformed corn treated with Delfin; (■) untransformed corn treated with Karate Xpress; Day 0, spray day. Statistically significant treatment effects when compared to control are circled (Tukey test, $P \leq 0.05$).



Only the Lepidoptera were reduced due to significantly lower counts of the target pests *Heliothis* spp., *Trichoplusia ni* (Lepidoptera: Noctuidae) and *Pseudoplusia includens* (Lepidoptera: Noctuidae). A further field trial with transgenic cotton expressing CryIAb showed no reduced abundance of spiders, predatory bugs or predatory beetles, but the study was carried out on a very small scale with just 200 transgenic plants (Fitt *et al.*, 1994).

Figure 25:Monarch Butterfly, Missouri Botanical Garden, September 2003, photo K.Ammann

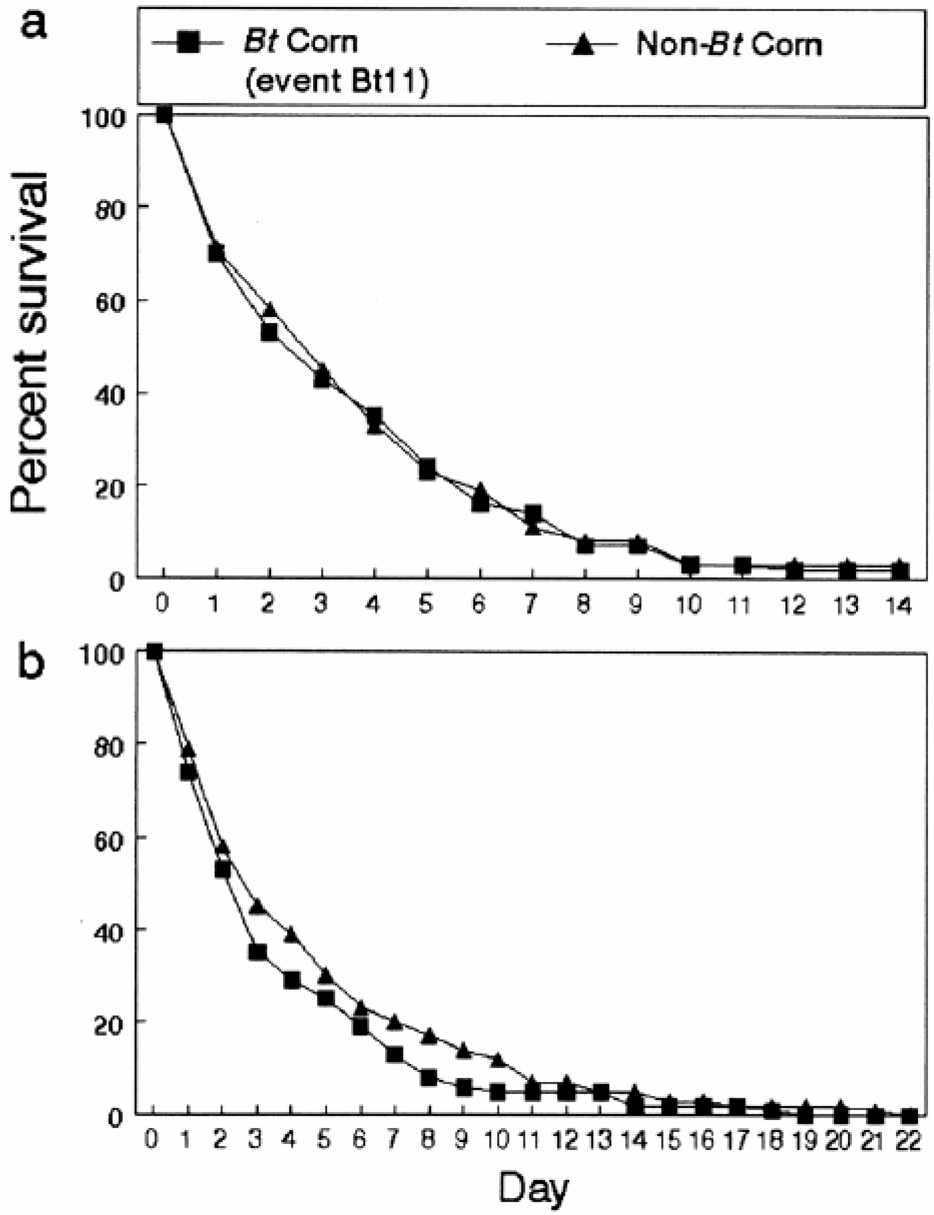


Figure 26: Survival curves for monarch larvae placed in and near *Bt* and non-*Bt* corn fields. (*a*) Iowa. (*b*) New York. The survival curves of larvae pooled over the three Bt corn sites were not significantly different from those in non-Bt (Fig. 13a). In New York, trends in survivorship were also statistically the same for cohorts of larvae feeding for 22 days on milkweeds in Bt and non-Bt fields (Fig. 13b). (Stanley-Horn et al., 2001)

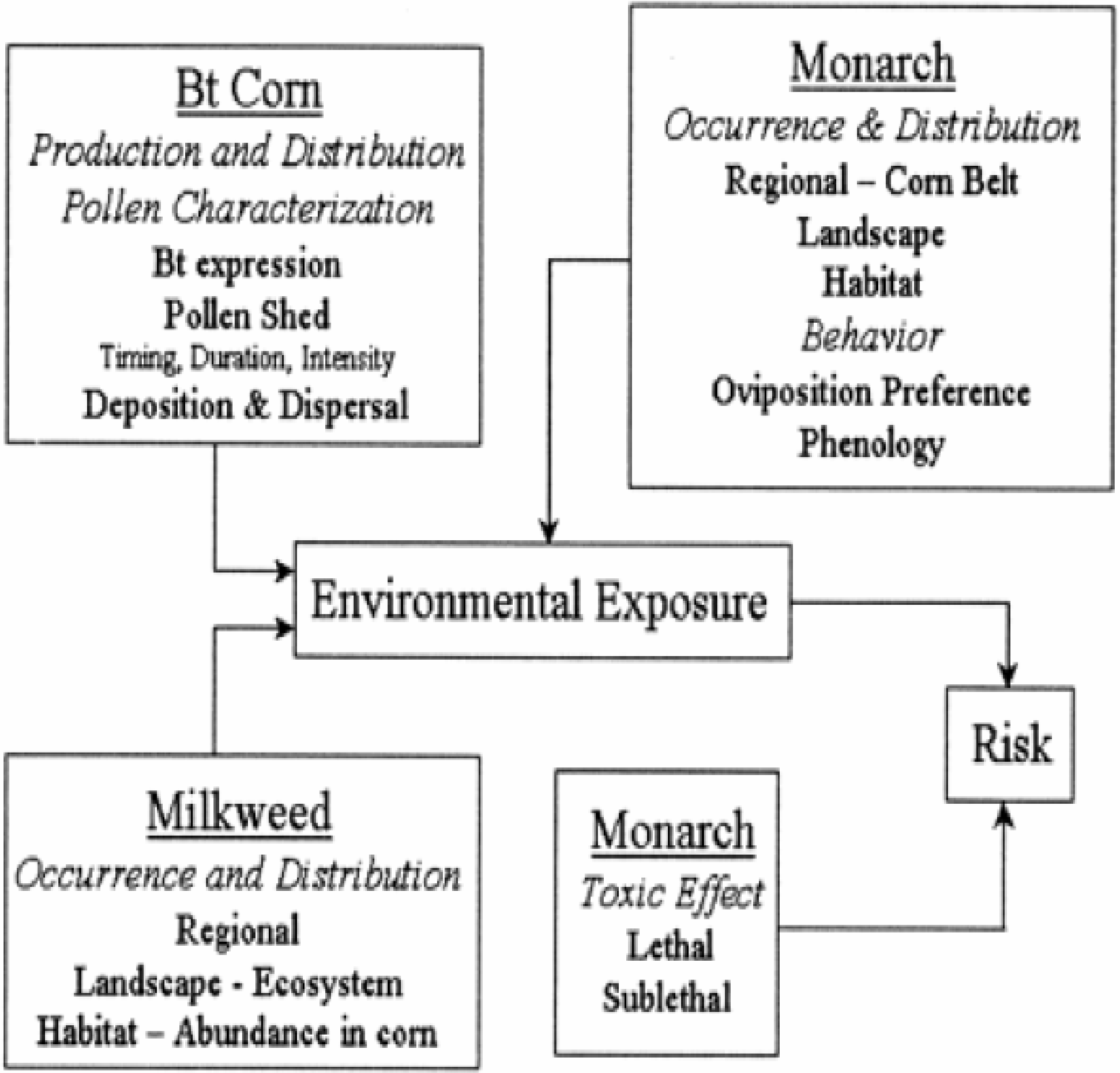


Figure 21: Conceptual model of components of risk assessment of the impact of *Bt* corn pollen on populations of the monarch butterfly. (Sears et al., 2001a)

NEW BT FEEDING STUDIES: NO EFFECT ON LACEWINGS

ELSEVIER

Journal of Insect Physiology 50 (2004) 175–183

Journal of Insect Physiology

www.elsevier.com/locate/jinsphys

Bacillus thuringiensis toxin (Cry1Ab) has no direct effect on larvae of the green lacewing *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae)

Jörg Romeis *, Anna Dutton, Franz Bigler

Swiss Federal Research Station for Agroecology and Agriculture (FAL), Reckenholzstr. 191, 8046 Zurich, Switzerland

Received 14 July 2003; received in revised form 7 October 2003; accepted 6 November 2003

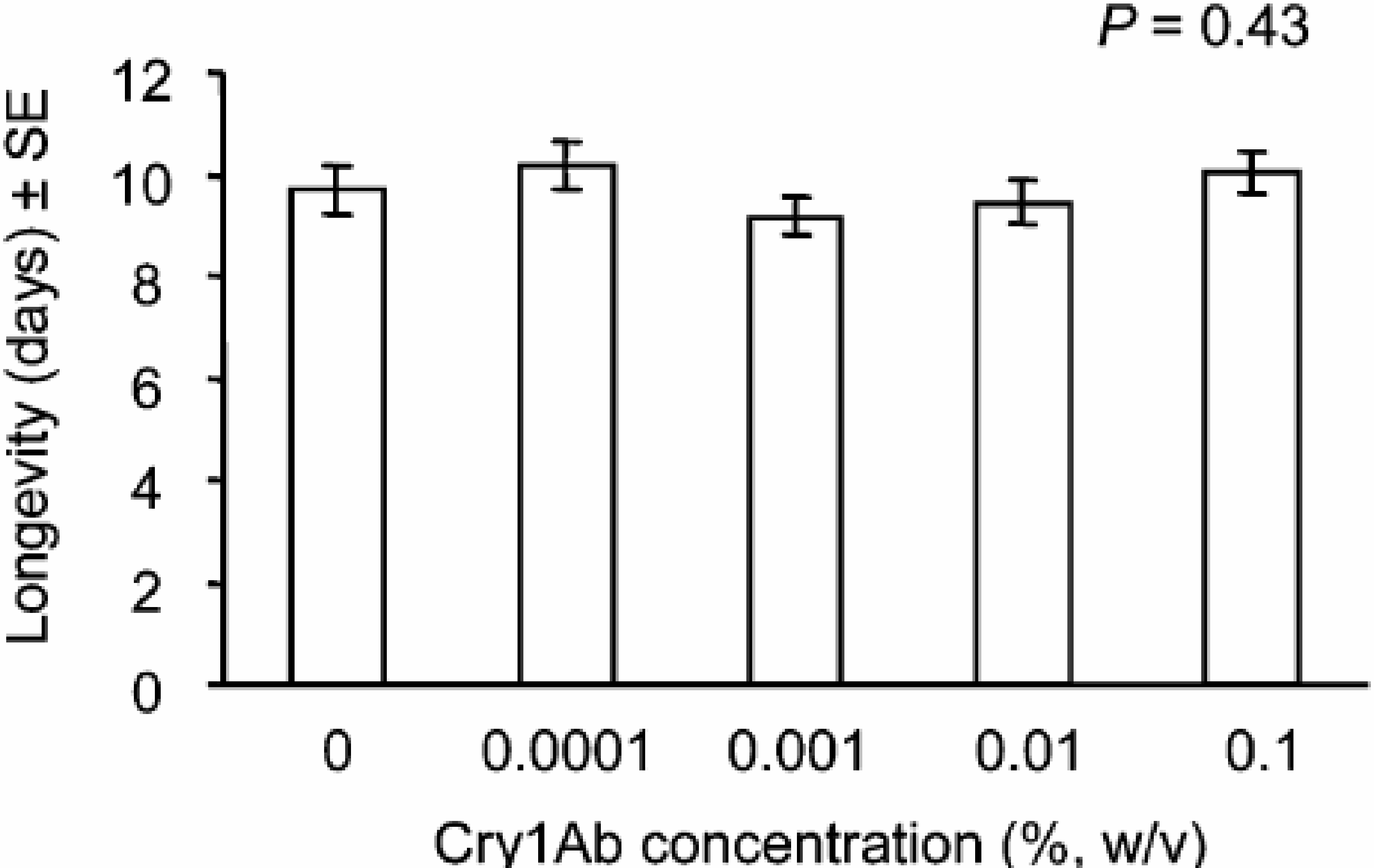
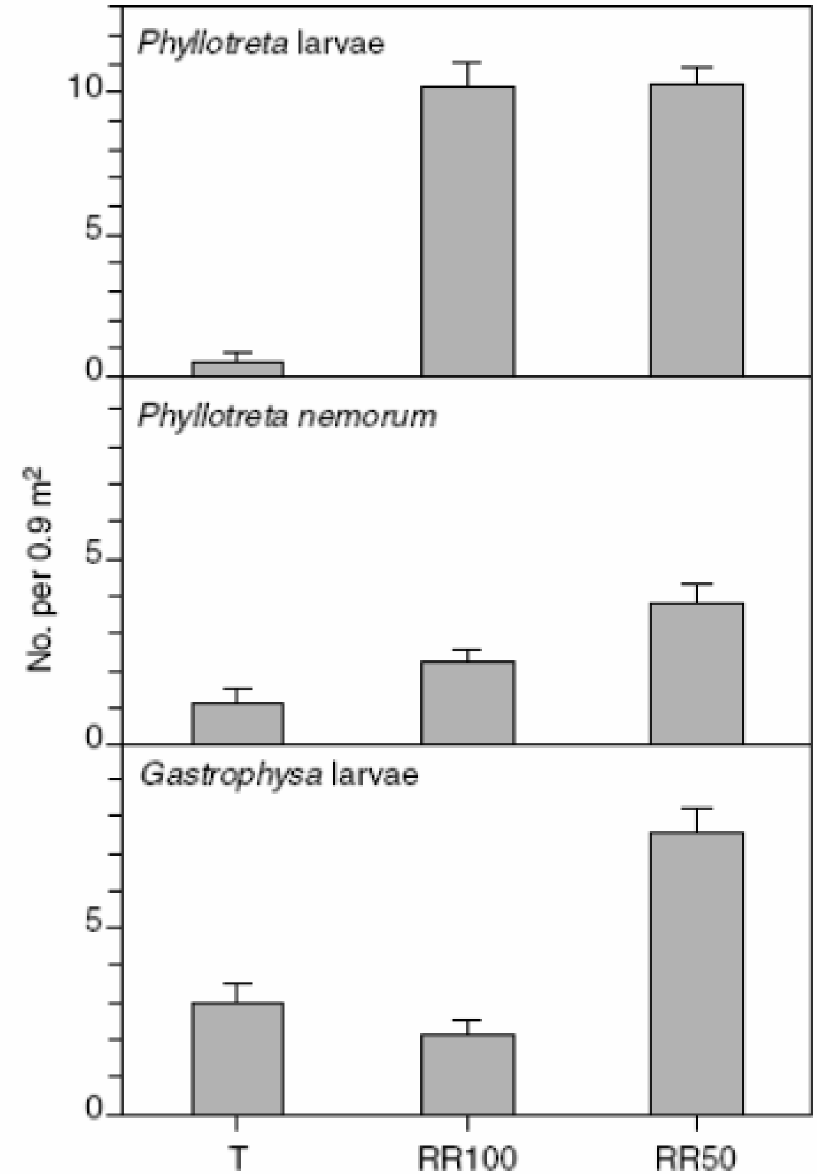


Fig. 1. Mean longevity (±SE) of first instar *C. carnea* fed with different concentrations of the Cry1Ab toxin dissolved in a 2 M sucrose solution ($n = 57–60$ per treatment).

NO TILLAGE AND SOIL FERTILITY



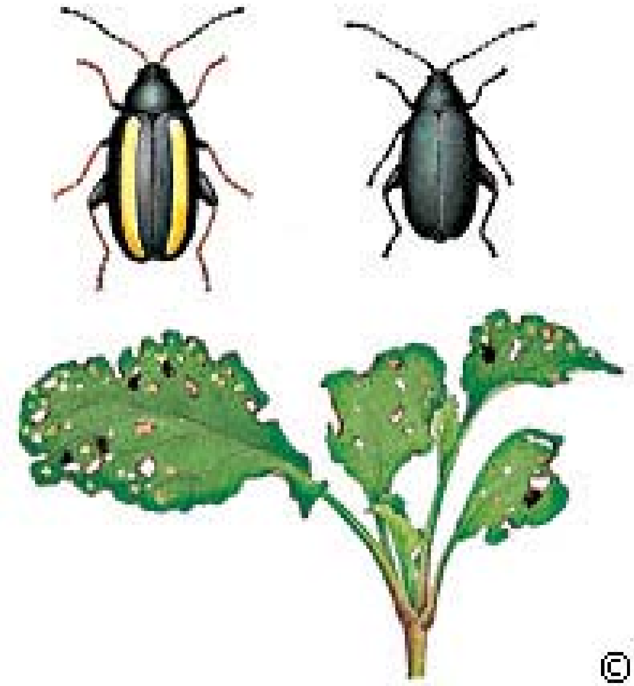


Figure 27: Density of *Gastrophysa polygoni* larvae, flea beetle larvae and *Phyllotreta nemorum* in the traditional (T) fodder beet plot, RR100 plot and RR50 plot at Skejby. Bars indicate standard error of means. (Elmegaard & Pedersen, 2001)

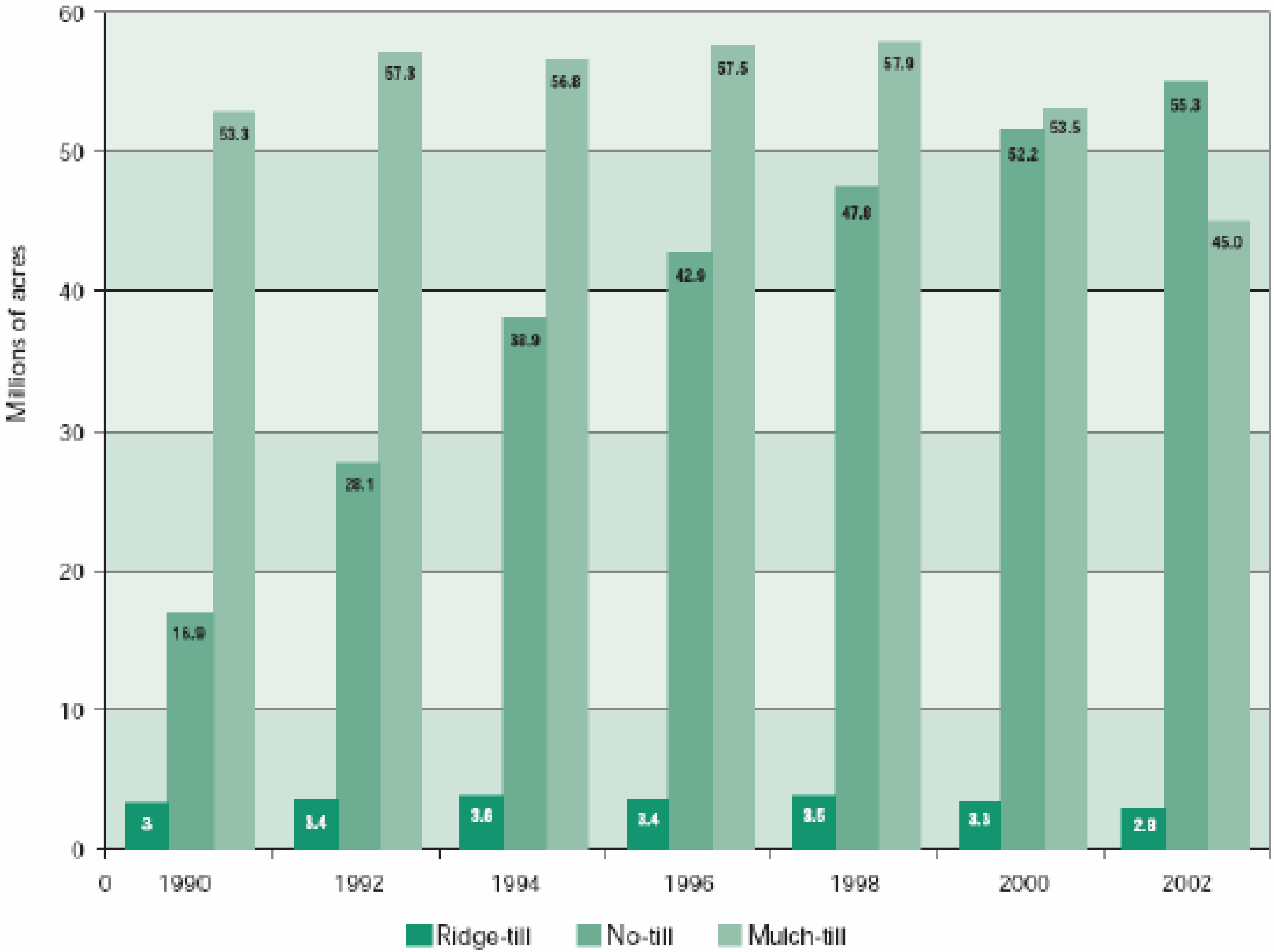


Figure 9: Conservation Tillage Adoption in the U.S. (1990 – 2002)

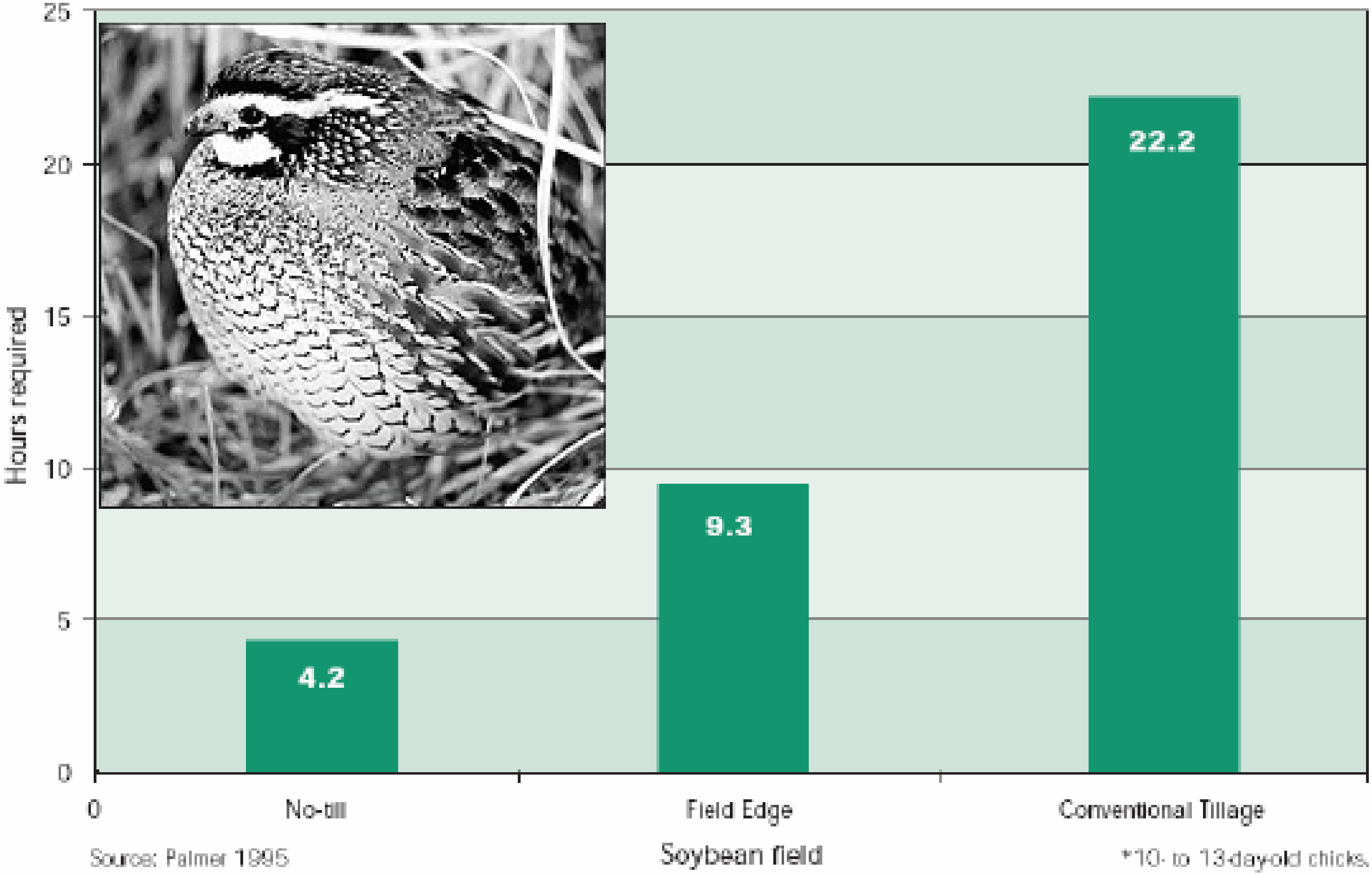


Figure 12: Time needed for Bobwhite Quail Chicks to Satisfy Daily Inect Requirements

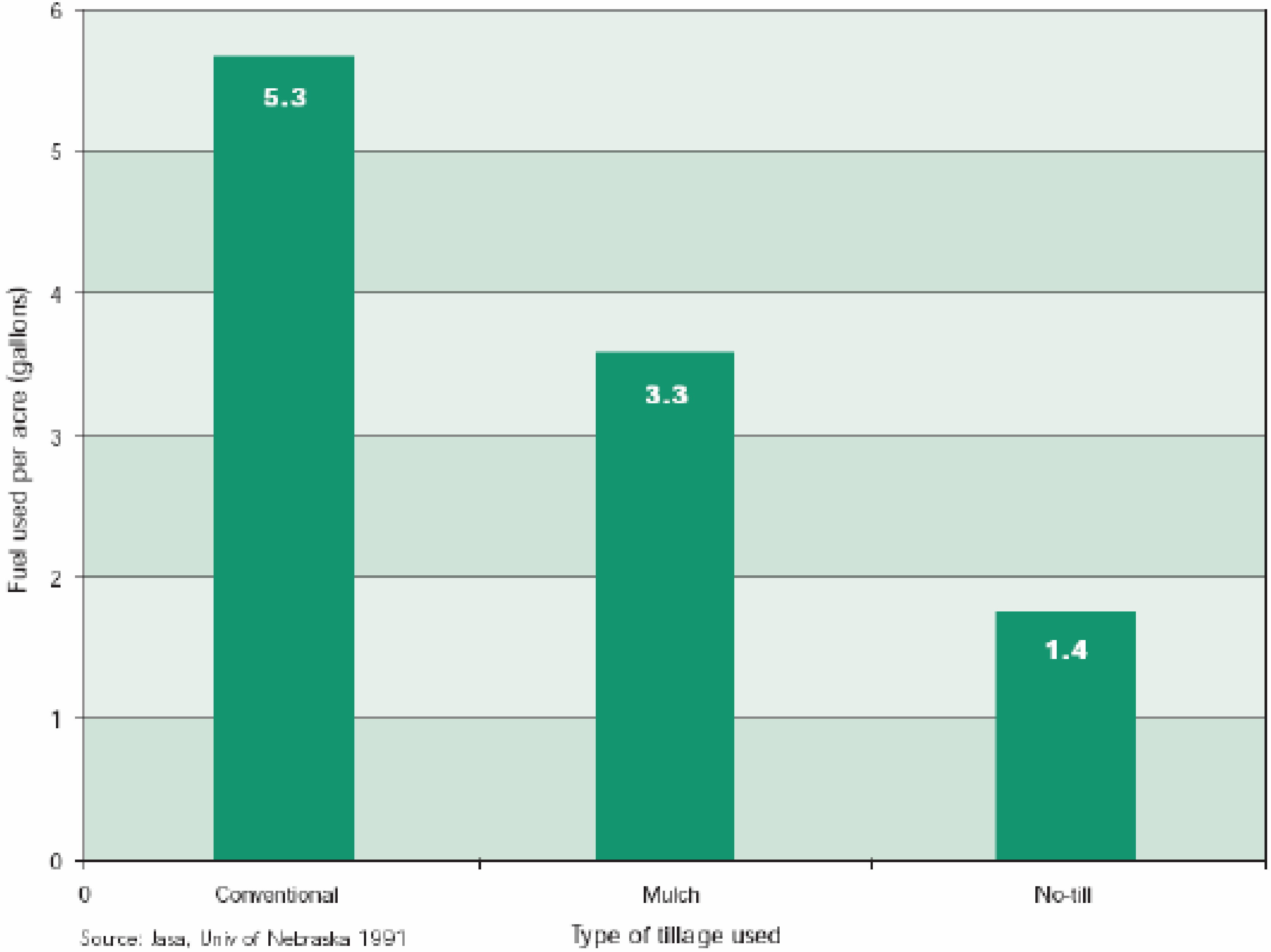


Figure 8: Tillage System versus Fuel Consumption per Acre (Fawcett & Towery, 2002) (Fig. 9-12)

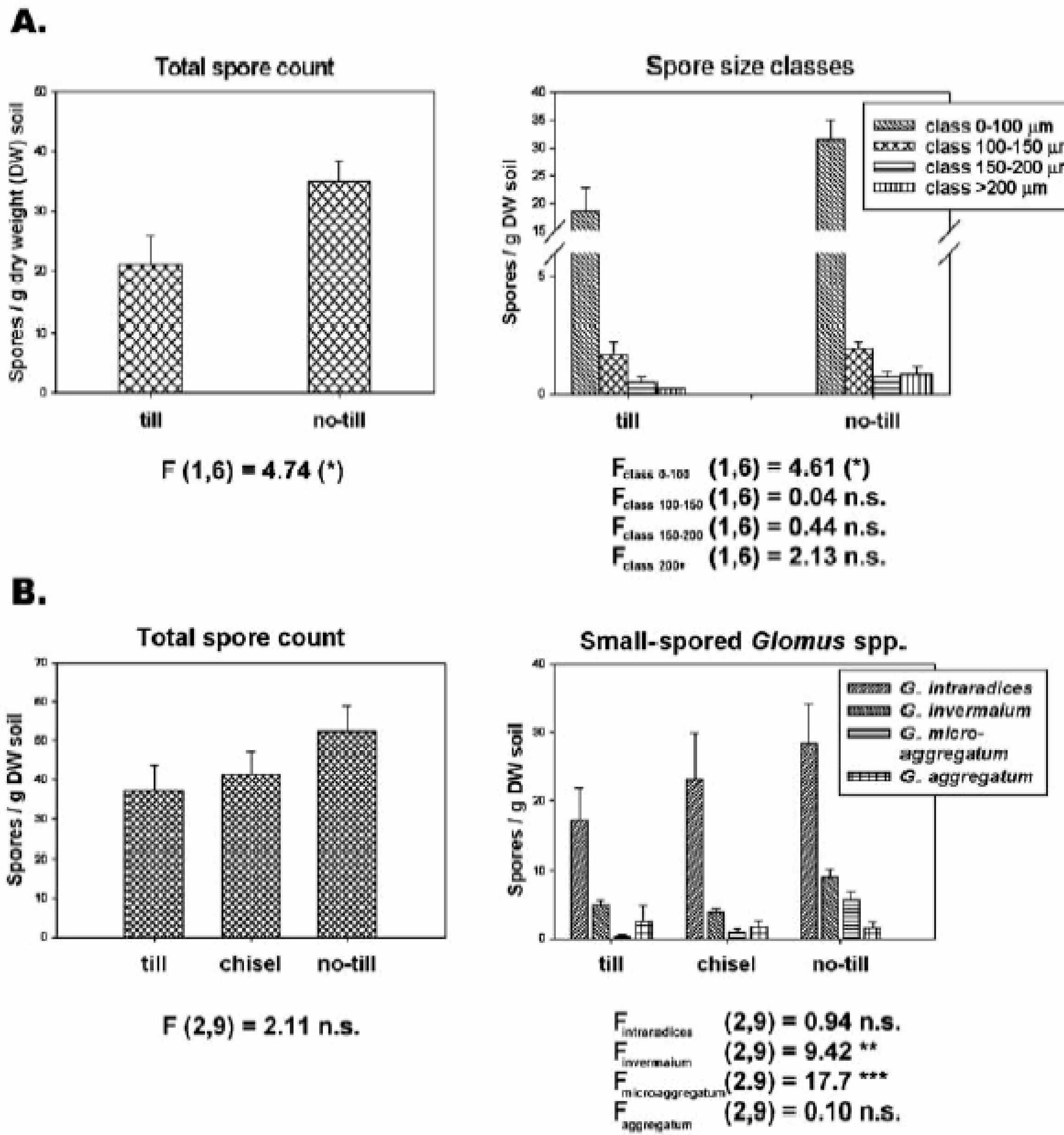


Figure 16: from (Jansa et al., 2002): Spore counts in field soils after a rapeseed season (1999), when only two tillage treatments were compared (A), and spore counts in soils following maize season (2001), where three tillage treatments were compared (B). F-values following ANOVAs are given. Statistical significance of results is shown (*n.s.* not significant (P=0.1); (*) $P<0.1$; * $P<0.05$; ** $P<0.01$)

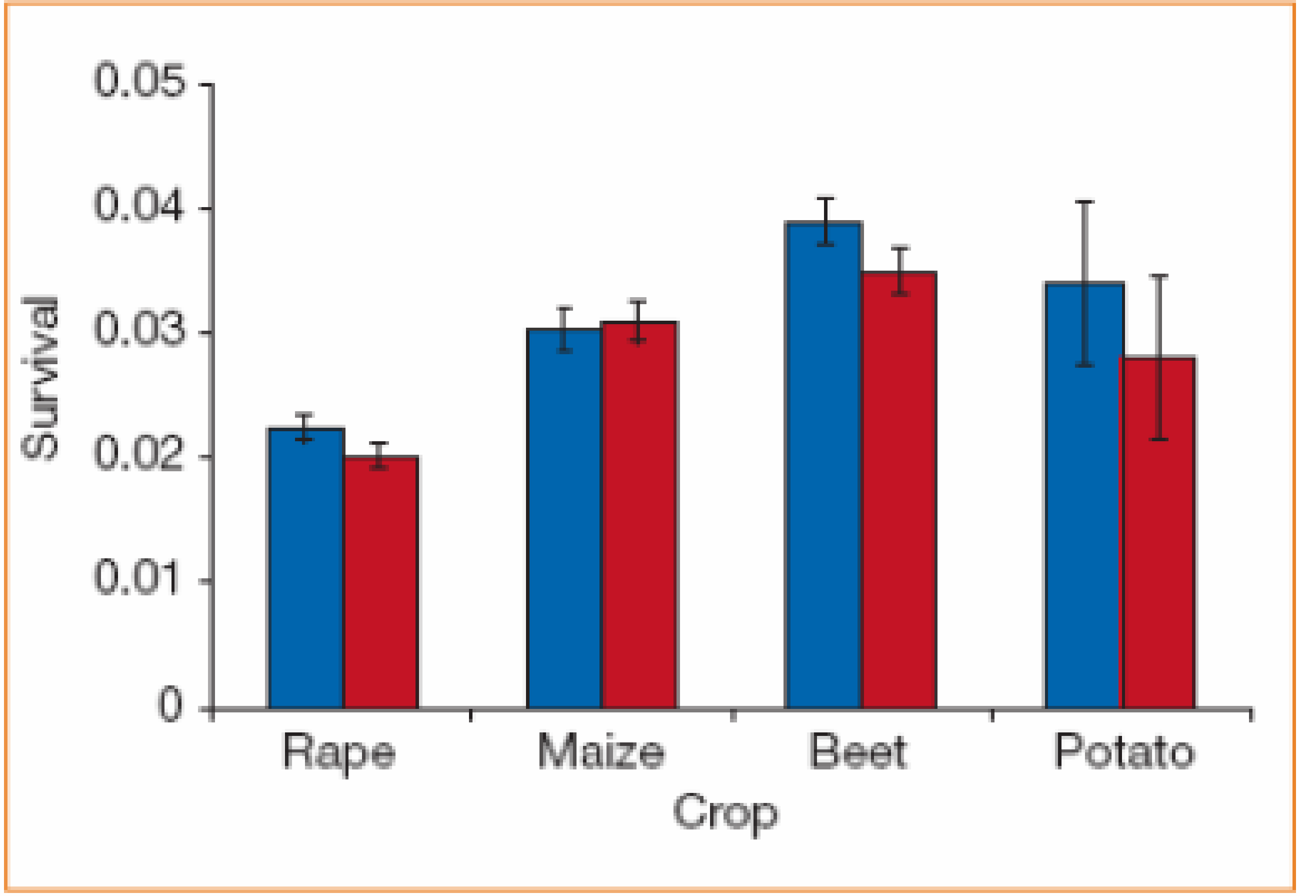


Figure 28: The performance of conventional (blue) and transgenic (red) crops in natural habitats. Survival is the fraction of seeds sown (or tubers planted in the case of potato) that produce mature plants at the end of the first growing season. Error bars, 1 s.e. Data are averaged over habitats and replicates within habitat. In no case did populations of either conventional or transgenic plants increase, and transgenic plants never persisted significantly longer than conventional plants. All populations of maize, rape and sugar beet were extinct at all sites within 4 years of sowing. Potato still survives at one site, 10 years after planting, but the survivors are all conventional. (Crawley et al., 2001)

THE BRITISH FARM SCALE EXPERIMENTS

FSE Timeline 2003/2004 (maize, beet, OSR)

(Impacts on the abundance and diversity of farmland biodiversity)*

	2003 September	2003 October	2003 November	2003 December	2004
ABC FSE Strategy Planning Meeting	30th				
Scientific Steering Committee (SSC) publishes results of at RI open meeting + Philosophical Transactions of Royal Society. (8 papers) 1 paper not accepted. Crop by crop summary on day of publication		16th (1.30pm - 5pm)			
2nd open meeting of SSC at Royal Institution (evening)		28th (6.30 pm - 9pm)			
Deadline for evidence to ACRE secretariat			16th		
SSC submits advice to Ministers			16th		
FSE Audit Committee			17th		
ACRE open meeting, London (Jules Pretty)			25th		
ACRE open meeting, Edinburgh (Jules Pretty)				4th	
ACRE advice to Government on FSE				? December	
First product undergoing 2001/18 review will reach endpoint. EU vote required					Q1
Winter oilseed rape results					Q3

DEFRA: www.defra.gov.uk/environment/gm/fse/index.htm
ACRE: www.defra.gov.uk/environment/acre/index.htm

*work conducted by The Centre for Ecology Hydrology, Rothamsted Research, SCRI

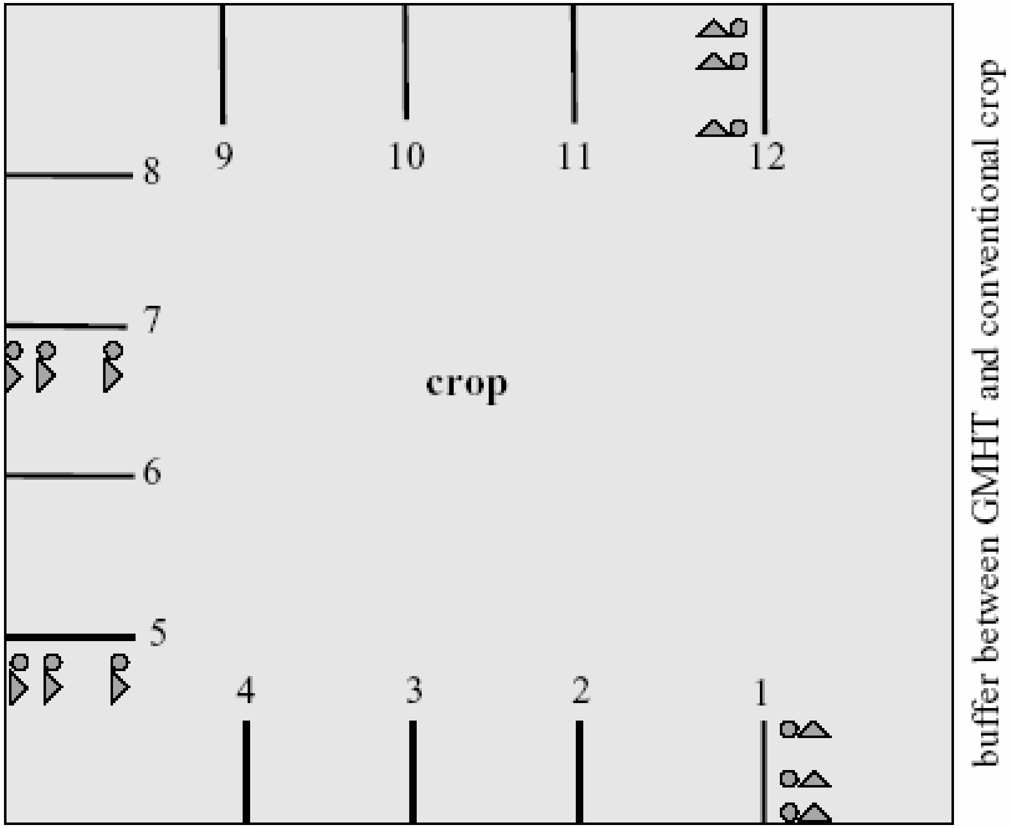
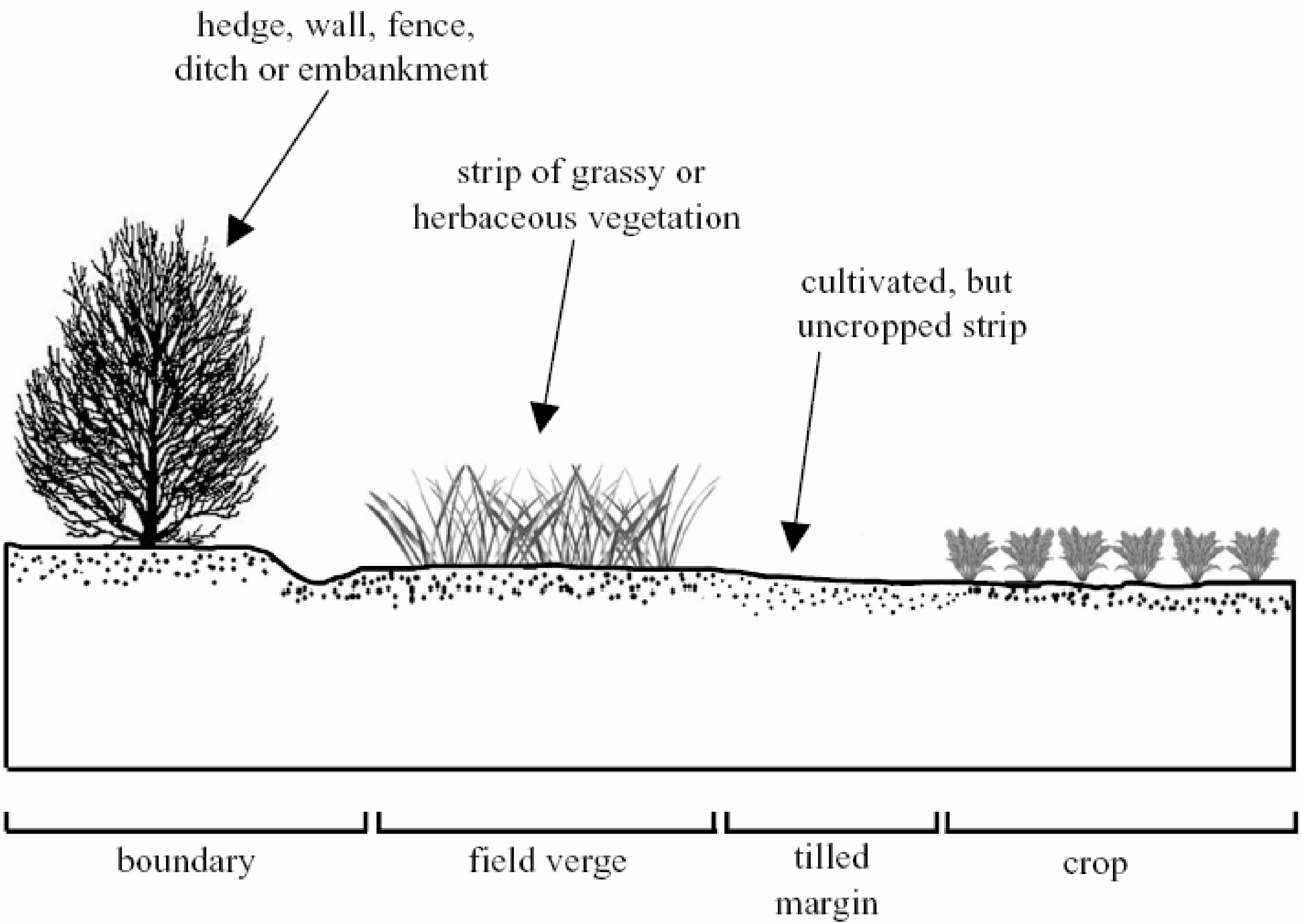


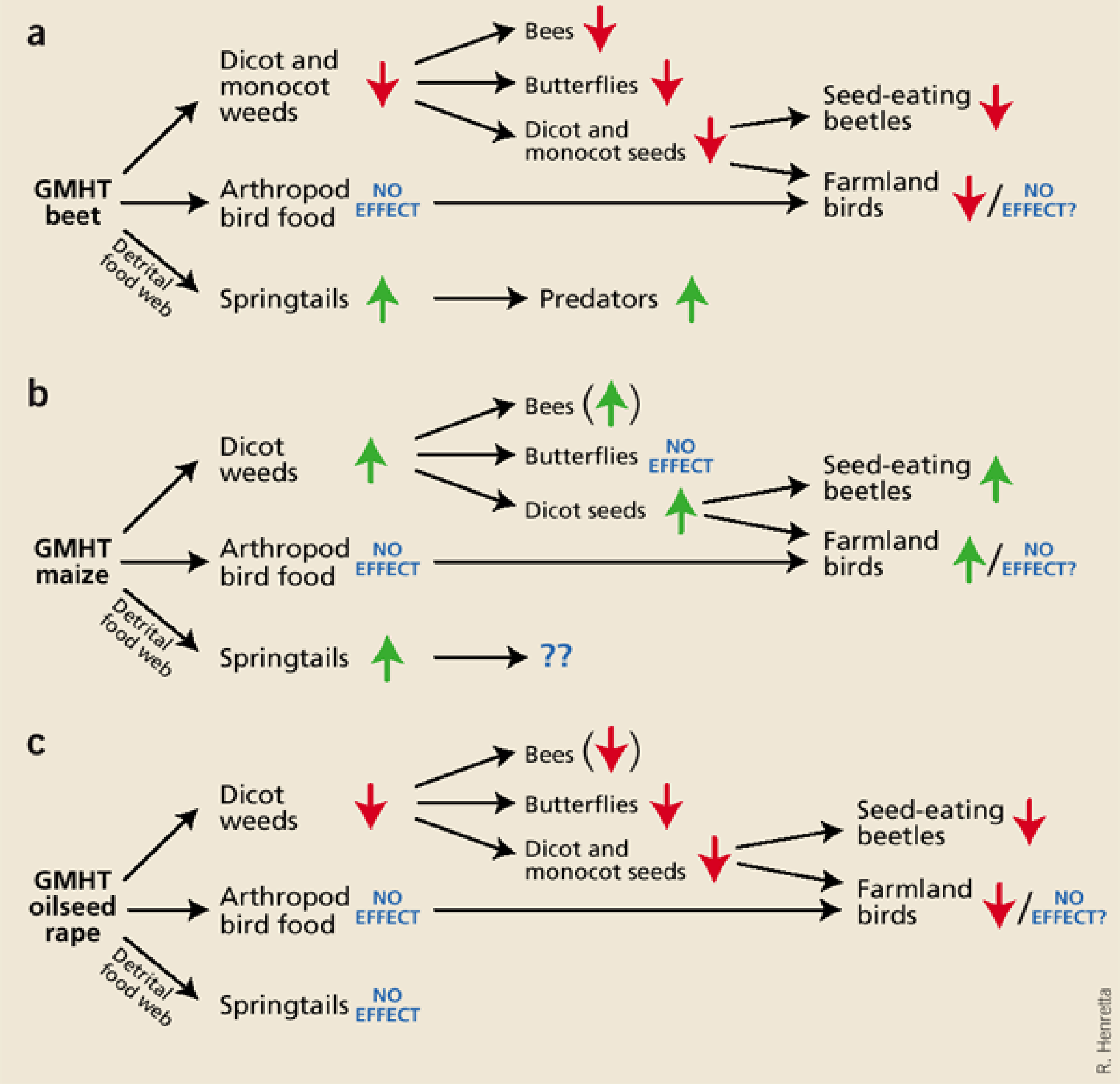
Figure 1. Field layout for arthropod pitfall and gastropod refuge trapping. Schematic diagram of a field showing locations of pitfall traps. This diagram is for an idealized geometry of the split-field design. Traps are placed at positions 2, 8 and 32 m from the edge of the crop along transects 1, 5, 7 and 12. Pitfall and refuge traps are offset 0.5 m and 3.5 m, respectively, from the centre line of these transects. The grey shaded area represents the crop, circles represent pitfall traps, triangles represent refuge traps and the numbered black lines show the transects in the crop.

Brooks, D., Bohan, D., Champion, G., Haughton, A., Hawes, C., Heard, M., Clark, S., Dewar, A., Firbank, L., Perry, J., Rothery, P., Scott, R., Woiwod, I., Birchall, C., Skellern, M., Walker, J., Baker, P., Bell, D., Browne, E., Dewar, A., Fairfax, C., Garner, L., Haylock, B., Horne, S., Hulmes, S., Mason, N., Norton, L., Nuttall, P., Randle, Z., Rossall, M., Sands, R., Singer, E., & Walker, M. (2003)

Invertebrate responses to the management of genetically modified herbicide tolerant and conventional spring crops. I. Soil-surface-active invertebrates. Phil. Trans. R. Soc. Lond. B, 358, pp 1847–1862
http://www.pubs.royalsoc.ac.uk/phil_bio/fse_content/TB031847.pdf



Roy, D., Bohan, D., Haughton, A., Hill, M., Osborne, J., Clark, S., Perry, J., Rothery, P., Scott, R., Brooks, D., Champion, G., Hawes, C., Heard, M., & Firbank, L. (2003)
Invertebrates and vegetation of field margins adjacent to crops subject to contrasting herbicide regimes in the Farm Scale Evaluations of genetically modified herbicide-tolerant crops. Phil. Trans. R. Soc. Lond. B, 358, 1879–1898.



Andow, D.A. (2003)

UK farm-scale evaluations of transgenic herbicide-tolerant crops. Nature Biotechnology, 21, pp 1453-1454

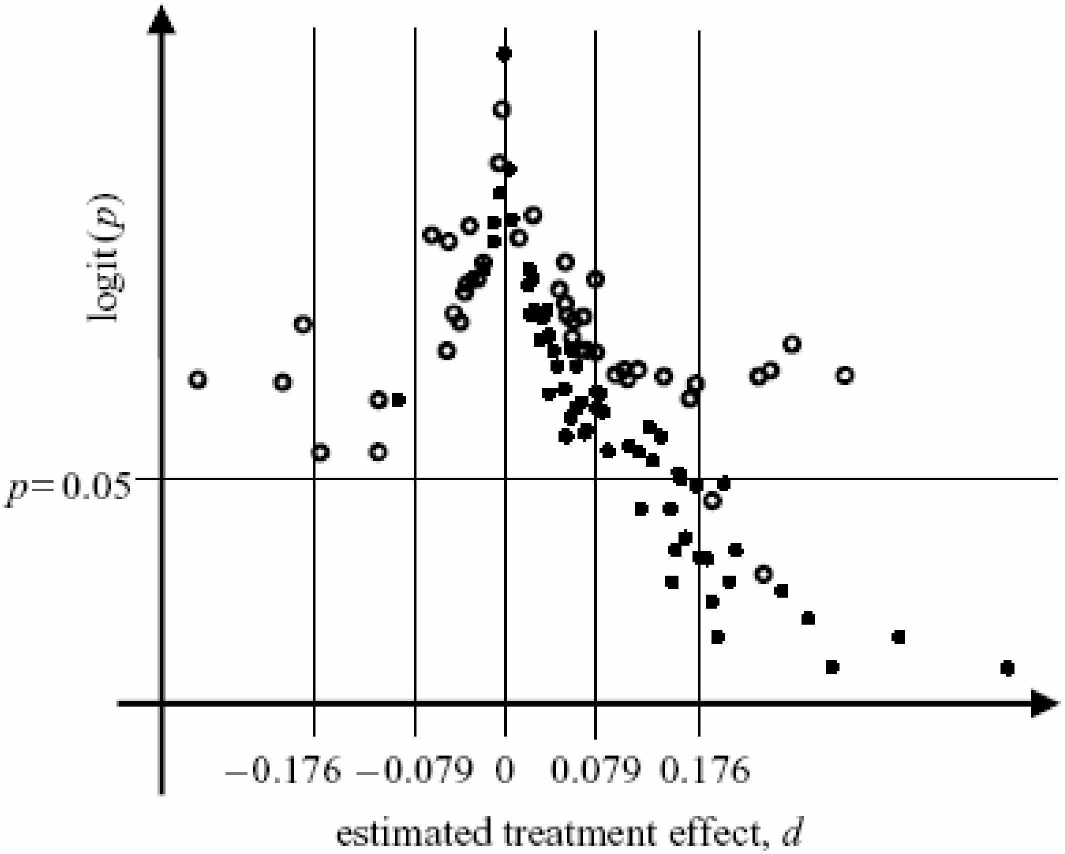


Figure 2. Relationship between randomization probability and estimated treatment effect, d ($d = \log R$), for Collembola at various times during the season. Filled circles, total Collembola, Entomobryidae and Isotomidae; open circles, Sminthuridae and Poduridae. Symbols to the right of $d = 0$ denote occasions when the abundance in GMHT half-fields exceeded that in conventional half-fields; symbols below the line $p = 0.05$ denote occasions when the test of H_0 was significant. Samples were combined from pitfall traps and Vortis suction.

Brooks, D., Bohan, D., Champion, G., Haughton, A., Hawes, C., Heard, M., Clark, S., Dewar, A., Firbank, L., Perry, J., Rothery, P., Scott, R., Woiwod, I., Birchall, C., Skellern, M., Walker, J., Baker, P., Bell, D., Browne, E., Dewar, A., Fairfax, C., Garner, L., Haylock, B., Horne, S., Hulmes, S., Mason, N., Norton, L., Nuttall, P., Randle, Z., Rossall, M., Sands, R., Singer, E., & Walker, M. (2003)

Invertebrate responses to the management of genetically modified herbicide tolerant and conventional spring crops. I. Soil-surface-active invertebrates. Phil. Trans. R. Soc. Lond. B, 358, pp 1847–1862 http://www.pubs.royalsoc.ac.uk/phil_bio/fse_content/TB031847.pdf

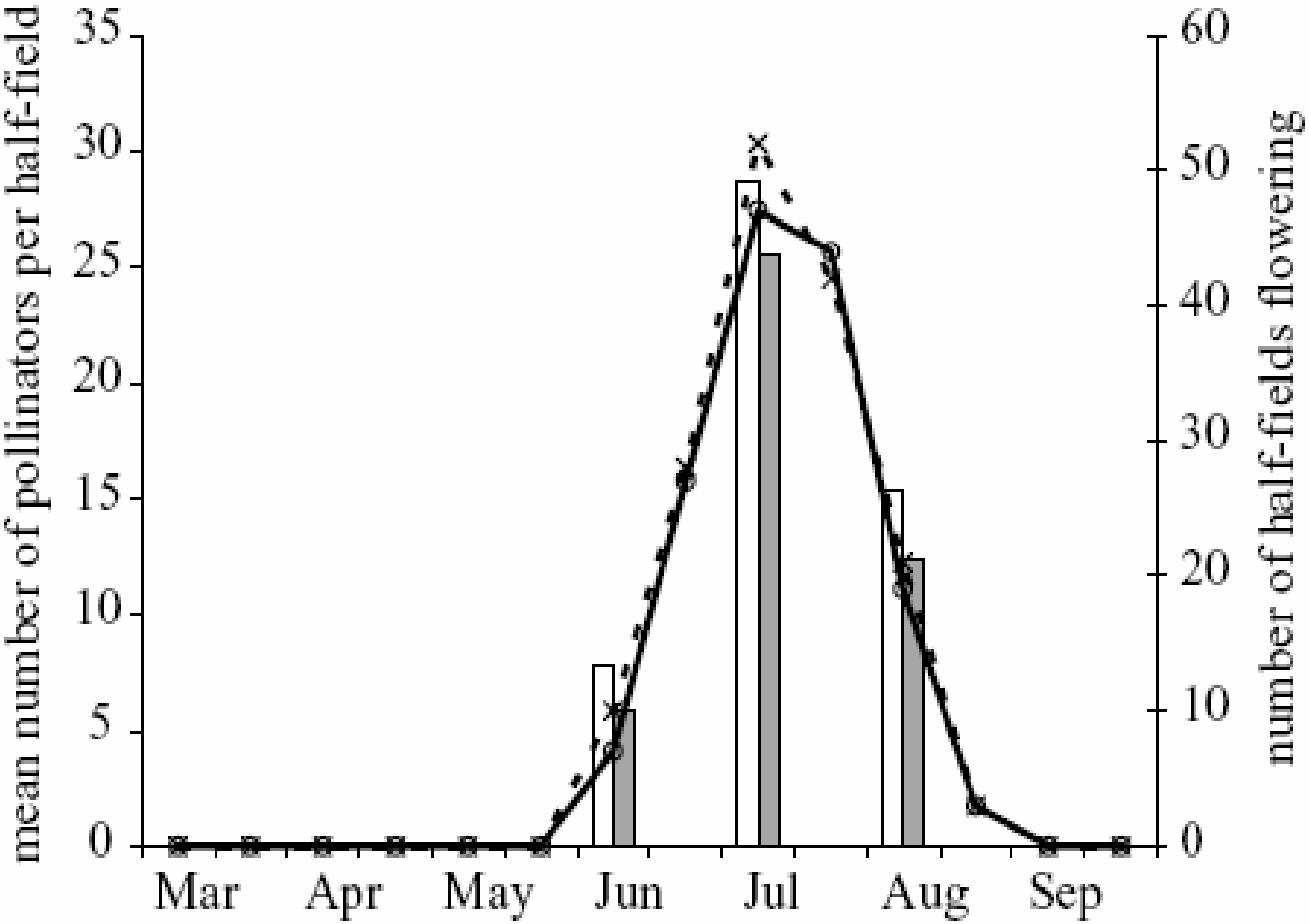


Figure 1. Number of spring oilseed rape half-fields in flower at two-week periods from March to September (dashed line, conventional; solid line, GMHT), and geometric mean number of pollinators sampled in June, July and August from four 50 m transects per half-field (open bars, conventional; grey bars, GMHT).

Hawes, C., Haughton, A., Osborne, J., Roy, D., Clark, S., Perry, J., Rothery, P., Bohan, D., Brooks, D., Champion, G., Dewar, A., Heard, M., Woiwod, I., Daniels, R., Young, M., Parish, A., Scott, R., LG., F., & Squire, G. (2003)
Responses of plants and invertebrate trophic groups to contrasting herbicide regimes in the Farm Scale Evaluations of genetically modified herbicide-tolerant crops. Phil. Trans. R. Soc. Lond. B, 358, pp 1899–1913
http://www.pubs.royalsoc.ac.uk/phil_bio/fse_content/TB031899.pdf

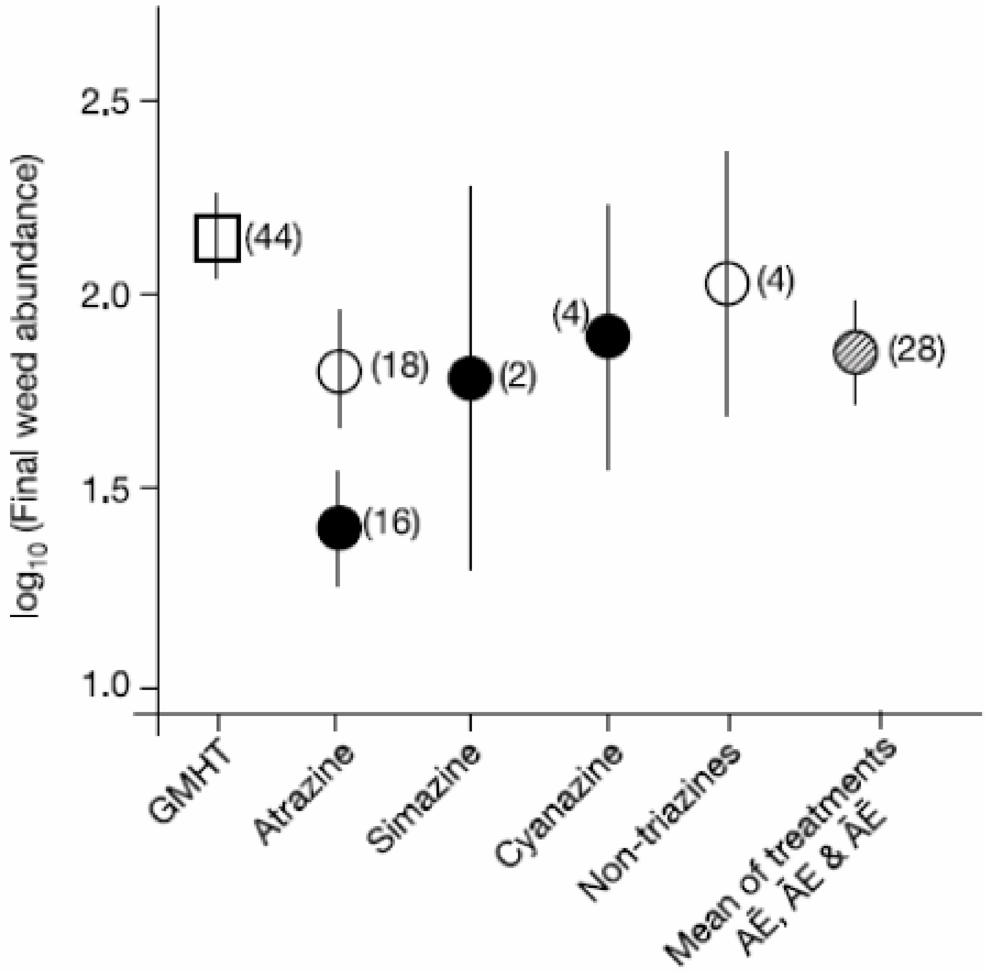


Figure 33: Mean abundance of total pre-harvest weeds and herbicide use. Consistent treatment effects from Table 2, illustrated here by mean abundance of total pre-harvest weeds in FSE fodder-maize per GMHT (square symbol) or conventional (round symbols half-fields, and treated either with pre-emergence herbicide plus possible postemergence application(s) (filled symbols, E) or with post-emergence herbicide only (open symbols, E̲). Hatched symbol represents the mean o the three conventional regimes AE̲ , A̲E and A̲E̲: that is, all those other than atrazine applied pre-emergence. Numbers in brackets denote N, the number of half-fields. Bar represents 95% confidence interval for each mean.

BT ROOT EXUDATES HAVE NO LONG TERM EFFECT

PERGAMON

Soil Biology & Biochemistry 33 (2001) 1225–1230

Soil Biology & Biochemistry

www.elsevier.com/locate/soilbio

Bacillus thuringiensis (Bt) toxin released from root exudates and biomass of Bt corn has no apparent effect on earthworms, nematodes, protozoa, bacteria, and fungi in soil

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Laboratory of Microbial Ecology, Department of Biology, New York University, New York, NY 10003, USA

Received 14 August 2000; received in revised form 24 November 2000; accepted 23 January 2001

Community and Ecosystem Ecology

No Detection of Cry1Ac Protein in Soil After Multiple Years of Transgenic Bt Cotton (Bollgard) Use

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Monsanto Company, Ecological Technology Center, 800 North Lindbergh, St. Louis, MO 63141

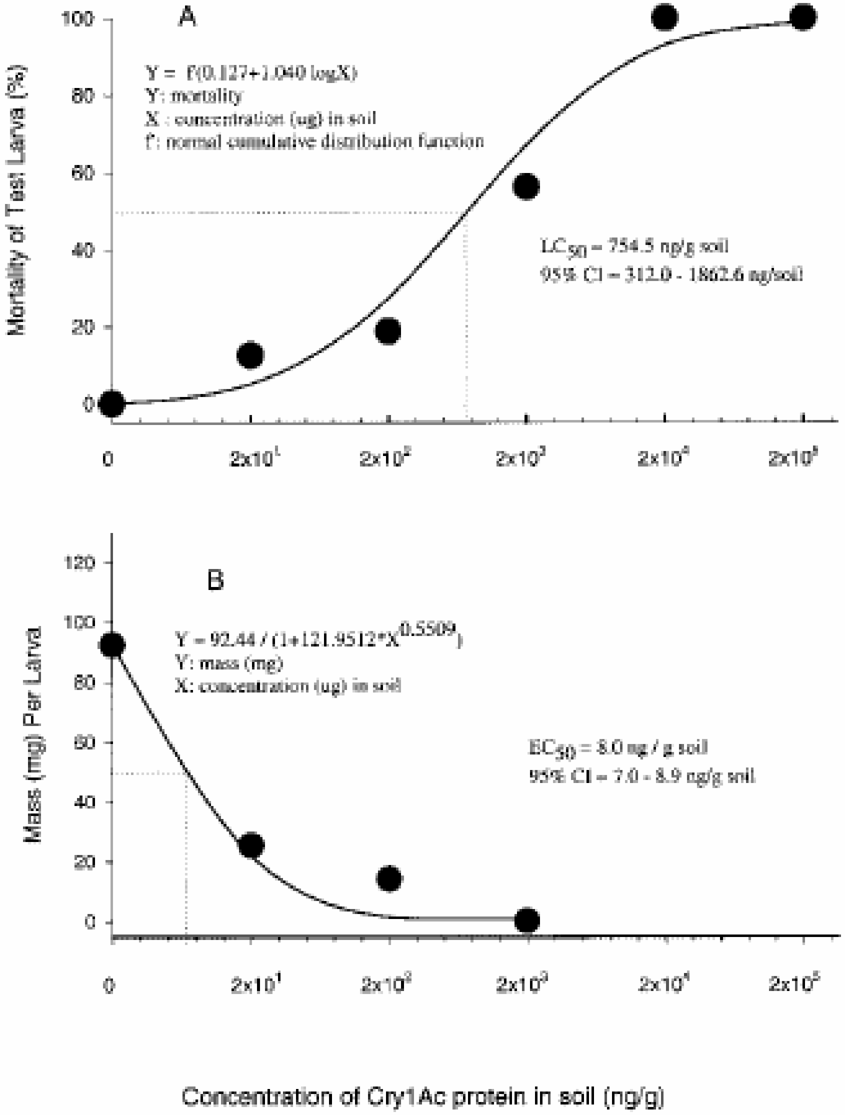

Fig. 1. Reference standard dose–response of *H. virescens* larvae feeding on diet mixed with soil samples spiked with known doses (2×10^1, 2×10^2, 2×10^3, 2×10^4, and 2×10^5 ng) of pure Cry1Ac protein per gram soil. (A) Dose–response for larval survival, and (B) dose–response for larval mass (mg).

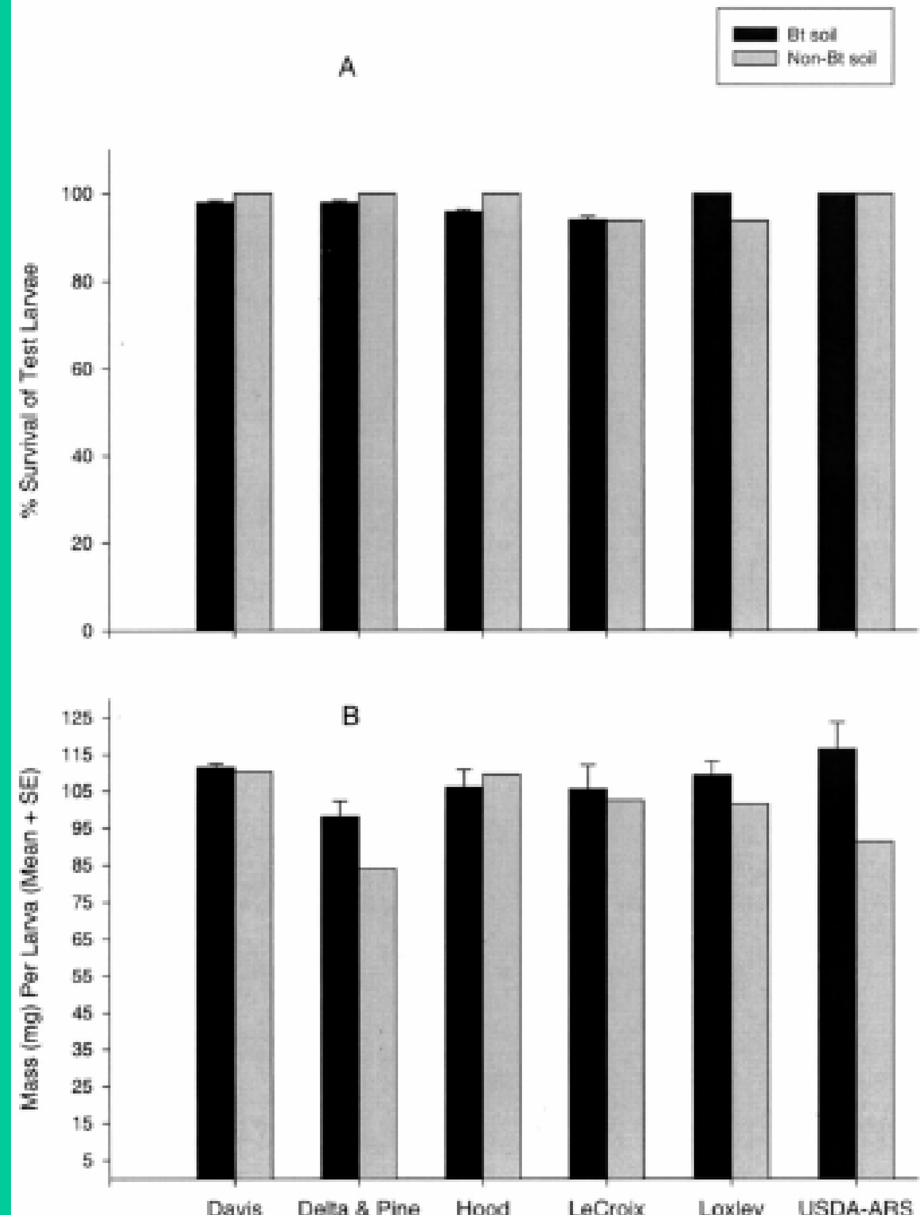

Fig. 2. Response of *H. virescens* larvae to diet mixed with soil samples collected from within and outside transgenic Bt cotton fields at six different sites. (A) Larval survival, and (B) average mass (mg) of surviving larvae.


順 路
THIS WAY

The new Euro bills are made out of pure cotton, most of it imported from the USA, see map of percentage of GM cotton in the USA. Since Europe has decided for a precautionary approach AND a proper labelling, we propose an altered and politically (nearly) correct Euro bill.

危机 = 危 + 机

Risk = Hazard / Chance

(Risk = Hazard x Likelyhood)


INSTITUTE for
ADVANCED HINDSIGHT
RESEARCH INTO WHAT
SHOULD HAVE BEEN