



Control of pollen-mediated flow of transgenes by cytoplasmic male sterility

The advent of genetically modified (GM) crop varieties has raised great public concern and political debate in many countries. Besides the acceptance of GM products themselves, the dispersal of GM pollen is of major agronomic interest with regard to the contamination of non-GM crop plants on adjacent fields with grave consequences for the product acceptance or the seed purity. The problems linked to the release of GM pollen could be reduced or even eliminated now by growing male sterile GM plants in a mixture with male fertile non-GM plants which act as pollen donors for the GM plants. Cytoplasmic male sterility was originally introduced for the production of cheap hybrid seed; for our method it has to be used without fertility restoration. A positive side-effect of growing cytoplasmic male sterile maize plants is that they often produce higher yields than their isogenic male fertile counterparts.

In another approach we are establishing methods for measuring cross pollination between different maize varieties. For this purpose a white grain maize hybrid is used that produces a yellow grain if pollen from a common maize hybrid is pollinating it. The yellow color can be taken as a simulated GM event. Thus the main biological factors (e.g. variety, time of flowering, duration of flowering, flower height, etc) affecting levels of cross pollination can be monitored in Swiss farmers' fields with the goal to set up models for the co-existence of different farming systems.



White grain maize ear with some yellow (dark) grains.



Tassels, left fertile, right cms.

Research focus

- Pollen dispersal
- Xenia effects
- Cytoplasmic male sterility

Interdisciplinarity

- Modeling of pollen flow
- Risk assessment
- Plant breeding



Contact person

Prof. Peter Stamp
Agronomy and Plant Breeding
Institute of Plant Sciences
ETH Zurich
Phone +41 (0)44 632 38 78 / 79
peter.stamp@ipw.agr.ethz.ch
www.ab.ipw.agr.ethz.ch

Liste 1: Promotionsarbeiten

	Betreuer(in)	Doktorand(in) und Titel	Anzahl der Betreuer
1.	Stamp, Peter	Eschholz, Tobias; Genetic relationship between Swiss maize landraces	3
2.	Stamp, Peter	Kumar, Sunil; Molecular analysis of cold tolerance of photosynthesis in maize	3
3.	Stamp, Peter	Munsch, Magali; Impact of cytoplasmic male sterility and xenia on maize yield	3
4.	Stamp, Peter	Pa-In, Nathinee; Quantitative trait loci controlling root traits of maize at drought	3
5.	Stamp, Peter	Zimmermann, Urs; Impact of elevated CO ₂ on the root system of white clover and English ryegrass	3
6.	Stamp, Peter	Weider, Christoph; Stability of cytoplasmic male sterility in maize	3
7.	Stamp, Peter	Vogler, André; Pollen dispersal in maize at short distance	3
8.	Stamp, Peter	Faget, Marc; Green fluorescent protein (GFP) for studying synchronicity of root location in mixed plant stands	3
9.	Stamp, Peter	Schneider, David; Alte Eigenschaften - neue Ansprüche: Schweizer Maislandsorten in der Landwirtschaft der Gegenwart und der Zukunft	3
10.	Stamp, Peter	Rupitak, Quanjai; The dynamics of female flowering and grain set in sweet corn	3
11.	Stamp, Peter	Kohls, Susanne; Identification and fine-mapping of rf-genes restoring	3
12.	Stamp, Peter	Freitag, Niclas; Ex-situ conservation and on-farm management in a core collection of Swiss maize landraces	3
13.	Stamp, Peter	Reimer, Regina; Temperature dependence of root morphology and root growth of modern maize inbred lines	3
14.	Stamp, Peter	Dang Ngoc Chi; Protein quality improvement of waxy maize by incorporation of QPM in South East Asia	3
15.	Stamp, Peter	Trachsel, Samuel; Genotype x environment interactions of root formation under multiple abiotic stresses	3
16.	Stamp, Peter	Dietiker, Dominique; Simulation of transgenic seed contamination effects in maize	3
17.	Stamp, Peter	Crespo, Pamela; Influence of agronomic factors on pertinent quality parameters of berry fruits	3
18.	Stamp, Peter	Levy, Lilia; Influence of environmental and genetic factors on quality parameters of feed cereals	3
19.	Stamp, Peter	Britschgi, Deborah; Transgenic grasses with fluorescent roots	3
20.	Stamp, Peter	Egodawatta, Chaminda; Integrating agronomic and socioeconomic aspects of reversing soil degradation by tropical legume trees by GIS analysis	3
21.	Stamp, Peter	Reynard, Jean-Sébastien; Recherche d'indicateurs physiologiques pertinents de l'état hydrique de la vigne (CVS Doral et Gamarete) dans le cadre d'une étude de terroirs viticoles	3

Liste 4: Forschungsprojekte

Projekt-ID	Projektleiter	Titel

1.	5901	Stamp, Peter	Genetic analysis of cold-tolerance of photosynthesis in maize
2.	8595	Stamp, Peter	Transcriptional profiling of maize genotypes exposed to a combination of cold temperature and light stresses.
3.	8637	Stamp, Peter	Study of genetic and physiological aspects of the resistance of cotton to water and temperature stresses
4.	8865	Stamp, Peter	Rooting patterns and protein yield of spring wheat cultivars.
5.	8866	Stamp, Peter	Rooting dynamics in crop successions. A model experiment with spring wheat and cover crops.
6.	11029	Stamp, Peter	Influence of different living mulches on weed populations and yield formation of winter wheat (<i>Triticum aestivum</i> L.) under no-tillage conditions.
7.	13935	Stamp, Peter	Sustainable Introduction of GMOs into European Agriculture SIGMEA
8.	15206	Stamp, Peter	Molecular biological and physiological analysis of cold tolerance of photosynthesis in maize (<i>Zea mays</i> L.)
9.	18952	Stamp, Peter	GM and non-GM supply chains: their CO-EXistence and TRAcEability (COEXTRA): sterility of CMS maize hybrids
10.	18953	Stamp, Peter	GM and non-GM supply chains: their CO-EXistence and TRAcEability (COEXTRA): Plus-hybrid effect in maize
11.	18954	Stamp, Peter	Improving protein quality of waxy maize by introgressing QPM
12.	18955	Stamp, Peter	Flowering pattern of sweet corn (<i>Zea mays</i> L.)
13.	18956	Stamp, Peter	Mapping restorer of fertility (rf) genes of CMS maize
14.	18957	Stamp, Peter	Integrating agronomic and socioeconomic aspects of reversing soil degradation by tropical legume trees by using GIS
15.	18980	Messmer, Rainer; Liedgens, Markus; Hund, Andreas; Stamp, Peter	Kombination aus Ex-situ-Erhaltung und On-Farm-Management Schweizer Maislandsorten auf Basis einer Kernkollektion
16.	19758	Liedgens, Markus	Alte Eigenschaften - neue Ansprüche: Schweizer Maislandsorten in der Landwirtschaft der Gegenwart und der Zukunft
17.	19760	Stamp, Peter	Seed purity in maize as one of the keys to define appropriate threshold limits for a peaceful coexistence
18.	19762	Liedgens, Markus	Green fluorescent protein (GFP) for studying synchronicity of root location in mixed plant stands
19.	19855	Leipner, Jörg	Adaptation and acclimation of the photosynthetic apparatus of crop plants to drought stress
20.	19925	Hund, Andreas	A common genetic basis for tissue growth rate under water-limited conditions across plant organs and genomes

Liste 5: Wissenschaftliche Publikationen

a) Referierte Publikationen

	Publikations-ID	Autoren	Titel	Erschienen in
1.	42050	Bannert M., Vogler A., Stamp P.	Short-distance cross-pollination of maize in a small-field landscape as monitored by grain color markers.	European Journal of Agronomy
2.	42051	Eschholz T.W., Peter R., Stamp P., Hund A.	Genetic diversity of Swiss maize (<i>Zea mays</i> L. ssp. <i>mays</i>) assessed with individuals and bulks on agarose gels.	Genetic Resources and Crop Evolution
3.	42052	Gobaa S., Bancel E., Branlard G., Kleijer G., Stamp P.	Proteomic analysis of wheat recombinant inbred lines: Variations in prolamin and dough rheology.	Journal of Cereal Science
4.	42053	Hiltbrunner J., Liedgens M.	Performance of winter wheat varieties in white clover living mulch.	Biological Agriculture & Horticulture
5.	42054	Hund A., Fracheboud Y., Soldati A., Stamp P.	Cold tolerance of maize seedlings as determined by root morphology and photosynthetic traits.	European Journal of Agronomy
6.	42056	Leipner J., Jompuk C., Camp K.-H., Stamp P., Fracheboud Y.	QTL studies reveal little relevance of chilling-related seedling traits for yield in maize.	Theoretical and Applied Genetics
7.	37006	Massacci A., Nabiev S.M., Pietrosanti L., Nematov S.K., Chernikova T.N., Thor K., Leipner J.	Response of the photosynthetic apparatus of cotton (<i>Gossypium hirsutum</i>) to the onset of drought stress under field conditions studied by gas-exchange analysis and chlorophyll fluorescence imaging.	Plant Physiology and Biochemistry
8.	42057	Rieger S., Richner W., Streit B., Frossard E., Liedgens M.	Growth, yield, and yield components of winter wheat and the effects of tillage intensity, preceding crops, and N fertilisation.	European Journal of Agronomy
9.	42060	Sangakkara U.R., Attanayake K.P., Stamp P.	Impact of locally derived organic materials and method of addition on maize yields and nitrogen use efficiencies in major and minor seasons of tropical South Asia.	Communications in Soil Science and Plant Analysis

10.	42059	Sangakkara U.R., Nissanka S.P., Stamp P.	Effects of organic matter and time of incorporation on root development of tropical maize seedlings.	Acta Agronomica Hungarica
11.	42058	Sangakkara U.R., Stamp P.	Impact of improved fallow periods on soil properties and productivity of maize (Zea mays L.) in major and minor seasons of Asian humid tropics.	Acta Agronomica Hungarica
12.	42061	Waldispühl S., Stamp P., Streit B.	Effect of tillage systems and herbicides on the control of Yellow Nutsedge /Cyperus esculentus L.) in maize.	Journal of Plant Diseases
b) Monografien				
	Publikations- ID	Autoren	Titel	Erschienen in
c) Varia				
	Publikations- ID	Autoren	Titel	Erschienen in
1.	42055	Kölliker R., Gaume A., Hund A., Winzeler M., Einsele A.	Eine Vision für den Schweizer Pflanzenbau im Jahr 2050.	AgrarForschung

Liste 6: Vorträge vor wissenschaftlichem Publikum

a) Eingeladene Vorträge vor wissenschaftlichem Publikum		
	Redner	Titel
1.	Stamp, Peter:	Klimawandel im Gespräch, Switzerland, Zurich-Reckenholz (Forschungsanstalt Agroscope ART), 18.01.2008, Herausforderung Klimawandel: Klimawandel - Witterungsrisiken - Landwirtschaft.
2.	Stamp, Peter:	Züchtung - die Voraussetzung für gutes Brot, Switzerland, Zurich (ETH), 01.06.2008, Unsere Nahrung - eine globale und eine Schweizer Perspektive.
3.	Stamp, Peter:	Wie viel Boden braucht der Mensch?, Switzerland, Zurich (ETH), 11.09.2008, Landmanagement ermöglicht eine optimierte Ressourcennutzung.

4.	Stamp, Peter:	Pflanzenbau im Wandel, Germany, Kiel, 10.07.2008, Festkolloquium an der Agrar- und Ernährungswissenschaftlichen Fakultät.
5.	Stamp, Peter:	Ernährungssicherung in einer globalisierten Welt, Switzerland, Klosters, 02.12.2008, Trends im Foodmarkt - Chancen für die Schweizer Gemüseproduzenten.
6.	Leipner, Jörg:	Chilling tolerance in maize: From physiology to genetics, Poland, Warsaw, 4.6.2008, Seminar of the Institute of Botany.
7.	Biradar, Sunil:	Marker assisted introgression of a major QTL for chilling tolerance of photosynthesis in maize. Austria, Vienna, 3-6 February 2008, Molecular mapping & marker assisted selection in plants.
8.	Hund, Andreas:	Is genetic variation in root growth of maize related to drought resistance? Germany, Hohenheim, 12.02.2008, Kolloquium zur Züchtungsforschung, Biotechnologie und Saatgutforschung.
9.	Aulinger-Leipner, Ingrid:	GM pollen containment by cytoplasmic male sterility (CMS) in maize. England, York, 5-8 February 2008, Co-extra annual meeting 2008.
10.	Aulinger-Leipner, Ingrid:	The plus-hybrid system in maize: A new approach of gene flow mitigation and yield increase. England, York, 5-8 February 2008, Co-extra annual meeting 2008.
11.	Reynard, Jean-Sebastien:	Swiss terroir studies, Switzerland, Nyon, 19-23 May 2008, VIIth International Terroir Congress.
12.	Messmer, Rainer:	Saving water by adapted crops: Drought resistant maize, Switzerland, Zurich (ETH), 04.06.2008, Water for development (Annual Conference of the North-South Centre).
13.	Crespo, Pamela:	Effect of tunnel cultivation on quality and yield of ten strawberry genotypes, Germany, Geisenheim, 29-31 October 2008, COST 863 workshop on berry production in changing climatic conditions and cultivation systems.
14.	Lukman, Rudy, Afifuddin, Ahmad, Stamp, Peter, Thiraporn, Rachain, Khaeruni, Andi:	A precise means to confirm purity of commercial maize varieties on the basis of SSR analysis. Indonesia, Makassar, 20-23 October 2008, The 10th Asian Regional Maize Workshop.

b) Sonstige Vorträge und Posterpräsentationen vor wissenschaftlichem Publikum

	Redner	Titel
1.	Stamp, Peter:	The potato's long journey in Swiss science and research, Switzerland, Zurich (ETH), 22.02.2008, Potato research for development.
2.	Stamp, Peter:	Saving water by adapted crops: Drought resistant maize, Switzerland, Zurich (ETH), 04.06.2008, Prospects for integrated water resources management.
3.	Sangakkara, Ravi, Stamp, Peter:	Nitrogen use efficiency of maize grown in tropical major and minor seasons, Korea, Jeju, 13-18 April 2008, Soil conservation and integrated nutrient management.
4.	Sangakkara, Ravi, Stamp, Peter:	Root development, shoot growth and yields of maize as affected by irrigation schedules in a minor season in tropical Asia, Korea, Jeju, 13-18 April 2008, Soil conservation and integrated nutrient management.

5.	Trachsel, Samuel, Messmer, Rainer, Stamp, Peter, Hund, Andreas:	Identification of root QTLs conferring drought tolerance in tropical maize, Austria, Vienna, 3-6 February 2008, Molecular mapping & marker assisted selection in plants.
6.	Pa-In, Nathinee, Liedgens, Markus, Ribaut, Jean-Marcel, Stamp, Peter, Hund, Andreas:	QTLs for the response of root elongation to desiccation in tropical maize, Austria, Vienna, 3-6 February 2008, Molecular mapping & marker assisted selection in plants.
7.	Messmer, Rainer:	The genetic dissection of drought tolerance in tropical maize. Austria, Vienna, 3-6 February 2008, Molecular mapping & marker assisted selection in plants.
8.	Weider, Christophe, Munsch, Magali, Aulinger-Leipner, Ingrid, Stamp, Peter:	Pollen containment by cytoplasmic male sterility (CMS) in maize (<i>Zea mays</i> L.). The plus-hybrid system in maize: a new approach of gene flow mitigation and yield increase. England, York, 5-8 February 2008, Co-extra annual meeting 2008.
9.	Munsch, Magali, Weider Christophe, Camp, Karl-Heinz, Stamp, Peter:	Plus-hybrids in maize, a new approach of gene flow mitigation increasing the yield. England, York, 5-8 February 2008, Co-extra annual meeting 2008.
10.	Liedgens, Markus:	Einblick in die Wurzelforschung des Instituts für Pflanzenwissenschaften: Wurzeleitfaden, Switzerland, Lindau-Eschikon, 10.09.2008, Wurzeltag.
11.	Schneider, David:	Exploring early vigour of Swiss maize landraces, Switzerland, Kappel am Albis, 21-22 August 2008, Symposium for new PhD students 2008 (Institute of Plant Science, ETH Zurich).
12.	Freitag, Niclas:	Die Vielfalt alter Maislandsorten, Switzerland, Zürich, 26.09.2008, Gemeinsame Tagung Europäische Union, ETH Zürich, Universität Zürich, Alstom.
13.	Freitag, Niclas, Stamp, Peter, Messmer, Rainer:	Charakterisierung Schweizer Maislandsorten, Germany, Göttingen, 30.09.08-02.10.08, Biodiversität in der Pflanzenproduktion (Gemeinsame Tagung der Gesellschaft für Pflanzenbauwissenschaften und der Gesellschaft für Pflanzenzüchtung).
14.	Schneider, David, Stamp, Peter, Liedgens, Markus:	Exploring early vigour of Swiss maize landraces, Germany, Göttingen, 30.09.08-02.10.08, Biodiversität in der Pflanzenproduktion (Gemeinsame Tagung der Gesellschaft für Pflanzenbauwissenschaften und der Gesellschaft für Pflanzenzüchtung).
15.	Dang, Chi:	Protein quality improved waxy maize varieties for South East Asia, Germany, Stuttgart, 7-9 October 2008, Tropentag 2008: Competition for Resources in a changing world: New drive for rural development.
16.	Messmer, Rainer, Fracheboud, Yvan, Bänziger, Marianne, Ribaut, Jean-Marcel:	Drought stress in tropical maize : the genetic dissection of key traits in multiple environments, Germany, Stuttgart, 7-9 October 2008, Tropentag 2008: Competition for Resources in a changing world: New drive for rural development.
17.	Rupitak, Quanjai, Aulinger-Leipner, Ingrid, Messmer, Rainer, Stamp, Peter:	Dynamics of ear grain set in maize under drought stress of flowering, Germany, Stuttgart, 7-9 October 2008, Tropentag 2008: Competition for Resources in a changing world: New drive for rural development.

18.	Faget, Marc:	Development of a method for studying root growth in mixed plant stands, Switzerland, Zurich, 25.11.2008, Kolloquium in Pflanzenwissenschaften.
19.	Trachsel, Samuel:	Genotype x Environment interaction of root formation under multiple abiotic stresses, Switzerland, Zurich, 16.12.2008, Kolloquium in Pflanzenwissenschaften.
20.	Messmer, Rainer:	Toward improved water productivity of tropical maize, Switzerland, Zurich (ETH), 12.12.2008, How to ensure food security today and tomorrow? Agriculture in the face of new and urgent global needs (Conference of the North-South Centre and the Syngenta Foundation for Sustainable Agriculture).

Liste 7: Gutachten

	Gutachter	Art des Gutachtens	Typ der anfordernden Organisation	Sitz der anfordernden Organisation	Anzahl
1.	Leipner, Jörg	Projektanträge	Bundesstellen (-ämter)	Europa	1
2.	Leipner, Jörg	Publikationen			11
3.	Stamp, Peter	Projektanträge	Forschungsinstitute	Europa	2
4.	Stamp, Peter	Publikationen			13
5.	Stamp, Peter	Dissertation	ETH Zürich / ETH Bereich	CH	2

Liste 11: Organisierte Kongresse

	Organisator(en)	Titel	Ort	Teilnehmerzahl
1.	Liedgens, Markus, Jäger Mareike, Messerli Niklaus:	Wurzeltag: Die Wurzeln lassen uns nicht los	Switzerland, Lindau-Eschikon, Versuchsstation ETH	40

Liste 12: Kommissionsarbeit

	Kommissionsmitglied	Neu	Typ Kommission	Typ Organisation	Sitz	Anzahl
1.	Leipner, Jörg	Nein	Editorial Board	andere	Europa	1
2.	Leipner, Jörg	Nein	Editorial Board	Privatfirmen / Industrie	Europa	1
3.	Hund, Andreas	Ja	Fachkommissionen	andere	CH	1
4.	Liedgens, Markus	Ja	Editorial Board	andere	Europa	2
5.	Stamp, Peter	Nein	Editorial Board	andere	Europa	4
6.	Stamp, Peter	Nein	Fachkommissionen	Forschungsinstitute	CH	1
7.	Stamp, Peter	Nein	Stiftungsrat / Verwaltungsrat	öffentliche	CH	1
8.	Stamp, Peter	Nein	Forschungskommission	Forschungsinstitute	Europa	1
9.	Stamp, Peter	Nein	weitere Kommissionen	Bundesstellen (-ämter)	CH	1

10.	Stamp, Peter	Ja	Planungskommission	ETH Zürich / ETH Bereich	Asien	1
11.	Stamp, Peter	Ja	Planungskommission	ETH Zürich / ETH Bereich	CH	1
12.	Stamp, Peter, Mitglied Expertengruppe	Ja	Forschungskommission	Bundesstellen (-ämter)	CH	1
13.	Stamp, Peter, Mitglied EFBS	Ja	Fachkommissionen	Bundesstellen (-ämter)	CH	1
14.	Stamp, Peter, Ausschuss	Ja	weitere Kommissionen	ETH Zürich / ETH Bereich	CH	1

Liste 13: Öffentlichkeitsarbeit

a) Presseartikel	
	Bezeichnung
1.	Wie viel Boden braucht der Mensch? (Peter Stamp), Geomatik Schweiz, 10/2008.
2.	Ackerbau 2050 - Eine Herausforderung (Peter Stamp), UFA-Revue, 03/08.
3.	L'agriculture a besoin de managers qui la défendent (Peter Stamp), Revue UFA, 02/08.
b) Vorträge vor nicht-wissenschaftlichen Gremien	
	Bezeichnung
c) Andere Veranstaltungen	
	Bezeichnung
1.	Spezialitäten-Herbstfest (ZHAW und NAP), Erhaltung pflanzengenetischer Ressourcen am Beispiel Mais (Niclas Freitag), Schweiz, Wädenswil, 13.09.2008.
2.	Spezialitäten-Herbstfest (ZHAW und NAP), Vielfalt und Herkunft Schweizer Maislandsorten (Niclas Freitag), Schweiz, Wädenswil, 13.09.2008.
3.	Spezialitäten-Herbstfest (ZHAW und NAP), Maislandsorten: Unkraut- und Kältetoleranz in der Jugendentwicklung (David Schneider), Schweiz, Wädenswil, 13.09.2008.
4.	Nacht der Forschung: Die vielen Farben von Mais (Rainer Messmer, Niclas Freitag, David Schneider), Euresearch und ETH Zürich, Schweiz, Zürich, 26.09.2008.
5.	Nacht der Forschung: Die 1000 Wege des Pollenflugs (Dominique Dietiker), Euresearch und ETH Zürich, Schweiz, Zürich, 26.09.2008.
6.	Nacht der Forschung: Virtueller Sortengarten - Ackerbau im Internet (Susanne Stamp), Euresearch und ETH Zürich, Schweiz, Zürich, 26.09.2008.
7.	Nacht der Forschung: Licht ins Dunkle - Beobachtung von Pflanzenwurzeln (Markus Liedgens), Euresearch und ETH Zürich, Schweiz, Zürich, 26.09.2008.