

NEWSLETTER NRP 59

Benefits and Risks of the Deliberate Release of Genetically Modified Plants

EDITORIAL

Prevailing conditions are decisive

The NRP 59 synthesis process has begun. This means that we are condensing the results of the separate projects into an overall picture. This process includes a series of workshops during which the scientists discuss their work of the last three years with practically orientated specialists. The insights gained during these discussions will then be included in the further condensation of the results.

A first workshop on coexistence was held in March and brought together representatives from agriculture, the federal offices, cantonal executive authorities and NGOs. They discussed possible biological implications such as cross-breeding or the mixing of seed from different cultivation methods, basic legal conditions, as well as possible agro-economic repercussions of the cultivation of genetically modified plants.

The results of a specific project that we present to you in more detail in this newsletter were also discussed. This project shows that the cultivation of GMPs brings about quite a bit more work for the farmer: neighbours need to reach agreements, safety distances need to be observed, tools and machines must be cleaned. On the other hand, under certain conditions, GMPs also promise economic advantages, including higher yields and lower pesticide use amongst other things. It is interesting to see who would profit most, according to the agro-economic model used: organic production in the presence of large numbers of pests. Both are however hypothetical assumptions of the model. Presently, pest numbers are small in Switzerland – and organic cultivation methods and GMOs are (still) two incompatible worlds.

Prof. Dr. Dirk Dobbelaere
President of the NRP 59 Steering Committee

ECONOMIC VIABILITY

Coexistence is possible; its economic viability is arguable

If the cultivation of genetically modified plants is authorized after the moratorium expires, it will be important to prevent mixing with conventionally cultivated plants. A research group at Agroscope has examined how high the investments are to make coexistence possible and what its benefits would be.



image: Avenue Images

Assuming the cultivation of genetically modified plants (GMP) is to be authorized in Switzerland, would the farmers be interested in growing such plants? What factors would be decisive for their decision? And how high would the costs for coexistence be?

In order to answer these questions, a group at the Agroscope Reckenholz-Tänikon ART research institute questioned farmers in three villages in the canton of Zurich. These farmers are representative of Switzerland in that a large part of their land is arable and because of the size of their holding. Of the 86 farmers in the test area, 61 participated in the survey.

One third of them would consider cultivating GMPs – though only under certain conditions. The GMPs would have to reduce their workload and not have any negative repercussions on the environment. The appraisal of

One out of three farmers is considering sowing genetically modified plants, if this is permitted in the future.

the neighbours' opinion would also be important in determining a farmer's personal decision concerning the cultivation of GMPs.

Coexistence costs are relatively low

In order to make possible the side by side cultivation of conventional and genetically modified plants, various additional costs arise: the farmers must apply for authorizations and the neighbouring holdings need to be informed. Further costs are caused by the cleaning of seeders and harvesters as well as all the measures necessary to prevent the mixing of genetically modified and conventional products during transportation. The height of the expected coexistence costs depends on various factors.

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The size of an agricultural holding is an important factor when determining whether the cultivation of GM crops is worthwhile.

These are:

- the size and the structure of the holding
- the behaviour of the neighbours and
- the legal guidelines.

The smaller and the more cut up the area of the holding, the more restrictive the guidelines and the larger the number of conventionally or organically worked fields in the vicinity, the higher are coexistence costs. The cost calculations were performed using various scenarios (favourable, average, unfavourable), in which all three factors were varied.

The calculations show that for Bt grain maize the additional costs for coexistence amount to 92 francs in the most favourable case, to 274 francs in the average scenario and to 899 francs per hectare and year in the unfavourable case. In terms of the total production costs, this

equates to between 1.6 and 16.6 percent, for estimated cultivation costs of 5591 francs per hectare.

For further crops the coexistence measures were adapted in a crop-specific manner. For example, in the case of genetically modified wheat, the safety distance between fields can be minimal because wheat is self-pollinating and the pollen is not carried far. On the other hand, herbicide-resistant rape seed would require a large safety distance and during six years one would need to laboriously check whether GM plants have multiplied in an uncontrolled manner within the field. This means more work, rendering coexistence more expensive.

In a next step, the scientists developed a so-called multiagent model. This model takes into account the true size of the holdings in the test area and the opinions of the

farmers as expressed during the survey. In this way, the calculated costs for coexistence depend only on the legal guidelines. On average, they amount to 80 to 217 francs per GMP-growing holding. The additional costs would be economically acceptable, thinks project leader Stefan Mann. "Coexistence costs would not prevent the cultivation of transgenic plants, even under the most severe conditions we tested."

No benefits under the present pest infestation conditions

In the end however, the question whether the cultivation of genetically modified plants is worthwhile for a holding is decisive: the additional costs for coexistence and more expensive seed versus lower harvest losses and savings in the area of pest control. In this respect there are differences that depend on

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Comparison of the economic viability of arable crops in the average coexistence scenario

	Grain maize			Rape seed		Winter wheat		Sugar beet	
	Conv.	Bt	HT	Conv.	HT	Conv.	FR	Conv.	HT
Revenue (francs / hectare)	5 713	5 906	5 906	5 744	5 808	5 198	5 148	10 830	11 198
Cost (francs / hectare)	5 312	5 591	5 347	5 664	5 254	5 149	5 308	9 304	9 032
Profit / Loss (francs / hectare)	401	315	559	80	554	49	-160	1 526	2 166
Excess profit GMP versus conventional (francs / hectare)		-86	+158		+474		-209		+640

Conv. = conventional cultivation, Bt = resistance to plant-eating insects, HT = herbicide tolerance, FR = fungus resistance

As a general rule, the revenue for genetically modified arable crops is higher than for conventional cultures, due to higher yields – up to 3.4 percent for grain maize and sugar beets. The total costs vary strongly from one crop to another. They are 5.3 percent higher for Bt than for conventional grain maize. For HT grain maize however, the cost increases by only 0.7 percent, as considerable savings can be realized in terms of work and machine costs. Savings are also possible on these points for HT rape seed and HT sugar beets, amounting to a total cost reduction of 7.2 percent

for HT rape seed and 2.9 percent for HT sugar beets. In the case of FR wheat, the work and machine cost savings cannot compensate the extra costs for coexistence. For this crop, the costs are 3.1 percent higher than for conventional wheat.

Finally, the economic viability of HT grain maize, HT rape seed and HT sugar beets can be judged positive. When these crops are cultivated by means of a direct sowing method, an excess profit ranging from 158 francs for grain maize to 640 francs for sugar beets can be achieved per ha land under crop.

The cultivation of Bt grain maize and FR wheat, on the other hand, is not deemed worthwhile. The profit for Bt grain maize is 86 francs per hectare lower than that of conventional grain maize. For FR wheat the disadvantage by comparison with conventionally grown wheat is even more distinct, amounting to 209 francs per hectare.

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image: Avenue Images

the characteristics of each genetically modified plant. All herbicide-tolerant crops are of interest, as for these cost savings and higher yields can lead to higher profits per cultivated hectare. Bt grain maize and FR winter wheat on the other hand are not of interest because the profit per hectare for both these crops is lower than for the conventional crops.

For these calculations the scientists assumed that one quarter of the maize plants were infested by pests. According to the farmers however, the actual infestation is much less severe. From this the researchers concluded that under the given circumstances the additional costs for GM seed and coexistence are not worthwhile in the case of Bt maize and that the potential of this GMP is limited in Switzerland. However, new crops such as herbicide-tolerant sugar beets have been put

The smaller the structure of the fields, the more complicated are the precautionary measures for coexistence.

on the market since the study began. Currently, the scientists at Agroscope are testing their economic viability. For this crop, the result could be different, because in this case weeds are a much severer problem than in maize and rape seed. However, herbicide-tolerant crops can be deemed positive in terms of their economic viability when their cultivation permits a change from a conventional mode of cultivation with a plow to a no-till method. ♦

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Improving communication on gene technology experiments

Since many years the use of gene technology in non-human organisms is a source of highly controversial discussions in Switzerland. While supporters and opponents often voice their opinions in a detailed manner well covered by the media, the authorities' official communication, as demanded by the legislators, remains modest.



Image: Gabriela Brändle, ART

Federal Councillor Doris Leuthard informs herself about the GM wheat release trials on site. In order that other people can also be adequately informed, the legal bases need to be revised.

In the year 2000, researchers at the Swiss Federal Institute of Technology (ETH) in Zurich applied for the authorization of a release trial with transgenic KP4 wheat (see background information, page 6). At that time, they could not have guessed that another four years would go by before they could sow outdoors. The reason for this long procedure: the canton of Zurich as well as the involved federal offices and commissions demanded additional information from the scientists concerning the planned trial. The local residents also felt that they had not been informed properly – by the ETH, but also by the authorities; and this even though legislators dictate that the population be informed on the release of genetically modified plants.

Reasons have been identified

“The legal mandate to provide information is not formulated precisely enough”, says Rainer J. Schweizer of the University of St. Gallen. Within the NRP 59, the jurist and his interdisciplinary team have examined why the guidelines established by the legislators have until now been applied insufficiently. For this purpose, the legal and communication specialists analyzed the valid Law on Gene Technology (LGT) and the Release Ordinance (RO), as well as other federal information requirements. They also questioned people representing the administration, science, commissions and dialogue organs regarding their handling of the current guidelines. Additionally, they examined the communication strategy applied within the context of the release trial in Lindau in the canton of Zurich.

Overloaded law gives leeway

At first sight the results of this legal examination seem paradoxical: the LGT as well as the RO contain numerous regulations and requirements which deal specifically with communication. Yet these are very poorly structured and the information subjects are only generally described. “There is uncertainty as to who must inform whom, about what and when”, says Schweizer. In these regulations, important questions are often left unanswered. In addition, the legal orders do not differentiate between internal and public communication. This double-use can result in interpretation problems, which means that the people involved in the procedure can interpret the norms at their leisure.

At leisure – with consequences

The survey has shown that all people involved in the procedure – with the

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