



Chapter 1

Impact Assessment

1.1 Need for an impact assessment

There are scientific concerns that genetically modified (GM) crops are a risk for the environment and that the environmental impact of such crops has to be studied in detail before GM crops are produced on a large scale in a specific environment. This information will ultimately allow possible recommendations for the appropriate relatively risk-free growing of GM crops and can help developing countries in particular to preserve and use their resources economically to their best advantage.

This impact assessment study has therefore been focused on identifying and evaluating some of the potential risks these GM crops might have on the South African flora. This includes

- The possibility of gene flow from corn and cotton, which are currently grown still on an experimental scale as commercial GM crops in South Africa, to both their wild and cultivated plant relatives by cross-pollination.
- The possible transfer of herbicide resistance from GM crops to weedy relatives.
- The creation of super weeds by the application of GM crops.
- The possible transfer of insect resistance from GM crops to weedy relatives.

1.2 What is an impact assessment?

An impact assessment helps to support a technology development to stimulate further research in order to remedy any intended and unintended adverse effects of the technology (Anandajayasekaram *et al.*, 1996). The term 'impact assessment' means,



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however, different things to different people and there is generally no single definition of 'impact assessment'. Porter *et al.* (1980) for example defines impact assessment as the systematic study of the effect on a society, which can also be a plant/animal society that may occur when technology or development projects are introduced, extended or modified. It emphasizes those consequences that are unintended, indirect or delayed. In contrast, Boroush *et al.* (1980) defines impact assessment as a perspective that seeks holistically to inquire into short and long-term effects arising from the interactions of technologies and societal systems. In this study the impact assessment is defined as the assessment of the effect of transgenic plants on the South African flora. It is necessary to determine whether the transgenic maize and cotton have an adverse effect on the South Africa's natural environment and whether any precautionary measures need to be taken.

1.3 Purpose of an impact assessment

The purpose of an impact assessment is to increase the awareness of a possible risk due to the generation of unwanted side effects from technological change. This might have provoked a widespread demand for improved mechanisms to manage or control new technology or development project initiatives (Boroush *et al.*, 1980). Impact assessment will enable policy makers to consider systematically the known options about future technological or project developments. It will further allow them to encourage, discourage, modify, and prepare the institutional infrastructure and to block them when appropriate. Furthermore, impact assessment assumes that the future is not pre-ordained and that it can be shaped in accordance with conscious choices.

The purpose of conducting an impact assessment also depends on when the assessment is done (Anandajayasekaram *et al.*, 1996). An impact assessment can be carried out before initiating any research (*ex-ante*) or after the completion of research activity (*ex-poste*), which would then include technology transfer, which is also applicable for this study. The purpose of undertaking an impact assessment prior to starting a research program is to assist in any planning and priority setting. This will allow studying the likely impact of a proposed research activity project and formulate research priorities by examining the



relative benefits of different research programs. It further assists to identify the optimal combination of research programs. An *ex-ante* assessment can also provide a framework for gathering information to carry out an *ex-poste* evaluation.

Anandajayasekaram *et al.* (1996) identified the following two purposes for conducting an *ex-poste* impact assessment after the completion of the program:

- To provide feedback for researchers and policy-makers.
- To improve the decision making process.

The special appeal of impact assessment is that it is an early warning system based on systematic evaluation conducted ahead of the introduction of the technology or project (Borouh *et al.*, 1980). Even though the most thorough impact assessment cannot possibly anticipate all future impacts and risks of a new technology or project, a comprehensive assessment could, however, narrow the usual vast range of uncertainty by distinguishing what is known from what is unknown.

A well-executed impact assessment could provide the following outcome (Porter *et al.*, 1980):

- Modify the project.
- Stimulate research and technology, particularly to deal with adverse effect of the technology.
- Stimulate research to specify or define risks.
- Identify regulatory and legal changes to promote or control the technology.
- Define intervention experiments to reduce negative or enhance positive consequences.
- Stop the technology.
- Provide a reliable base of information to parties at interest.



1.4 Case studies

Case studies are one of the most useful methods of examining the relationship between research and development of a product and its associated impacts. Such a case study, using two South African GM crops (maize and cotton) as examples, has been carried out in this thesis. Case studies are generally conducted in conjunction with other methods such as surveys, as done also in this study, and cost-benefit methods (Anandajayasekaram *et al.*, 1996). The primary advantage of case studies is that if carried out in sufficient number and detail, they represent probably the best chance of fully identifying the relationship between research and development activities and the resulting impacts. Case studies are suitable to estimate the impact of past research and development activities and, therefore, they are more suitable for assessing applied research.

1.5 Environmental impact assessment

Environmental impact assessment (EIA) can be defined as an activity designed to identify and predict the impact of an action specifically on the bio-geophysical environment and on man's health and well being and to interpret and communicate information about the impacts (Munn, 1979). This thesis can be considered as an EIA study on transgenic plants mainly maize and cotton. However, there is no general and universally accepted definition of EIA. The following examples illustrate the great diversity of definitions:

- To identify, predict and describe in appropriate terms the pros and cons of a proposed development.
- To assess all relevant environmental and resulting social effects, which would result from a project.

Such definitions provide a broad indication of the objectives of EIA but they illustrate different concepts of EIA.



The main objective of EIA is to provide decision-makers with an account of the implications of the proposed course of action before a decision is made (Clark, 1983). Despite the diversity of techniques, the differences in emphasis, and the varied objectives that characterize impact assessment as practiced in different nations, four important aspects of EIA are increasingly approaching consensus (Erickson, 1994). This includes first seeing the environment as the aggregate of things and conditions that surround or envelop everything including non-living things. Secondly, the value of EIA to be more likely realized in the timely communication of information between individuals conducting the assessment and individuals planning a proposed project. Thirdly, realizing that although many environmental components, processes and attributes are amenable to currently available methods of quantification, many are not. Fourthly, mitigation of significant impacts, which includes the minimization of undesirable impacts and enhancement of desirable impacts and which must be assessed for all possible impacts.