MAHYCO at Jalna is the first private seed company in getting approval for commercial production of Bt cotton seeds. Out of nearly 1 lakh acres which has come under Bt cotton in the country during kharif 2002, more than 35,000 acres has been taken up in the state. Farmers are enthusiastic to accept genetically modified seeds provided the cost of plant protection goes down and the productivity shows improvement. A preliminary survey by an expert committee of GOI has indicated positive results on both the counts. Though there are certain concerns expressed from a few quarters questioning the success of the experiment, as far as farmers are concerned, they are adopting this frontier technology with all the recommended package of practices, like the growing of a refuge area with non-Bt cotton.

### 11.1 Many crops of importance to Maharashtra still are grown as varieties, in some cases due to lack of availability of hybrids or inadequate knowledge about the same. The state should promote the use of hybrids in crops such as sorghum, wheat, pigeon pea, desi cotton (diploid cotton), safflower and others. This can be achieved within five to seven year time period.

### 11.2 Gene transfer technologies are available in many crops, including crops of importance to Maharashtra such as cotton, sorghum, pigeon pea, number of vegetables. However, not all of them are being used in the state to bring technology products to the farmer. To make use of these advances it is essential to have the basic infrastructure in place and the need for sustained investments. A favourable regulatory environment will help developers and investors in bringing new products to the market place.

### 11.3 New laboratory tools and technologies are improving our efficiency and effectiveness. Technologies that utilize molecular markers, disease diagnosis tools and others provide precision, which was not possible with conventional tools. New knowledge is also available in the form of sequences of whole genomes as published for rice. It is important that the State establishes at least one institute / centre that works in these areas to maintain its leadership position in agricultural technology. This institute/centre should be a part of any of the existing universities and should also provide suitable training in new laboratory tools to various research workers in the state.
11.4 Maharashtra has large number of agricultural universities and other research institutes that are engaged in agricultural research. The State has strong plant breeding programs and the same need to be further strengthened to make use of new tools. Biotechnology activities are at different stages of development at different universities and institutes within the state. In this regard it will be very important to have an inventory of biotechnology tools and technologies which are in use at the Institutes / universities and their current status to define clearly the gaps and fill the same.

11.5 A clear understanding on biosafety issues is a must and it is important that information in this regard is widely distributed and understood, some training program should be organized.

11.6 Uses of molecular markers are at varying stages. This tool should be an integral part of all plant breeding activities and for key crops in the state, centers be designated to do marker analysis for the crop.

11.7 Strategic research for future needs must focus on the area of drought. A strategic program to look at how drought or water limiting conditions can be overcome with improved plants should be a key research area. Genomics research to address drought would build capacity in the state as well as would help to innovate.

11.8 Precision farming methods allow for fertilization only when soil health is below the optimum, use of weedicides and use of pesticides only after the insect ETL has crossed or use of water only when essential. With the use of diagnostic tools, state should optimize the use of all these farm inputs to maximize productivity in a sustainable manner.

11.9 The challenge of producing enough food in water limiting environment should be met by modifying the plants so that productivity is maintained with the use of less water combined with on farm water management practices and water conservation.

11.10 Technologies both conventional and new are available which allow us to manage our soil better. Soil residue, use of biofertilizers and bioremediation are also tools which can be used in sick soils. Cropping practices such as low tillage or zero-tillage can help reduce soil erosion. The state already has facilities of soil testing and the same need further support to enlarge their activity.

11.11 With advances made in information and communication technologies, agriculture can be greatly benefited by using this infrastructure to have access to information, extension advice can be sought at farm level, weather information and centralized data facilities could be created and most important, this could be used as supplemental classroom to bring new advances and knowledge at farm level.
11.12 Along with the existing policy of the state to provide connectivity, the state universities could use this connectivity for educational purposes as well.

11.13 Maharashtra has a strong university and research institute structure in place. To make full use of the biotechnology revolution, academic curriculum being offered at both graduate and post graduate levels, training needs of students and faculty in new areas, basic infrastructure needs and availability, priority setting exercise at state level for crops, traits and agricultural practices and designation of centre of excellence on thematic basis needs to be reviewed and modifications made wherever necessary.

11.14 In addition to the existing university infrastructure which focuses on imparting education and conducting research, technology based entrepreneurship should be encouraged by setting up knowledge parks, biotechnology parks as a unique opportunity to build partnerships between academia and commercial enterprise and public and private sectors.

11.15 Biotechnology research requires large investment commitment for multiple years. Given the existing capital infrastructure of the universities, the initial investment requirement should be provided on priority by the state. Similarly, State can build on the existing IT infrastructure to provide facilities such as GIS, IT, bioinformatics, and others. HYV and hybrid technology promotion can use much of the existing infrastructure. Additional support wherever needed should be provided.

11.16 Strategic research area is the most investment intensive area but also very essential. With the biotechnology fund that has been set up by Maharashtra already, a portion of the same should be designated for this activity. The committee chaired by Dr. R.A. Mashelkar on bio-technology should include an eminent expert in the field of agriculture to deal more effectively with the issues related to the application of bio-technology in the state’s agriculture.

11.17 State should increasingly harness renewable energy resources like bio-gas, biomass, solar energy, hybrid systems, gasohol etc. in the field of agriculture wherever it leads to decrease in the cost of cultivation, greater use of locally available resources and a cleaner environment for the state’s rural population in general and farm families in particular.

11.18 A promising technology for future is nano-technology, which needs to be increasingly applied in state’s agriculture. One of the state’s agricultural universities could be developed to deal with various aspects of nano-technology including capacity building in the state for greater application of this technology.
In order to ensure that Maharashtra is at the forefront of the technological transformation of agriculture, it is essential that a new category of training centres, based on the method of learning by doing, is established. These may be termed Krishi aur Udyog Vigyan Kendras, where the training will include production and post-harvest technologies. Non-farm employment opportunities will also be introduced.