FROM A CORN FIELD TO MOLECULAR PHYSIOLOGY AND GENETICS

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Over the last 70 years the American company Pioneer Hi-Bred, Intl. (Johnston, Iowa, USA) carried out a selection of modern hybrids of corn (*Zea mays* L.) capable of providing high yields even when the plants are grown at very small distances apart from one another. This is possible because the leaves of these modern hybrids (e.g. hybrid 3394) are more erect compared to the leaves of older hybrids (e.g. hybrid 307). In 2000 Pioneer Hi-Bred set up a grant for a project which was to answer the question what happened during the many years of hybrid selection and led to the development of erected leaves.

Our research within the framework of the project (2000–2003) showed that the plants of the modern hybrid 3394 have a lower ability to respond to light. The hybrid also has a limited capacity to respond to the plant hormone auxin IAA. This is manifested at the level of whole plants (changed growth) and at the level of the cell and the molecule. At the molecular level the modern hybrid 3394 has a reduced expression of the *ABP4* gene. These code the so-called auxin-binding protein ABP, i.e. the protein that binds the IAA hormone. In the consecutive project (2005–2008) we used the genetic approach in the experiments. This consists of an analysis of selected corn plants which have a fatal genetic change in the genes coding the auxin-binding proteins mentioned above. In practice, we analysed plants with either a dysfunctional ABP1 protein, dysfunctional ABP4 protein and/or plants with both proteins missing at the same time. The aim of the experiments was to find out whether these mutated plants exhibit some changes in the development of the leaf position angle. Our presuppositions were confirmed as the principle result of our analyses was the finding that plants with a defect in the genes for ABP developed leaves with a different angle and exhibited lower sensitivity to the auxin hormone and to light.

Our results led to the conclusion that the process of long-term selection of modern hybrids caused a change in the sensitivity of the plants to auxin and to light, probably through a change in the genes for auxin-binding proteins. Auxin and light play an important part in the development of leaves. It is therefore very likely that the changes at the molecular level resulted in a change in the development of the angle of the corn leaf position. Our research continues through an EU project (2006–2010). We discovered that the younger the hybrid, the less auxin IAA the plants contain. In addition, analyses revealed that in older hybrids blue light reduces the amount of auxin in plants and this reduction is smaller as the hybrid is younger. At the molecular level we found out that blue light reduces expression of the *ABP1* gene in the organs of older hybrids, while in modern lineages the light has no effect on the expression of *ABP1*. As is known, the signal routes of the auxin plant hormones and light interact by which they regulate plant growth and development. The results of our research bring new information on the existence of a similar interaction through auxin-binding hormones.

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