

Next Tool in Grass Breeding: Genome Wide Selection



DLF-Trifolium is now investing significantly in what may spark its forage breeding programs to unprecedented heights. The tool is called "Genome Wide Selection" and with experts from Department of Genetics and Biotechnology, Aarhus University, the company has formed a strong research alliance to implement the technology in grass breeding. The method is expected to increase efficiency and reduce time from development to product.



Shortly, GWS consists in selecting new breeding material based on genetic potential (the plants DNA code) rather than experimental field data. In order to do this, a thorough investigation first needs to clarify, which DNA variations are responsible for either a positive or a negative influence on a specific trait. In this investigation DNA profiles of many plants are associated with corresponding field data. During the last decade DLF-TRIFOLIUM has kept safe seeds and associated field data for thousands of breeding families. This material constitutes a unique source for such an association. Once the association is established it is possible to estimate the genetic potential for any trait for each plant and thereby select the individuals with the highest breeding value. GWS opens up entirely new perspectives and has the potential to alleviate some of the current limitations in grass breeding.

Theoretically, it takes 400 x 400 field plots to select for two traits if you want the top 10 for both traits simultaneously in the same plant. Add an extra trait and you will need to multiply with another 400 – a mission impossible, which means that in practice the breeder usually will select for one trait (typically yield) and then will have to do with what's left of variation for the other traits. This task is much more easily and intelligently handled by GWS because it can separate, which differences in the genome controls the first and the second trait, respectively. Thereby it is possible to select plants that comprise the highest scores for both traits. On the long run it is also expected that GWS will reduce the number of costly field test because selections will increasingly be made on the basis of genomic data.

It is the enormous progress that has been made in DNA sequencing combined with massive computer power that has enabled the break-through in GWS. The technology has already revolutionized cattle breeding where the best bulls are now selected on their genetic breeding value before they are one year old. Previously this selection could only be performed after 5-6 years, when enough data from their offspring demonstrated their breeding value. Even for traits where annual gains previously were negligible it is now possible to make great progress thanks to GWS. At the same time

the breeding programs saves money on animal housing because of the reduced selection period.

The goal for DLF-TRIFOLIUM is now to tailor GWS to grass breeding. In contrast to animals grasses are bred in families and not as individuals. This situation raises a number of scientific and technical challenges, which are to be solved in collaboration with experienced and recognized research groups at Aarhus University. The outcome of this project will constitute the basis of a new generation of forage grasses containing significant improvements in yield, seed yield, disease resistance, and nitrogen use efficiency – for the benefit of producers, end-users, and the environment.

For Danish plant research and for Aarhus University in particular the project houses a great future potential and it may pave the way for a strong International leading platform on GWS in other plant species with complex genetics.

The GWS project started in 2010 and will run till 2015. It has a total budget on 4.4 million Euro and has received financial support from the Law of Innovation and the program for "Green Development- and Demonstration Projects" (GUDP) from the Ministry of Food, Agriculture and Fisheries.

