Plant breeding on political agendas

Plant breeding is a key element in developing a sustainable Nordic bio-economy. Obtaining a sustainable food production while reducing its environmental footprint, and at the same time securing a fair Nordic contribution to Global food security with healthy, diverse, stable and competitive food products – in a changing climate - is an ambitious but necessary agenda. Demographic changes with an increased population in all Nordic countries must be taken into account. Innovative use of biomass for materials and energy is expected to add to the economic development. New knowledge on the function of genes and continuous plant breeding efforts form a basis to meet these challenges.

Governmental bodies and policy makers from different stakeholders have in their agendas a number of needs and expectations, which can, be met through plant breeding.

- The Danish Minister of Agriculture recently declared that plant breeding has a key role in the sustainable development of Danish agriculture, combining competitiveness with environmental measures and growth of a bio-economy.
- The EU Parliament recently voted to strengthen European plant breeding.
- A new EU Directive on Integrated Pest and Pathogen Management (IPM) is now being implemented in the Member states with implications for the need of continued development of plant varieties with resistance to pests and pathogens.
- The new EIP instruments – EIP Agriculture being part of the overall CAP policies – are aimed to link to Horizon 2020 in order to strengthen the innovation system in which plant breeding research and pre-breeding can play an important role.
- Farmers’ organizations in the Nordic countries have expressed their support for the Nordic PPP for pre-breeding as an important measure to meet societal challenges and to secure strengthened competitiveness of Nordic agriculture.

All agricultural production - whether it is for food, feed, fuel, or fiber - start with cultivation of the best adapted plant varieties, carrying suitable traits for different end use purpose. Access to continuously improved, well adapted and competitive plant varieties is a precondition for a sustainable Nordic agriculture, plant production as well as animal husbandry. Exploiting the properties of plants by using genetic solutions is a key for tomorrow’s Nordic bio-economy.

More must be produced with, at best, the same input of resources. It has been estimated that half of the increased productivity of plant production over the last 100 years of 1.0-1.5 %/y can be attributed to genetic gains from plant breeding. Genetic gains become more important with higher energy prices and restrictions on the use of fertilizers and pesticides for reduced environmental footprint from the production, even more in organic production systems.

With Climate Change our agricultural productions systems will develop changed practices and crop rotations while at the same time tolerances to abiotic stress will have a new understanding. As new races and strains of pests and pathogens evolve or appear in new areas, new varieties carrying corresponding resistance traits to cope with the changing challenges must be developed and made available for farmers to maintain and to increase productivity. The adaptation to climatic changes and to biotic stresses must go hand in hand with continued yield improvement.

- IPCCs latest report concludes that yields of main crops will decrease with 2%/decade while demand for food increases with 14%/decade.

The location far to the north of our region, together with the strong demands for clean, green and sustainable food production applying as little as possible of pesticides and nutrients; and accentuated by the fact that the Nordic agricultural region is very diverse in climatic
conditions and seed markets, provide extra challenges for our societies. Plant breeding from other regions of the world will only to a very limited part be able to contribute. Global plant breeding entities will continue to have their focus on the global markets and not pay any attention to our fragmented markets. We have to rely on our own activities to succeed.

Strong competition in the seed market, and low licenses, makes it difficult and often impossible for the plant breeding entities to invest in long term goals beyond one breeding cycle – the time it takes from e.g. crossing of parental lines until a potential new variety is identified, 6-12 years. The license income is on average for the Nordic countries around 50 DKK/ha for cereals, taking into account the lower licenses for Farm saved seed.

Funding of pre-breeding collaboration between plant breeding entities and plant breeding research is a powerful tool to secure desired development. Improved high yielding varieties with better yield stability and increased nutrient use efficiency can secure growth in food production while reducing environmental footprints; highly resistant varieties can reduce the need for pesticide application and support organic production; focus on health related traits in breeding can improve the nutritional value of food products; all contributing to sustainable growth and global food security by adapting our crops to Climate Change.

Through the established PPP-collaboration the Nordic and Baltic plant breeding entities have proved that collaboration on a precompetitive level, across borders, between public research and private or public plant breeding entities provides an efficient way forward to address compelling societal challenges. Nordic collaboration has been strengthened.

Plant breeding and especially pre-breeding is a long term engagement and can take considerable time, depending on the specific breeding goal and specific crop. Access to state-of-the-art technologies and specific knowledge is becoming increasingly important for plant breeders in order to keep Nordic crop production competitive in a global context.

The established Nordic PPP-collaboration can be applied as an efficient platform for pre-breeding in crops, where Nordic plant breeding programs still exist. If the genes of interest are not integrated into a competitive genetic background and marketed in adapted varieties, we cannot benefit from the development. Support to pre-breeding efforts thus requires that there is a clear way forward to market introduction and also that the societal values are such that support from the Nordic countries through the PPP platform can be justified. Focus on specific breeding goals and traits of importance for agendas on climate change adaptation, environmental policy targets, sustainable growth, and competitiveness of Nordic food production will provide guidelines for a strengthened Nordic collaboration in pre-breeding.

Estimates on the direct value to farming of Nordic pre-breeding projects:

- Pre-breeding in barley for resistance and stress tolerance (ongoing): +0,5%/y annual productivity gain for Nordic barley production (3 Mton) = +20 MSEK every year
- Pre-breeding in wheat for resistance and stress tolerance (tentative): +0,5%/y annual productivity gain for Nordic wheat production (7 Mton) = +55 MSEK every year
- Fusarium-resistance in oats (tentative): average annual export of +200 Kton instead of downgrading to energy market = 60 MSEK
- Technology reducing time to market (tentative) in cereal breeding with 1 year = 180 MSEK and reduced cost for breeding
- Ryegrass with improved winter hardiness(ongoing):50 Kha x1000 SEK/ha = 50 MSEK
- Pre-breeding in apple for resistance (ongoing): increased market share for Nordic apples with 10% = 50 MSEK to growers

Additional to these estimated direct values come the added values of access to improved varieties for a range of Nordic societal agendas, as improved environment, healthy food, etc.

/Steering Committee of the Nordic PPP on Prebreeding