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Brief Analysis:

The German Seed Sector and the Seed Policy of the BMEL

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Abbreviations

BDP	Association of German Plant Breeding Companies
BLE	Federal Agency of Agriculture and Food
BMBF	Federal Ministry for Education and Research
BMEL	Federal Ministry of Food and Agriculture
BSA	Federal Plant Variety Office
GSA	German Seed Alliance

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1) Policy of BMEL towards the Seed Sector

There is no single, specific seed policy within the Ministry of Food and Agriculture (BMEL), the topic of Plant Breeding is one field of activity within the recently adopted overall crop cultivation strategy of the Ministry. However, the BMEL has delegated the task of overseeing the regulatory framework for the seed sector to its main agency, the Federal Office for Agriculture and Food (BLE) and its subordinated Federal Plant Variety Office.

The field crop strategy 2035 has been adopted by the German parliament in early 2020 and has six main broader objectives [3]. To reach these objectives, the Ministry has identified 12 fields of activity. One of them is plant breeding. The strategy was developed in cooperation with more than 40 organizations, associations from civil society and industry who commented and provided inputs to the draft of the strategy paper. The overall objectives of this strategy, to which the seed sector has to contribute, are the following:

- Ensure supply of food, feed and bio based raw materials;
- Ensure income of farmers;
- Strengthening of environmental and resource protection;
- Conservation of biodiversity in agriculture;
- Increase agriculture's contribution to climate protection and adapt agriculture to climate change;
- Increase the general acceptance of crop production within German society.

Within the breeding sector as a field of activity, the BMEL puts special emphasis on the further development of traditional breeding methods and the development of new genetic molecular breeding methods. The aim is to bring these new technologies in line with existing EU law [3]. If a variety that has been developed by using the CRISP/Cas method does not contain any new genetic material it can be considered as free of GMO and would follow the regulations of the EU seed law.

2) Structure of the German seed sector; overview of main actors

The Seed sector, like many other economic sectors in Germany, is characterized by a strong participation of the public and private sector, giving it a pluralistic structure. Its main actors are

- Federal Office for Agriculture and Food (BLE)
- Federal Plant Variety Office (BSA)
- Private Sector
 - Association of German Plant Breeding Companies (BDP)
 - Saatgut Treuhandverwaltung
 - German Seed Alliance
 - German Agrobusiness Association
 - Society for the Promotion of Innovations in Plants (GFPI)
- Research Institutions
 - Julius Kühn Federal Research Institute for Cultivated Crops
 - Leibniz Institute of Plant Genetics and Crop Plant Research (IPK); operates the gene bank in Gatersleben, one of the largest gene banks for crops in the world
 - Max Planck Institute for Research on Plant Breeding (MPIPZ)
 - Society for Plant Breeding

BLE - Federal Office for Agriculture and Food

The BLE has formulated the general objectives of plant breeding in Germany. From the previously exclusive goal of yield increase, the objectives have evolved over time to include objectives like:

- Breeding for certain contents of the plants e.g. sugar content of sugar beets;
- Breeding to develop plants with certain properties e.g.:
 - Pest resistance,
 - Disease resistance,
 - Adaptation to climatic conditions,
 - Adaptation to different soils,
 - Elimination of certain contents e.g. reduction/elimination of erucic acid in rape seeds,
 - Development of certain qualities, properties of traditional species or varieties like certain pulses (broad bean) or historic wheat varieties (*Triticum monococcum*).

The current main objectives are

- Yield increase,
- Quality (size, storage capacities, taste),
- Short length of grain straw, early ripening varieties, frost tolerance etc.

These objectives should be reflected in an enlarged regulatory framework for the release of new varieties which is still relying to a high degree on parameters like yield and plant contents [2]. Through its Information and Coordination Centre for Biological Diversity (IBV) the BLE coordinates strategies for the conservation and use of plant genetic resources. The IBV also directs the National Inventory on Plant Genetic Resources in Germany. One of the methods of conserving biological diversity is conserving plant genetic resources in ex situ plant collections. Several gene banks were established for this purpose. Information about existing gene banks and relevant institutions in Germany are published in the genetic resources information system ([GENRES](#)) of the BLE. The Leibniz Institute for Plant Genetics and Research of Cultivated Plants (IPK) in Gatersleben operates one of the largest ex situ gene banks for crops in the world [7]. The Federal Research Center for Cultivated Plants, a Julius Kühn-Institut (JKI) in Dresden, is coordinating the German Gene Bank for Fruits and a separate German Germplasm Bank for Grape Vines at its location in the Southwest of Germany [8]. The Botanical Garden in Osnabrück [5] maintains the Germplasm Bank for Wild Crops. Traditional Seeds (in situ gene banks) are regarded as a safeguard towards changing environments, new diseases, and pests.

BSA - Federal Office for Plant varieties

The BSA regulates the system of certified seeds to ensure the viability of private seed companies, to ensure that farmer receive quality seed material and to ensure the innovation in the seed sector in the long run. The BSA oversees the regulatory framework. Patent law, for example, only applies to certain technological aspects of the breeding process while whole varieties or animal races cannot be patented in Germany.

If a company has developed a new plant variety and has applied to the BSA for the official registration of this variety in the so-called National List of Varieties, the new variety must be better or at least new in terms of

- Quality,
- Quantity,
- Certain properties,
- Pest or disease resistance.

Another pre-requisite for a variety to be admitted to the national list includes distinctiveness from other varieties, uniformity, and stability, which are tested in open field or greenhouse testing procedures (DUS testing). VCU testing (test of value for cultivation and use) requires at least a two-year test period for most species, with three years of testing for cereals, winter oilseed rape and forage crops. VCU testing is generally carried out without the use of fungicides and growth regulators in order to assess the properties of the varieties related to their genetic composition [1].

Out of approximately 900 agricultural varieties applied for national listing each year, around 20% are registered and admitted to the National List by the variety committees at the Federal Plant Variety Office. National listing is granted for 10 years (20 for vines and fruit). After the expiration of this period, national listing can be extended on request.

The agency conducts test at its own test facilities all over the country and cooperates with the research institutes of the BMEL and the Ministries of Agriculture at the individual state level. The law which is governing the release and trade of seed varieties is based on the EU Seed Law. The agency conducts testing on behalf of the Community Plant Variety Office (CPVO) of the EU since 1994. Since the adoption of Regulation (EC) No. 2100/94 on Community plant variety rights, it has been possible to obtain plant breeders' rights on an EU-wide basis. For the trade of certified seeds, it is mandatory to label the seed packages with the official registration number of the BSA and further information.

The BSA represents Germany at the International Union for the Protection of New Varieties of Plants (UPOV) and as a member of the Administrative Council of the EUs Community Plant Variety Office (CPVO) it contributes to long-term and strategic decisions on Community plant breeders' rights. The BSA is also supporting the seed schemes of the Organization for Economic Cooperation and Development (OECD) which aims for internationally agreed methods of seed propagation and seed certification. Within the context of BMEL cooperation projects, the BSA supports various countries in establishing and developing plant variety and seed certification schemes.

In addition to these tasks, the BSA also plays a role in the conservation of biodiversity; coordinates the German Gene Bank for Ornamentals; and is a partner in the gene bank network for roses and the coordination center for the German Gene Bank for Rhododendrons, as well as the sub gene banks for seed propagated ornamentals and vegetatively propagated ornamentals.

Private seed sector

Key Facts:

- The sector comprises many medium and a few large private companies.
- The sector is highly innovative as up to 15% of revenues are used for R&D, compared to about 5 % in the pharmacy industry.

- The sector evolved in eastern and central Germany around 100 years ago when large private domains started to engage actively in plant breeding.
- Currently there are about 130 companies engaged in breeding and trade of plant varieties, about 60 companies with own breeding programs.
- The companies released together more than 3000 seed varieties. [4]

Progress in plant and animal breeding has been the major driver for increase in agricultural productivity. Developments in plant breeding acted as growth engine for crop yields. Plant breeding has a 30 – 50% share in the total increase of productivity in agriculture, in recent years this share has risen to more than 80% [5].

Plant breeding is one of the most important aspect of crop production, representing an industry with an annual turnover of more than 26 Billion EUR in Germany. In light of less and less available crop land, reduced inputs of mineral fertilizer and pesticides, the plant breeding sector becomes crucial to ensure stable yields and high-quality products. The annual increase in productivity in crop production (about 1 -2%;) depends largely on plant breeding [5].

Investments in plant breeding result in higher productivity, this results in higher profit margins for farmers, lead to lower prices for agricultural goods and this leads to

- more income for consumers,
- contributes to global food security,
- strengthens the global protection of natural resources and biodiversity,
- increases the competitiveness of German agriculture.

It is estimated that public investments are about 50 – 75 % of private investment in the seed sector.

BDP: Association of Plant Breeding companies

The BDP is the main association of all the private seed companies in Germany. All the leading plant breeding and seed trade companies in Germany are members of the BDP. Currently, there are about 130 member companies associated in the BDP.

The BDP coordinates a network of other organizations which are active in the fields of plant breeding research, seed certification and marketing of certified seeds, these include:

- *Society for the promotion of plant breeding (GFPI)*: coordinates the support of public and private investments in plant breeding. The current flagship project is the Pilton project: the leading 60 private seed companies and about 100 public research institutions are developing a new fungi resistant wheat variety, using the Crisp gene editing methodology.
- *Seed Administration Trust (STV)*; collects fees and royalties from farmers and other companies on behalf of its member companies.

- *Society for the promotion of certified seeds (SFG)*; cooperates with the Federal Office of Plant Varieties in the field of seed testing, operates international projects for the production of certified seeds.
- *German Seed Alliance (GSA)*; comprised of several seed companies which are mainly engaged in the Russian seed market. Has established its own plant breeding Centre in Russia and has sales outlets for seeds all over the country.

3) Research on Plant Breeding

The BMEL is financing and has political oversight over several research institutions that deal with issues of plant breeding. The public sector is focusing more on long term fundamental research whereas the private sector is more engaged in applied research. It provides institutional funding for research facilities that work on the development of new plant varieties:

- Fundamental research which is long term oriented with the goal to ensure the availability of adapted varieties in the long term;
- Breeding with traditional breeding methods using wild crops like apple, vine;
- E.g. new grapevine varieties; 25 years of development until new variety can be brought onto the market.

BMEL finances research e.g. to identify the complete Genom of the most important cultivated crops in Germany which will further foster innovative research and enables faster and more targeted breeding of new varieties.

In the case of wheat, it is cooperating with the international consortium for the sequencing of the Wheat Genom (IWGSC)[2] . Policies like promotion of genome editing are supported through publication of articles in official research publications of the BMEL. The current flagship project on plant breeding is TERTIUS, a research project to increase drought resistance in wheat through integration of rye- wheat gene loci.

In the research sector, there is also a cooperation with the Ministry of Education and Research (BMBF) which finances for example a huge project on all research aspects related to plants including seeds.

Project Plant 2030 is an initiative to support plant breeding research for the Bio Economy, Crops for the Future and Innovative Plant Breeding in Crop Cultivation. Together with the BMBF, the BMEL is also cooperating with the private sector through the Wirtschaftsverbund Pflanzeninnovation (WPI), the Business Association for Innovations in Plants.

The Association was founded by private companies from the seed sector and worked for many years with different public research institutes on basic research to identify the genome of the main cultivated crops in Germany (GABI project). The current focus of research is on Plant Biotechnology of the Future, a research project that involves 28

different institutions and is mainly financed by the Ministry for Education and Research (BMBF).

The latest research project of the BMEL is the ADLATUS project, which is coordinated by the Federal Office for Agriculture and Food (BLE) and is financed with budget from the Crop Cultivation Strategy 2035.

Research partners is a private seed potato company and several research institutions like the Julius Kühn Federal Research Institute for Cultivated plants, the University of Münster as well as the Fraunhofer Institute for Molecular Genetics. The project aims to develop new potato seeds that are completely resistant to nematodes and various viruses.

Research Institutes financed by BMEL on a permanent basis with institutional funding:

- the Julius Kühn Federal Research Institute for Cultivated Crops (JKI),
- the Leibnitz Institute for Plant Genetics and research of Cultivated Plants (IPK); operates the gene bank in Gatersleben,
- the Max Planck Institute for Research on Plant Breeding (MPIPZ),
- the Society for Plant Breeding.

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