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Final report

Market analysis on import, quality and use in Germany of seeds treated in the European Union

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Dr. Volker Ebert, Marcel Helfmeier, Lukas Müller, Dr. Margit Paustian, Prof. Dr. Otto Strecker

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On behalf of the German Environment Agency

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Data collection was completed in the year 2020 and represents the current status at the time. It is possible that the regulation of certain products and active substances has changed. For up-to-date information on regulation please refer to the services of the Federal Office of Consumer Protection and Food Safety (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, BVL).

Abstract: Market analysis on import, quality and use in Germany of seeds treated in the European Union

Treated seeds imported from the EU may be sown in Germany, although they migt be treated with plant protection products that are not authorized in Germany. This possible gap in legislation, not preestimated during the negotiations for the EU regulation, results in a gap in the current environmental risk assessment and risk mitigation of seed treatments: it is neither possible to assess the specific risks to the environment from the application of treated seeds in Germany, nor to define appropriate risk mitigation measures.

This market study aims at examining the reasons for the plant protection product and use of treated seeds and to provide information regarding the quantity and type of pesticides used. The findings of the report are intended to identify potential risks to the environment that have not yet been considered in the risk assessment of treated seeds and that may arise specifically for the environment in Germany due to the use of imported treated seeds. Based on this, proposals for possible solutions for risk assessment and risk mitigation of treated seeds on a regulatory level will be developed.

Kurzbeschreibung: Marktanalyse zu Import, Qualität und Verwendung in Deutschland von in der Europäischen Union gebeiztem Saatgut

In Deutschland darf aus der EU importiertes gebeiztes Saatgut ausgebracht werden, selbst wenn es mit Pflanzenschutzmitteln behandelt ist, welche keine Zulassung in Deutschland besitzen. Aus diesem möglichen Defizit im EU Recht, welches zum Zeitpunkt der Verhandlungen zur Pflanzenschutzmittel Verordnung nicht abschätzbar war, ergibt sich eine Lücke in der aktuellen Umweltrisikobewertung und Risikominimierung von Saatgutbeizen: Es ist weder möglich, die spezifischen Risiken für die Umwelt durch die Ausbringung von gebeiztem Saatgut in Deutschland abzuschätzen, noch geeignete Risikominderungsmaßnahmen festzulegen.

Ziel dieser Marktstudie ist, Gründe für den Import und die Verwendung von gebeiztem Saatgut zu beleuchten und Informationen bezüglich der Menge und eingesetzten Pflanzenschutzmitteln zu geben. Die Erkenntnisse des Gutachtens sollen potenzielle, bisher noch nicht bei der Risikobewertung von Saatgutbeizen berücksichtigte Risiken für die Umwelt identifizieren, die durch die Ausbringung von importiertem gebeiztem Saatgut spezifisch für den Naturhaushalt in Deutschland entstehen können. Darauf basierend sollen mögliche Ansätze für die Risikobewertung und Risikominimierung von gebeiztem Saatgut auf regulatorischer Ebene erarbeitet werden.

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List of abbreviations

approx.	approximately
BVL	Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (Federal Office of Consumer Protection and Food Safety)
CLP	Classification, Labelling and Packaging
CS	Capsule suspension
e.g.	for example
EC	European Community
EEC	European Economic Community
ES	Emulsion for seed treatment
ESA	European Seed Association
ESTA	European Seed Treatment Assurance Scheme
etc.	et cetera
EU	European Union
FS	Flowable concentrates for seed treatment
g	Gram
ha	Hectares
incl.	including
ISTA	International Seed Testing Association
JKI	Julius Kühn-Institut
km	Kilometres
l	Litre
LS	Solution for seed treatment
m	Meter
max.	Maximum
min.	Minimum
Nr.	Number
PQM	Plan Qualité Poussières
t	Tons
s	Seconds
UBA	Umweltbundesamt (German Environment Agency)
WP	Wettable powder
WS	Water dispersible powder for slurry treatment

Summary

In conventional agriculture, chemical plant protection products are mostly used for the safeguarding of yields. An application of plant protection products can take place in various forms and at different times during plant development. Seed treatment is the dressing of seed with a pesticide (here: plant protecteion product)prior to sowing. Spray applications may also be made to the seeds in advance of sowing, but these products might also be used in subsequent crop management. Plant protection products can also be applied in solid form as granules. However, the main forms of application of plant protection products in agriculture are spraying and seed treatment.

In the authorization procedure for plant protection products under Regulation (EC) No. 1107/2009, the seed treatment process itself is considered as the application of a plant protection product, however also the sowing of the treated seeds might impact human health and the environment. Seeds treated in a country of the European Union with a plant protection product authorized there may be freely traded and sown in other Member States if no further restrictions apply. This is also the case if the same product has not been authorized or applied for authorization in the importing country as a seed treatment.

This situation might result in a gap in the current environmental risk assessment and risk mitigation of seed treatment products in a given Member State resulting from spezific agricultural and ecological conditions: It is neither possible to estimate the specific risks to the environment from the use of imported treated seeds in Germany, nor to define appropriate risk mitigation measures that might be specifically needed for the conditions in Germany. So far, no data is available on the amount of treated seeds imported from other EU countries sown in Germany, nor on its share in the total amount of treated seeds sown in Germany. Furthermore, it is not known for which crops the use of imported treated seeds is preferred or necessary in the different regions of Germany. Information on determining factors for the use of imported treated seeds is also not available.

This market study aims to examine reasons for importing and using treated seeds in Germany and to provide information on the quantity and type of pesticides used. The findings of the report are intended to address uncertainties and possibly identify potential risks to the environment that have not yet been considered in the risk assessment of treated seeds and may arise specifically for the environmental conditions in Germany due to the use of imported treated seeds. Based on the results of the analyses, proposals for, possible solutions for the risk assessment and risk mitigation of treated seeds on a regulatory level will be developed. The study focuses on the following central questions:

- For which field crops is the purchase of imported treated seeds from other European countries attractive or necessary for the farmer in Germany?
- Which quantities of treated seeds are imported for each crop and which proportion do the imported quantities have of the total seeds sown in Germany?
- Which are the reasons for buying and using imported treated seeds (price, availability, etc.)?
- Are there regional differences in Germany regarding the purchase and sowing of treated seeds imported from other European countries?
- Which plant protection products were used to treat the imported seeds? Seeds of which crops are usually treated with which plant protection products or combinations of several plant protection products - separated into seed treated in Germany and imported treated seeds - and which active ingredients are contained in these?
- Are quality control instruments implemented in seed treatment facilities in other European countries and how are they designed and implemented (e.g., certifications)?

- What additional information on the quality description of treated seeds is suitable for labelling traded seeds?

Methodologically, the investigated topics outlined above were analysed based on a literature study (section 3.1) and assessed in more detail through an online survey of agricultural enterprises and plant protection services (section 3) as well as interviews with relevant stakeholders in the seed sector. Possible risks and proposed solutions for minimising risks were discussed in a workshop (section 6). The results of the study (summary in section 7) serve to answer the research questions and form the basis for further discussions and options for action.

Results of the secondary data analysis

- Availability of plant protection products in Germany

The evaluation of the secondary data currently available indicated that 28 plant protection products (excluding emergency authorizations) are authorized in Germany for the treatment of the four most important crops, cereals, maize, oilseed rape and sugar beet as of July 2020. However, there are six products without authorization in Germany that are also used on arable land via imports. Three of the six products were used to treat maize seeds, two to treat oilseed rape seeds, and one for cereal seeds. The active ingredients in the seed treatment products approved for use on sugar beet seeds in Germany do not differ from those approved in other EU countries.

- Cultivated areas of important crops in Germany

Due to the different characteristics, requirements and regional cultivation decisions, the import of treated seeds varies depending on the type of crop. The crops themselves have different requirements in terms of climate and soil. Due to the different site conditions, special cultivation areas have developed in Germany resulting in different cultivation densities of the crops. In addition to the need to use imported treated seeds, the share of them also varies depending on the growing regions.

Eight of the federal states grow cereal varieties on at least 50 % of the arable land. The relative acreage is greatest in the central states of Germany (Hesse and Thuringia). The most extensive cultivation areas for cereals in absolute terms are in Bavaria and Lower Saxony, the largest German federal states in terms of total area. More than 750,000 ha are cultivated there. Along with the size of the total area of each state, the absolute acreage of cereals increases.

In North Rhine-Westphalia, Baden-Württemberg and Bavaria, grain maize is cultivated on at least 5 % of the arable land. The largest cultivated areas in absolute terms are located in Bavaria, followed by Lower Saxony and North Rhine-Westphalia. In Bavaria, more than 100,000 ha are used for grain maize production. A cultivation focus within Germany cannot be identified. The smaller states in the western centre of Germany (Saarland, Rhineland-Palatinate, Hesse) as well as the eastern states (Saxony, Saxony-Anhalt, Thuringia, Brandenburg, Mecklenburg-Western Pomerania) produce grain maize on only a few hectares.

In Schleswig-Holstein, Lower Saxony, North Rhine-Westphalia and Bavaria, silage maize is grown on at least one-fifth of the arable land. The largest cultivated areas in absolute terms are in Lower Saxony and Bavaria, where more than 250,000 ha are used for silo production. As in the case of grain maize, no cultivation focus can be identified for silage maize in Germany. In the smaller states in central Germany (Saarland, Rhineland-Palatinate, Hesse), maize cultivation has a subordinate role.

Oilseed rape is grown on almost 20 % of the arable land in Mecklenburg-Western Pomerania, Thuringia, and Saxony. The largest absolute production areas with more than 150,000 ha are

located in Mecklenburg-Western Pomerania and Saxony. Other important cultivation regions are Saxony-Anhalt and Brandenburg; therefore, the eastern part of Germany can be defined as the cultivation focus. In general, the absolute cultivation area of oilseed rape is increasing from west to east.

Sugar beet production occupies significantly smaller areas than cereals, maize, or oilseed rape. Compared to other field crops, sugar beet is grown in 6 % of the agricultural areas in Lower Saxony, North Rhine-Westphalia, and Saxony-Anhalt. With 105,000 ha, Lower Saxony is also the federal state with the largest production area in absolute terms. This region is followed by North Rhine-Westphalia and Bavaria, which cultivate more than 60,000 ha. Apart from Bavaria, production is concentrated in north-western Germany.

- Import volumes of (treated) seeds

The statistics on seed trade do not differentiate between treated and untreated seeds. Nevertheless, the relevance of imports and the importing countries in terms of volume (concerning the individual crops) can be inferred from the import and export volumes. The data basis for the import and export quantities is provided by the foreign trade statistics of the Federal Statistical Office.

The imputed sowing quantity of cereal seeds in 2019 was around 926,000 t. The import and export volumes in the same year comprised about 54,000 t and 59,000 t, respectively. Major trading partners for imports were France (26 %), Austria (22 %) and Poland (21 %). The largest importers of German cereal seeds were the Netherlands (53 %) and Belgium (12 %).

The amount of total maize seeds imputed for sowing in Germany was at about 78,000 t of seeds in 2019 and has therefore remained nearly constant since 2012. Foreign trade has also not seen any major changes since 2012. Imports in 2019 were at about 62,000 t. France (69 %) and Austria (20 %) are the main exporting countries. Maize seeds exports to other EU Member States were at about 9,500 t in 2019.

Oilseed rape sowings decreased from about 4,900 t (2018) to about 3,400 t (2019). The import of oilseed rape almost doubled from about 12,000 t in 2017 to about 20,500 t in 2018. The main exporting countries were France (65 %), Spain (12 %), the Netherlands (6 %) and Poland (5 %). Imports from Spain and Poland more than doubled compared to the previous year. Exports from Germany primarily went to France (24%) and Poland (22%).

A realistic quantification of the sown sugar beet seeds is not possible, since they are sown in the form of pilled / pressed seeds (coating consisting of the dressing, among other things) which have no specific weight. Import volumes have varied in recent years. In 2015, a total of 7,700 t of seeds were imported, while in 2017 it was 12,800 t. Imports come almost exclusively from Italy (52 %) and France (46 %), the countries where the bulk of European sugar seed production takes place. Exports from Germany went mainly to France (42 %), Poland (14 %) and the Netherlands (12 %). Based on the secondary data analysis, it was possible to gain knowledge about the available as well as the unauthorized plant protection products in Germany. This enabled the identification of incentives to import seed for all mentioned crop types. The analysis of the growing regions showed that the demand for treated seed also depends on the location of the agricultural enterprise. Cross-border business or supply structures create another incentive to import treated seed. The analysis of the foreign trade statistics revealed that seeds of all crop types are frequently imported, except cereals. A statement of the share of imported seeds that had already been treated could not be made yet.

In addition, further reasons for the purchase and use of imported treated seeds were identified via a literature analysis. In summary, the following reasons for importing treated seeds could be identified in the initial phase of the secondary data analysis:

- Lower price
- No availability of alternative plant protection products in Germany
- Regional reasons, e.g., the geographical proximity of the agricultural enterprise to other EU countries
- Cross-country operational organization
- Established business structures

The exact quantities and relevance of individual plant protection products could not be determined by the literature analysis and thus represent a need for further research. During the interviews with experts (primary data collection), the central questions were therefore examined in greater depth, including in particular the reasons that motivate the import of treated seeds.

Reasons for importing cereal seeds

According to the seed traders and associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or due to a cross-border business structure. However, especially in the case of cereals transports are only economical over short distances due to high transport costs (high sowing quantities) and low margins. According to experts, imports of treated cereal seeds fluctuate depending on supply and demand. Decisive factors here include the varying climatic conditions and the resulting seed volumes of German producers. In the case of cereals, there are no special production processes that justify the import of seeds.

Many products with fungicidal active ingredients are authorized in Germany for cereals. In other EU countries, in contrast to Germany, the product Vibrance Gold is authorized. However, the active ingredients sedaxane, fludioxonil and difenoconazole contained therein are also included as active ingredients in products authorized in Germany. Seed treatment products with insecticidal activity are currently not authorized for use in cereals throughout Europe. The lack of availability of plant protection products is therefore not an incentive to import cereal seeds.

According to several plant protection services and seed traders, cereal seeds are imported both treated and untreated. An exact determination of the share of treated seeds is not possible, since the already small quantities of imported seeds are imported by many traders and partly by the farmers themselves. It was reasoned by another expert that an estimated 50 % of the cereal seeds in the EU are farm-saved seeds; a statement about the seed treatment of those cannot be made. The remaining 50 % comprises certified cereal seeds, which are mainly locally treated, i.e., treated near the area where it is to be sown. It is estimated that cereal seeds are imported to Germany only by farmers producing close to the border with a range of about 50-80 km.

Reasons for importing maize seeds

According to participants from seed traders and associations interviewed, transnational trade takes place by default due to geographical proximity to neighbouring countries or due to a

transnational business structure. This trade concerns all field crops, which is why maize seeds are also imported due to existing trade and business structures.

Maize has high demands on climatic conditions for seed multiplication. Seed multiplication within Germany has hardly been possible for this reason. In the Freiburg-Krozingen area, seeds can be produced on a multiplication area of about 3,500 ha. This quantity corresponds to about 18 % of the annual seed demand in Germany. Apart from climatic conditions, experts stated that seeds are also multiplied abroad because of the requirement for minimum distances to be maintained between multiplication areas and other areas of the same crop. Seed treatment is often carried out in the country of multiplication, as it is considered to be more cost-effective within the overall production process than outsourcing of the treatment. The price of imported treated seeds is thus lower compared to seeds multiplied in other Member States and then treated domestically. Most of the supply is ensured by seed imports from France, Hungary, Austria, and Romania. Slovakia and Serbia were named as further production countries by one seed trader interviewed.

For maize, a wide range of authorized products with the corresponding fungicidal active ingredients is available against fungal diseases. With VOTiVO[1], a product with a nematicidal active ingredient is available on the German market; for products with insecticidal or repellent effects the situation is different. Currently, there are no plant protection products with a corresponding active ingredient authorized in Germany. Seeds treated with the products Sonido (active ingredient thiacloprid) against wireworm and Korit 420 FS (active ingredient ziram) against bird damage can be purchased via seed traders from other EU Member States. If enterprises plan to use insecticidal and repellent active substances, they must rely on imports from other EU Member States.

The interviewed seed processers, seed traders and plant protection services differed marginally in their estimates regarding the share of imported treated maize seeds sown in Germany. According to them, a share of 89 % of the maize seed sown was imported in 2019 / 2020. The imported seeds are usually already treated with pesticides, according to experts. Their estimates of imported quantities are in line with the results of the statistical analysis.

Reasons for importing oilseed rape

According to the seed traders and participants from associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or due to a cross-border business structure. This trade concerns all field crops, which is why oilseed rape is also imported due to existing trade and business structures.

EU countries represent an important role in seed production in oilseed rape. A large share of oilseed rape production takes place in France. Individual interviewees emphasized the better opportunities in France to maintain minimum distances between multiplication and field stands.

Among the oilseed rape treatment products, there is currently no authorized insecticide available in Germany. However, Lumiposa 265 (active ingredient cyantraniliprole), an insecticidal seed treatment product, is authorised for oilseed rape in other EU countries. Regarding fungicidal seed treatments, Integral Pro (active ingredient Bacillus amyloliquefaciens strain MBI 600) is a biological product available for seed treatment in Germany. The product Scenic Gold (active ingredients fluopicolide, fluoxastrobin) has been authorized in other EU

[1] Brand names and protected trademarks are property of their respective owners. The mention of brand names and protected trademarks is merely descriptive. To improve readability, this report does not mention the additions ©, ™ or ®.

countries. To control the small cabbage fly and the oilseed rape flea, producers have to rely on already treated seeds from other EU countries.

The interviewed participants from seed treatment plants, seed traders and plant protection services were able to give an estimate of the share of imported treated seeds concerning the total amount of seeds applied in these crops, with only slight deviations. The share of imports in oilseed rape is at about 45 % based on sowing in the 2019 / 2020 marketing year. The seeds are usually already treated when imported into Germany according to several interview partners.

Reasons for importing sugar beet seeds

According to the seed traders and participants from associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or a cross-border business structure. This trade affects all field crops, which is why sugar beet seeds are also imported due to existing trade and business structures.

Sugar beet seed production within the EU is done almost exclusively in northern Italy and southwestern France due to climatic requirements. Almost all seeds are therefore imported due to technical production processes.

Products with fungicidal, insecticidal and nematicidal activity are currently available in Germany for the cultivation of sugar beet and fodder beet. Relevant products from other EU countries (without authorization in Germany) could not be identified. Therefore, imports due to a lack of availability of alternative plant protection products are irrelevant for sugar beet.

Seeds for growing sugar beet is almost entirely imported. Whether the seeds are treated or untreated depends on the breeder and the location of the treatment sites. The participants from treatment facilities and traders interviewed stated that around 80 % of the seeds sown in Germany are treated domestically. Accordingly, a proportion of 20 % of the seeds sown is already treated with plant protection products when imported into Germany.

Uncertainties, potential risks of sowing imported treated seed and discussion of possible solutions for risk regulation

To validate the results of the secondary data analysis and the expert interviews as well as to identify possible solutions for risk regulation, a workshop was held with experts from the seed treatment industry. The relevance of the study results for the potential risks of the use of imported treated seeds and possible risk regulation measures were discussed. The presented work results from the AFC surveys as well as the uncertainties, potential risks, and possible measures for risk regulation served as the basis of the discussion.

Eleven external experts participated in the workshop. Three each belonged to seed certifications, agricultural associations, and plant breeders' associations. One expert was associated with a federal state ministry, another with a plant protection service. Experts from the UBA and the AFC were also present during the workshop.

The initial basis for the discussion of the different scenarios and the proposed solutions was the uncertainty about potential risks arising in Germany due to specific conditions at national level since the quality of treated seeds regarding abrasion of dust during sowing is mostly unknown for imported treated seeds. In addition to the seed treatment quality, specific conditions of use and specific environmental or agricultural circumstances such as wind speed also play an important role in the extent of the dust abrasion and drift of the active ingredient.

During the workshop, the following measures were indicated and discussed:

- Implement additional seed declaration to create incentives among users to buy certified seeds
- Raise awareness of the risks of sowing seeds with special treatments
- Transfer risk mitigation measures to imported seeds
- Consider as ulima ratio restrictions of import and placing on the market of seeds treated with seed treatment products not authorized in Germany in case of corresponding risks according to European regulations
- Seek authorization in Germany for products used on imported treated seeds from other EU countries

Individual experts did not consider additional seed declaration to be useful, as the decision to purchase is already made before the packaging is viewed. Moreover, additional information on the packaging would be overlooked. This argument was critically seen by the authorities since information for the end consumer on the packaging is essential (see pictograms for hazards).A participant pointed to the already existing knowledge of farmers; they would already be aware of the application instructions and risks of using treated seeds. Another proposal to minimize risk was to indicate mitigation options also on the packages of (imported) seeds. According to one participant, additional requirements would make the implementation more difficult for producers. Additional requirements should be avoided, and sufficient seed quality should be ensured before distribution to the user.

The UBA indicated that as ulima ratio in the case of unacceptable risks, the import and marketing of treated seeds can be restricted according to EU rules. Two participants were critical of this solution, as it would restrict free trade in the EU. Action would be needed at the EU level rather than at the national level. Almost all experts supported the approach of aiming for uniform authorization in the EU, as this would advance the harmonization of regulations and thus improve the usage of seeds for users. At the same time, better risk regulation would be possible for regulatory authorities.
Despite an open discussion, some participants saw the indications regarding possible measures mainly as additional restrictions for users, but not as potential improvements for risk regulation. This hampered the further discussion of proposals or the development of new approaches. Further harmonized work is needed to advance the regulation of possible risks arising from treated seeds, including the information of the end users and the advancement of seed quality certifications.

Summary: short answers to the research questions

The results of the study can be summarized in terms of answering the research questions:

1. **For which field crops is a purchase of imported treated seeds from other European countries attractive or necessary for the farmer?**

- Due to existing trade / business structures:
  - Cereals, maize, oilseed rape, sugar beet
- Due to technical production processes
  - Maize, oilseed rape, (sugar beet)
- Due to the lack of availability of alternative plant protection products in Germany:
  - Maize, oilseed rape

2. **What quantities of treated seeds are imported per crop and what proportions do the imported quantities represent of the total seeds sown in Germany in these crops?**

- Cereals
  - The total import volume of cereal seeds is 54,000 t and thus has only a very small share in the imputed sowing volume in Germany (< 6 %).
  - No clear statement on the share of the imported seeds already been treated can be made, due to the import by many traders and the farmers themselves (about 50 % of the cereal seeds are treated at the farm).
- Maize
  - Imputed sowing quantity (2019): 77,913 t
  - Of which imputed import volume of treated seeds: 69,343 t
  - Share of treated imports in the sowing volume: approx. 89 %.
- Oilseed rape
  - Imputed sowing quantity (2019): 3,411 t
  - Of which imputed import volume of treated seeds: 1,535 t
  - Share of treated imports in the sowing volume: approx. 45 %
- Sugar beet
  - The seeds for growing sugar beet are almost entirely imported.
  - Whether the seeds are treated or untreated depends on the breeder and the location of the treatment facilities.
  - Share of treated imports in the sowing volume: approx. 20 %.

3. **What are the reasons for buying and using imported treated seeds (price, availability, etc.)?**

- Import due to existing trade or business structures
- Import due to technical production processes
- Import due to the lack of availability of alternative plant protection products in Germany

4. **Are there regional differences in Germany regarding the purchase and sowing of treated seeds imported from other European countries?**

- Regional differences in the sowing of imported treated seeds are due to the different growing regions of the field crops.
- The occurrence of pathogens essentially correlates with the growing regions of the affected crops. In individual cases, there are also regional differences due to specific pests, for which plant protection products from abroad are used.
- Geographical proximity to neighbouring countries plays only a minor role for the crops maize, oilseed rape and sugar beet.

5. **With which plant protection products were the imported seeds treated? Seeds of which crops are usually treated with which plant protection products or combinations of several plant protection products - separated into seeds treated in Germany and imported treated seeds - and which active substances are contained in them?**

- The crops maize, oilseed rape and cereals are generally treated with standard treatment (fungicides). The plant protection products used (except Scenic Gold for oilseed rape) are authorized in Germany.
- In the case of optional treatments, which are additionally applied as required, no authorizations in Germany for maize (insecticide against the wireworm and an active ingredient against bird damage) and oilseed rape (insecticide against the small cabbage fly) exist. The seeds treated with these products are therefore imported in their entirety.
- The optional treatments of cereals and sugar beet are authorized in Germany.

6. Are quality control instruments implemented in treatment facilities in other European countries and how are they designed and implemented (e.g., certifications)?

- The essential instrument for quality control of treated seeds in Europe is ESTA. The national instruments of quality control are compatible with ESTA or are based on the specifications of ESTA.
- The seeds sown in Germany are 90 % - 100 % certified according to ESTA for the crops maize, oilseed rape and sugar beet.
- For cereals, the share of ESTA-certified seeds is still very low. It is predicted that this share will increase sharply in the next five years.

7. What additional information on the quality description of treated seeds is suitable for labelling traded seeds?

- The existing labelling of treated seeds is considered sufficient by most of the interviewed experts from the seed sector.
- The suitability of additional (mandatory) information for describing the quality of treated seeds is assessed very differently by stakeholders in the industry.

Zusammenfassung

In der konventionellen Landwirtschaft werden chemisch-synthetische Pflanzenschutzmittel größtenteils zur Ertragssicherung eingesetzt. Die Applikation kann in verschiedenen Formen und zu unterschiedlichen Zeitpunkten der Pflanzenentwicklung erfolgen. Unter einer Saatgutbehandlung versteht man das Beizen des Saatguts mit einem Pestizid vor der Aussaat. Spritzanwendungen könne ebenfalls zur Behandlung des Saatgutes eingesetzt werden, häufig finden diese aber auch bei der späteren Kulturführung Anwendung. Pflanzenschutzmittel können auch in fester Form als Granulat ausgebracht werden. Neben der Sprühanwendung ist die Beizung des Saatguts die verbreitetste Form des Pflanzenschutzes für Produzent*innen.

Im Zulassungsverfahren von Pflanzenschutzmitteln nach der VO (EG) Nr. 1107/2009 wird der Beizvorgang selbst als Anwendung eines Pflanzenschutzmittels betrachtet; die Ausbringung des gebeizten Saatgutes auf dem Feld kann jedoch auch zu Risiken für Mensch und Umwelt führen. Saatgut, das in einem Land der Europäischen Union mit einem dort zugelassenen Pflanzenschutzmittel gebeizt wurde, darf in Europa -abgesehen von möglichen spezifischen Einschränkungen- frei gehandelt und ausgesät werden. Dies ist auch der Fall, wenn im Importland das gleiche Produkt für die Beizung nicht zugelassen oder eine Zulassung nicht beantragt wurde.

Aus diesem Sachverhalt ergibt sich eine Lücke in der aktuellen Umweltrisikobewertung und Risikominimierung von Saatgutbeizen: Es ist weder möglich, die spezifischen Risiken für die Umwelt durch die Ausbringung von gebeiztem Saatgut in Deutschland abzuschätzen, noch geeignete Risikominderungsmaßnahmen festzulegen. Bisher liegen weder Daten zu der Menge von aus dem EU-Ausland importiertem gebeiztem Saatgut, das in Deutschland ausgesät wird, noch dessen Anteil an der Gesamtmenge des in Deutschland ausgesäten gebeizten Saatgutes vor. Des Weiteren ist nicht bekannt, beim Anbau welcher Kulturen die Verwendung von importiertem gebeiztem Saatgut in den verschiedenen Regionen Deutschlands bevorzugt wird oder notwendig ist. Informationen zu ausschlaggebenden Faktoren für die Verwendung von importiertem gebeiztem Saatgut sind ebenfalls nicht verfügbar.

Ziel dieser Marktstudie ist, Gründe für den Import und die Verwendung von gebeiztem Saatgut zu beleuchten und Informationen bezüglich der Menge und eingesetzten Pflanzenschutzmitteln zu geben. Die Erkenntnisse des Gutachtens sollen Unsicherheiten und potenzielle, bisher noch nicht bei der Risikobewertung von Saatgutbeizen berücksichtigte Risiken für die Umwelt identifizieren, die durch die Ausbringung von importiertem gebeiztem Saatgut aufgrund von spezifischen landwirtschaftlichen und ökologischen Bedingungen für den Naturhaushalt in Deutschland entstehen können. Darauf basierend sollen mögliche Lösungsvorschläge für die Risikobewertung und Risikominimierung von gebeiztem Saatgut auf regulatorischer Ebene erarbeitet werden. Im Mittelpunkt der Untersuchung standen die folgenden zentralen Fragen:

- Für welche Feldkulturen ist in Deutschland ein Kauf von importiertem gebeiztem Saatgut aus dem europäischen Ausland für den Landwirt attraktiv bzw. notwendig?
- Welche Mengen an gebeiztem Saatgut werden je nach Kultur importiert und welche Anteile haben die importierten Mengen an der Gesamtheit des in Deutschland in diesen Kulturen ausgebrachten Saatgutes?
- Welche Gründe sind in Deutschland ausschlaggebend für den Kauf und die Verwendung von importiertem gebeiztem Saatgut (Preis, Verfügbarkeit etc.)?

- Gibt es in Deutschland regionale Unterschiede bezüglich Kauf und Aussaat von aus dem europäischen Ausland importiertem gebeiztem Saatgut?
- Mit welchen Pflanzenschutzmitteln wurde das importierte Saatgut behandelt? Saatgut welcher Kulturen wird in der Regel mit welchen Pflanzenschutzmitteln bzw. Kombinationen mehrerer Pflanzenschutzmittel - getrennt nach in Deutschland gebeiztem Saatgut und importiertem gebeiztem Saatgut - gebeizt und welche Wirkstoffe sind in diesen enthalten?
- Sind im europäischen Ausland Instrumente der Qualitätskontrolle in Beizstellen implementiert und wie sind diese gestaltet und umgesetzt (z. B. Zertifizierungen)?
- Welche zusätzlichen Angaben zur Qualitätsbeschreibung des gebeizten Saatgutes eignen sich, um Saatgut im Handel zu kennzeichnen?

Methodisch wurde dazu das oben umrissene Problem anhand einer Literaturstudie aufgearbeitet (Kap. 3.1) und durch eine Onlinebefragung bei Landwirten und Pflanzenschutzdiensten (Kap. 3) sowie Interviews mit relevanten Akteur*innen der Saatgutbranche, näher bemessen. Durch einen Workshop (Kap. 6) wurden mögliche Risiken, sowie Lösungsvorschläge zur Risikominimierung diskutiert. Die Ergebnisse der Studie (Kap. 7) dienen der Beantwortung der Forschungsfragen und bilden die Basis für weitere Diskussionen sowie Handlungsoptionen.

Ergebnisse der Sekundärdatenanalyse

- Verfügbarkeit von Pflanzenschutzmitteln in Deutschland

Die Auswertung der derzeit verfügbaren Sekundärdaten hat gezeigt, dass zur Beizung der vier wichtigsten Kulturarten Getreide, Mais, Raps und Zuckerrübe zum Stand Juli 2020 28 Pflanzenschutzmittel (ohne Notfallzulassungen) in Deutschland zugelassen sind. Des Weiteren wurden sechs Produkte ohne Zulassung in Deutschland identifiziert, die über Importe auch auf Flächen der Bundesrepublik Anwendung finden. Drei der sechs Mittel werden zur Behandlung von Maissaatgut verwendet, zwei zur Behandlung von Raps und eines für Getreidesaatgut. Die zulässigen Beizmittel für Zuckerüben in Deutschland unterscheiden sich bzgl. der Wirkstoffe nicht im Vergleich zu den zugelassenen Beizmitteln im EU-Ausland.

- Anbauflächen wichtiger Kulturarten in Deutschland

Aufgrund der unterschiedlichen Eigenschaften, Ansprüche und regionalen Anbauentscheidungen variiert der Import von gebeiztem Saatgut abhängig von den Kulturarten. Die Feldfrüchte haben unterschiedliche Anforderungen an Klima und Boden. Durch die verschiedenen Standortbedingungen haben sich in Deutschland spezielle Anbauregionen für die einzelnen Kulturen entwickelt. Dementsprechend sind die Anbaudichten der Feldfrüchte in den Bundesländern unterschiedlich hoch. Je nach Notwendigkeit, in den Regionen importiertes gebeiztes Saatgut zu verwenden, ist auch der Anteil von importiertem gebeiztem Saatgut regional unterschiedlich.

Acht der Bundesländer bauen auf mindestens 50 % der Ackerfläche Getreidesorten an. Die relative Anbaufläche ist in den mitteldeutschen Bundesländern (Hessen und Thüringen) am größten. Die absolut größten Anbaugebiete für Getreide liegen in Bayern und Niedersachsen, den auch flächenmäßig größten Bundesländern. Dort wird auf mehr als 750.000 ha angebaut. Mit der Größe der Gesamtfläche der einzelnen Bundesländer steigt auch die absolute Anbaufläche für Getreide.

In Nordrhein-Westfalen, Baden-Württemberg und Bayern wird auf mindestens 5 % der Ackerfläche Körnermais angebaut. Die absolut gesehen größten Anbauflächen liegen in Bayern, gefolgt von Niedersachsen und Nordrhein-Westfalen. In Bayern werden mehr als 100.000 ha für die Produktion genutzt. Ein Schwerpunkt des Anbaus ist nicht zu erkennen. Die flächenmäßig kleineren Bundesländer in der Mitte Deutschlands (Saarland, Rheinland-Pfalz, Hessen), sowie die östlichen Bundesländer (Sachsen, Sachsen-Anhalt, Thüringen, Brandenburg, Mecklenburg-Vorpommern) produzieren nur auf wenigen Hektar Körnermais. In Schleswig-Holstein, Niedersachsen, Nordrhein-Westfalen und Bayern wird auf mindestens einem Fünftel der Ackerfläche Silomais angebaut. Die absolut größten Anbauflächen liegen in Niedersachsen und Bayern; dort werden mehr als 250.000 ha für die Silomaisproduktion genutzt. Ein Schwerpunkt des Anbaus ist nicht zu erkennen. In den kleineren Bundesländern in der Mitte Deutschlands (Saarland, Rheinland-Pfalz, Hessen) spielt der Maisanbau eine untergeordnete Rolle.

Auf knapp 20 % der Flächen in Mecklenburg-Vorpommern, Thüringen und Sachsen steht Raps. Die größten absoluten Produktionsflächen mit mehr als 150.000 ha liegen in Mecklenburg-Vorpommern und Sachsen. Weitere wichtige Anbauregionen sind Sachsen-Anhalt und Brandenburg, weshalb sich der Osten Deutschlands als Anbauschwerpunkt definieren lässt. Generell nimmt die absolute Anbaufläche von West nach Ost zu.

Die Zuckerrübenproduktion nimmt generell deutlich kleinere Flächen ein als Getreide, Mais oder Raps. Im Vergleich zu anderen Feldfrüchten finden sich Zuckerrüben auf 6 % der Äcker in Niedersachen, Nordrhein-Westfalen und Sachsen-Anhalt. Niedersachsen ist zudem das Bundesland, das mit 105.000 ha die absolut größte Produktionsfläche aufweist. Darauf folgen Nordrhein-Westfalen und Bayern, welche auf mehr als 60.000 ha Zuckerrübenanbau betreiben. Abgesehen von Bayern liegt der Produktionsschwerpunkt im Nordwesten Deutschlands.

- Importmengen von (gebeiztem) Saatgut

In den Statistiken zum Handel von Saatgut wird nicht zwischen gebeiztem und ungebeiztem Saatgut differenziert. Über die Ein- und Ausfuhrmengen können dennoch Rückschlüsse auf die Relevanz von Importen sowie auf die mengenmäßig relevanten Importländer (bezogen auf die einzelnen Feldkulturen) gezogen werden. Die Datengrundlage für die Ein- und Ausfuhrmengen bildet die Außenhandelsstatistik des Statistischen Bundesamtes.

Die kalkulatorische Aussaatmenge von Getreidesaatgut lag im Jahr 2019 bei etwa 926.000 t. Die Ein- und Ausfuhrmengen umfassten im gleichen Jahr etwa 54.000 t bzw. 59.000 t. Wesentliche Handelspartner für den Import waren Frankreich (26 %), Österreich (22 %) und Polen (21 %). Die größten Abnehmer von deutschem Getreidesaatgut waren die Niederlande (53 %) und Belgien (12 %).

Die Menge an Mais insgesamt, die kalkulatorisch in Deutschland zur Aussaat verwendet wird, ist seit 2012 nahezu konstant geblieben und lag 2019 bei etwa 78.000 t Saatgut. Auch der Außenhandel hat seit 2012 keine großen Änderungen erfahren. Importiert wurden 2019 etwa 62.000 t. Frankreich (69 %) und Österreich (20 %) sind die wichtigsten Importländer. Der Export von Maissaatgut in das EU-Ausland lag im Jahr 2019 bei etwa 9.500 t.

Bei Raps gab es einen Rückgang der ausgebrachten Saatgutmenge von ca. 4.900 t (2018) auf ca. 3.400 t (2019). Der Import von Rapssaatgut hat sich von etwa 12.000 t im Jahr 2017 auf etwa 20.500 t im Jahr 2018 fast verdoppelt. Die wichtigsten Importländer waren Frankreich (65 %), Spanien (12 %), Niederlande (6 %) und Polen (5 %). Die Importe aus Spanien und Polen haben sich im Vergleich zum Vorjahr mehr als verdoppelt. Exportiert wurde hauptsächlich nach Frankreich (24 %) und Polen (22 %).

Eine realistische Quantifizierung der ausgebrachten Menge an Zuckerrübensaatgut ist nicht möglich, da dieses bei der Beizung pilliert wird (Ummantelung u.a. bestehend aus der Beize) und für die Zuckerrübensamen kein spezifisches Gewicht vorhanden ist, welches adäquat mit den Handelsmengen verglichen werden kann. Die Einfuhrmengen haben in den letzten Jahren variiert. So wurden im Jahr 2015 insgesamt 7.700 t Saatgut importiert, im Jahr 2017 lag der Wert hingegen bei 12.800 t. Die Importe stammten fast ausschließlich aus Italien (52 %) und Frankreich (46 %), den Ländern, in denen der Hauptteil der europäischen Saatgutproduktion für Zuckerrüben stattfindet. In den Export gingen seit dem Jahr 2012 jährlich etwa 2.200 t. Ein Anstieg ist seit dem Jahr 2015 bis zu einem Wert von etwa 3.400 t im Jahr 2018 zu verzeichnen. Im Jahr 2019 wurden etwa 2.400 t hauptsächlich in die Länder Frankreich (42 %), Polen (14 %) und die Niederlande (12 %) exportiert.

Auf Basis der Sekundärdatenanalyse konnten Erkenntnisse zu den verfügbaren sowie den nicht zugelassenen Pflanzenschutzmitteln in Deutschland gewonnen werden. Für alle Kulturarten konnten dadurch erste Anreize zum Saatgutimport identifiziert werden. Die unterschiedlichen Anbaugebiete zeigen zudem, dass der Bedarf je nach Bundesland unterschiedlich hoch sein kann. Grenzüberschreitende Betriebs- bzw. Versorgungsstrukturen bilden einen weiteren Anreiz gebeiztes Saatgut zu importieren. Durch die Analyse der Außenhandelsstatistik wurde deutlich, dass bis auf Getreide alle Kulturarten häufig importiert werden, wobei noch keinerlei Aussage über den Anteil des bereits gebeizten Saatguts getroffen werden konnte. Zusätzlich wurden über eine Literaturanalyse weitere Gründe für den Kauf und die Verwendung von importiertem gebeiztem Saatgut identifiziert. Zusammenfassend konnten in dem ersten Schritt der Sekundärdatenanalyse die folgenden Gründe für einen Import von gebeiztem Saatgut erarbeitet werden:

- Geringerer Preis
- Keine Verfügbarkeit von alternativen Pflanzenschutzmitteln in Deutschland
- Regionale Gründe, z. B. räumliche Nähe des Betriebes zum EU-Ausland
- Länderübergreifende Betriebsorganisation
- Etablierte Vertriebsstrukturen

Die genauen Mengen und die Wichtigkeit einzelner Pflanzenschutzmittel konnten in der Literatur nicht bemessen werden und stellen somit weiteren Forschungsbedarf dar. Im Rahmen der Interviews mit Expert*innen (Primärdatenerhebung) wurden die zentralen Sachverhalte daher weiter vertieft, darunter insbesondere die Gründe, die zum Import von gebeiztem Saatgut führen.

Gründe für den Import von Getreidesaatgut

Nach Aussage der interviewten Saatgut Händler*innen und Verbände findet durch die räumliche Nähe zu Nachbarländern oder durch eine länderübergreifende Betriebsstruktur standardmäßig ein länderübergreifender Handel statt. Insbesondere bei Getreide muss jedoch berücksichtigt werden, dass Transporte aufgrund von hohen Transportkosten (hohe Aussaatmengen) und geringen Margen nur über kurze Strecken wirtschaftlich sind. Insgesamt schwankt der Import von gebeiztem Getreidesaatgut nach Angaben von Expert*innen abhängig von Angebot und Nachfrage. Ausschlaggebend dafür sind unter anderem die jährlich unterschiedlichen klimatischen Bedingungen und die daraus resultierenden Saatgutmengen deutscher Produzent*innen. Bei Getreide gibt es keine speziellen produktionstechnischen Abläufe, die einen Import von Saatgut begründen.

Für Getreide liegt eine große Anzahl an Produkten mit fungiziden Wirkstoffen und Zulassung in Deutschland vor. In anderen EU-Ländern besteht zwar, im Gegensatz zu Deutschland, eine Zulassung für das Produkt Vibrance Gold, die darin enthaltenen Wirkstoffe Sedaxane, Fludioxonil und Difenoconazol sind jedoch auch als Wirkstoffe bei in Deutschland zugelassenen Produkten enthalten. Beizmittel mit insektizider Wirkung sind für Getreide aktuell europaweit nicht zugelassen. Die fehlende Verfügbarkeit von Pflanzenschutzmitteln stellt daher keinen Anreiz für den Import von Getreidesaatgut dar.

Nach Aussage mehrerer Pflanzenschutzdienste und Saatguthändler*innen wird Getreidesaatgut sowohl bereits gebeizt als auch ungebeizt importiert. Eine genaue Bestimmung des Anteils von gebeiztem Saatgut ist nicht möglich, da die ohnehin sehr geringen importierten Saatgutmengen durch eine Vielzahl von Händler*innen und z. T. durch die Landwirt*innen selbst importiert werden. Durch einen weiteren*eine weitere Expert*in wurde erläutert, dass schätzungsweise 50 % des Getreidesaatguts innerhalb der EU-Nachbausaatgut ist, über dessen Saatgutbehandlung keine Aussage getroffen werden kann. Die restlichen 50 % umfassen zertifiziertes Getreidesaatgut, welches hauptsächlich lokal gebeizt wird, d.h. hauptsächlich in der Nähe des Gebietes behandelt wird, in dem es ausgesät werden soll. Es wird geschätzt, dass Getreidesaatgut nur von Landwirt*innen nach Deutschland importiert wird, die in Grenznähe bis zu einer Entfernung von etwa 50 – 80 km produzieren.

Gründe für den Import von Maissaatgut

Nach Aussage der interviewten Saatgut Händler*innen und Verbände findet durch die räumliche Nähe zu Nachbarländern oder durch eine länderübergreifende Betriebsstruktur standardmäßig ein länderübergreifender Handel statt. Dieser Handel betrifft sämtliche Feldkulturen, weswegen auch Maissaatgut aufgrund bestehender Handels- und Betriebsstrukturen importiert wird.

Mais stellt hohe Anforderungen an die klimatischen Bedingungen bei der Saatgutvermehrung. Aus diesem Grund lässt sich bisher eine Saatgutvermehrung innerhalb Deutschlands kaum realisieren. Im Raum Freiburg-Krozingen kann Saatgut auf einer Vermehrungsfläche von rund 3.500 ha erzeugt werden. Diese Menge entspricht etwa 18 % des jährlichen Saatgutbedarfs in Deutschland. Abgesehen von den klimatischen Bedingungen wird Saatgut laut Expert*innen auch aufgrund der einzuhaltenden Mindestabstände zwischen Vermehrungsflächen und anderen Flächen der gleichen Kultur im Ausland vermehrt. Im Rahmen der Produktionsabläufe wird im Ursprungsland der Vermehrung häufig auch der Beizvorgang durchgeführt. Dieses Vorgehen ist für die Saatgutproduzenten wirtschaftlich günstiger. Der Preis des importierten gebeizten Saatguts fällt somit geringer aus (im Vergleich zu Saatgut, welches im europäischen Ausland vermehrt und im Inland gebeizt wird). Der überwiegende Teil der Versorgung wird daher über Saatgutimporte aus Frankreich, Ungarn, Österreich und Rumänien sichergestellt. Als weitere Produktionsländer wurden von einem*einer interviewten Händler*in die Slowakei und Serbien genannt.

Bei Mais liegt gegen Pilzkrankheiten eine große Bandbreite an zugelassenen Produkten mit den dazugehörigen fungiziden Wirkstoffen vor. Mit VOTiVO ist zudem auch ein Produkt mit nematizidem Wirkstoff auf dem deutschen Markt verfügbar. Anders ist die Situation bei Produkten mit insektizider bzw. repellenter Wirkung. Aktuell sind in Deutschland keine Pflanzenschutzmittel mit einem entsprechenden Wirkstoff zugelassen. Über den EU-Handel kann jedoch behandeltes Saatgut mit den Beizmitteln Sonido (Wirkstoff Thiacloprid) gegen den Drahtwurm bzw. Korit 420 FS (Wirkstoff Ziram) gegen Vogelfraß bezogen und ausgebracht werden. Bei der Verwendung von insektiziden und repellenten Wirkstoffen sind landwirtschaftliche Betriebe daher auf Importe aus dem EU-Ausland angewiesen.

Von den interviewten Beizstellen, Saatguthändler*innen und Pflanzenschutzdiensten gab es in der Einschätzung des Anteils von importiertem gebeiztem Saatgut bezogen auf die Gesamtheit des in Deutschland ausgebrachten Maissaatgutes nur geringe Abweichungen. So ist, bezogen auf die Aussaat im Wirtschaftsjahr 2019 / 2020, ein Anteil von etwa 89 % des Maissaatgutes importiert worden. Die Einschätzungen der Expert*innen können mit den Ergebnissen der Statistikanalyse in Deckung gebracht werden. Generell ist das importierte Saatgut nach Aussagen der Expert*innen bereits mit Pflanzenschutzmitteln behandelt.

Gründe für den Import von Rapssaatgut

Nach Aussage der interviewten Saatguthändler*innen und Verbände findet durch die räumliche Nähe zu Nachbarländern oder durch eine länderübergreifende Betriebsstruktur standardmäßig ein länderübergreifender Handel statt. Dieser Handel betrifft sämtliche Feldkulturen, weswegen auch Rapssaatgut aufgrund bestehender Handels- und Betriebsstrukturen importiert wird.

Das EU-Ausland stellt für die Saatgutproduktion im Raps eine wichtige Rolle dar. Ein großer Anteil der Saatgutproduktion von Raps findet in Frankreich statt. Einzelne Interviewpartner*innen stellten heraus, dass es in Frankreich bessere Möglichkeiten zur Einhaltung der Mindestabstände zwischen Vermehrungs- und Feldbeständen gibt.

Unter den vorhandenen Rapsbeizen liegt aktuell kein Insektizid mit Zulassung in Deutschland vor. Mit Lumiposa 265 (Wirkstoff Cyantraniliprol) ist jedoch für Rapssaatgut ein insektizides Beizmittel im EU-Ausland zugelassen. Bezogen auf die fungiziden Beizen steht mit Integral Pro (Wirkstoff Bacillus amyloliquefaciens Stamm MBI 600) ein biologisches Produkt für die Saatgutbehandlung in Deutschland zur Verfügung. Eine Zulassung in anderen EU-Ländern hat das fungizid-wirksame Produkt Scenic Gold (Wirkstoffe Fluopicolid, Fluoxastrobin). Zur Bekämpfung der kleinen Kohlfliege und des Rapserdflohs müssen Produzent*innen entsprechend auf bereits gebeiztes Saatgut aus dem EU-Ausland zugreifen.

Auch für Raps konnte von den interviewten Beizstellen, Saatguthändler*innen und Pflanzenschutzdiensten eine Einschätzung des Anteils von importiertem gebeiztem Saatgut bezogen auf die Gesamtheit des in diesen Kulturen ausgebrachten Saatgutes mit nur geringen Abweichungen gegeben werden. So liegt der Anteil im Raps, bezogen auf die Aussaat im Wirtschaftsjahr 2019 / 2020, bei etwa 45 %. Nach Aussage mehrerer Interviewpartner*innen ist das Saatgut in der Regel bereits gebeizt, wenn es nach Deutschland importiert wird.

Gründe für den Import von Zuckerrübensaatgut

Nach Aussage der interviewten Saatguthändler*innen und Verbände findet durch die räumliche Nähe zu Nachbarländern oder durch eine länderübergreifende Betriebsstruktur standardmäßig ein länderübergreifender Handel statt. Dieser Handel betrifft sämtliche Feldkulturen, weswegen auch Zuckerrübensaatgut aufgrund bestehender Handels- und Betriebsstrukturen importiert wird.

Die Saatgutproduktion von Zuckerrüben innerhalb der EU findet aufgrund der klimatischen Anforderungen fast ausschließlich in Norditalien und in Südwestfrankreich statt. Sämtliches Saatgut wird daher aufgrund von produktionstechnischen Abläufen importiert.

Für den Anbau von Zucker- und Futterrüben stehen in Deutschland aktuell Beizmittel mit fungizider, insektizider und nematizider Wirkung zur Verfügung. Relevante Produkte aus dem EU-Ausland (ohne Zulassung in Deutschland) konnten nicht identifiziert werden. Daher ist ein Import aufgrund der fehlenden Verfügbarkeit von alternativen Pflanzenschutzmitteln für Zuckerrüben nicht relevant.

Das Saatgut für den Anbau von Zuckerrüben wird vollständig importiert. Ob es sich dabei um gebeiztes oder ungebeiztes Saatgut handelt, hängt von dem*der jeweiligen Züchter*in und dem Standort der Beizstellen ab. Die interviewten Beizstellen und Händler*innen gaben an, dass etwa 80 % des in Deutschland ausgebrachten Zuckerrüben Saatguts im Inland gebeizt wird. Entsprechend ist ein Anteil von 20 % des ausgebrachten Saatguts bereits mit Pflanzenschutzmitteln behandelt, wenn es nach Deutschland importiert wird.

Unsicherheiten, potenzielle Risiken der Ausbringung von importiertem gebeiztem Saatgut und mögliche Lösungsvorschläge für die Risikoregulierung

Um die Ergebnisse der Sekundärdatenanalyse und der Befragung der Expert*innen zu validieren sowie Lösungsvorschläge für die Risikoregulierung zu identifizieren, wurde ein Workshop mit Expert*innen der Branche durchgeführt. In der Diskussion sollte die Relevanz der Studienergebnisse für die potenziellen Risiken der Ausbringung von importiertem gebeiztem Saatgut erörtert sowie vorgestellte Lösungsvorschläge für die Risikoregulierung bewertet und weiter ausgearbeitet werden. Als Grundlage für die Diskussion dienten die Arbeitsergebnisse der AFC sowie eine Zusammenstellung des Umweltbundesamtes von Unsicherheiten, potenziellen Risiken und möglichen Lösungsvorschlägen zur Risikoregulierung.

Elf externe Expert*innen nahmen an dem Workshop teil. Je drei gehörten Institutionen zur Saatgutzertifizierung, landwirtschaftlichen Verbänden und Pflanzenzüchterverbänden an. Ein*eine Expert*in aus einem Landesministerium sowie ein*eine Expert*in eines Pflanzenschutzdienstes nahmen ebenfalls am Workshop teil. Experten des UBA und der AFC waren während des Workshops ebenfalls anwesend.

Ausgangslage der Diskussion der verschiedenen Szenarien und Lösungsvorschläge bildete die Unsicherheit über mögliche Risiken aufgrund der unbekannten Qualität des importierten behandelten Saatguts hinsichtlich des Staubabriebs, die in Deutschland aufgrund spezifischer Bedingungen auf nationaler Ebene entstehen. Dabei spielen neben der Qualität des behandelten Saatguts auch spezifische Anwendungsbedingungen und Umwelt- bzw. landwirtschaftliche Gegebenheiten wie z. B. die Windgeschwindigkeit eine wichtige Rolle für das Ausmaß des Staubabriebs und Abdriften des Wirkstoffs.

Im Zuge des Workshops wurden folgende Lösungsvorschläge zur Risikoregulierung diskutiert:

- Einführung zusätzlicher Deklarierung über die mögliche Zertifizierung von Saatgut, um Anreize bei Anwender*innen zu schaffen
- Risiken der Aussaat für spezielle Beizen ins Bewusstsein der Anwender*innen bringen
- Übertragung der Anwendungsbestimmungen auf importiertes Saatgut
- Bei entsprechenden Risiken und entsprechend der EU-Regulierung, ein Verbot der Einfuhr und des Inverkehrbringens von mit bestimmten Beizen behandeltem Saatgut aus dem EU-Ausland als ultima ratio in Betracht ziehen
- Zulassung der im EU-Ausland für die Beizung von importiertem Saatgut verwendeten Mittel in Deutschland anstreben

Einzelne Expert*innen hielten eine zusätzliche Deklaration des Saatguts nicht für sinnvoll, da die Kaufentscheidung bereits vor dem Betrachten der Verpackung getroffen werden würde. Außerdem würden zusätzliche Informationen auf der Verpackung übersehen werden. Das UBA verwies darauf, dass die Deklarationen auf der Verpackung sehr zentral für die Information der Anwender sind (z. B. Gefahrenpiktogramme. Ein*eine Teilnehmer*in wies auf die bereits vorhandenen Kenntnisse der

Landwirt*innen hin; sie würden die Anwendungshinweise und Risiken bei der Verwendung von behandeltem Saatgut bereits kennen. Ein weiterer Vorschlag zur Risikominimierung war die Übertragung von Anwendungsbestimmungen auf importiertes Saatgut. Nach Ansicht eines*einer Teilnehmer*in würden zusätzliche Anforderungen die Umsetzung für die Produzent*innen erschweren. Zusätzliche Anforderungen sollten vermieden und eine ausreichende Saatgutqualität vor der Abgabe an den*die Anwender*in sichergestellt werden. Das UBA wies darauf hin, dass im Falle eines nicht akzeptablen Risikos und bei Gefahr der Import und die Vermarktung von behandeltem Saatgut entsprechend der EU-Regelungen als ultima ratio eingeschränkt werden könnte. Zwei Teilnehmer*innen sahen diesen Lösungsvorschlag kritisch, da dadurch der freie Handel in der EU eingeschränkt würde. Handlungsbedarf bestünde vorrangig auf EU-Ebene; nicht auf nationaler Ebene. Fast alle Expert*innen unterstützten den Ansatz, eine einheitliche Zulassung in der EU anzustreben, da dies die Harmonisierung der Vorschriften vorantreiben und damit die Nutzung des Saatguts für die Anwender*innen verbessern würde. Gleichzeitig wäre eine bessere Risikoregulierung für die Kontrollbehörden möglich.

Trotz einer offenen Diskussion sahen einige Teilnehmer*innen in den Vorschlägen zur besseren Risikobeschreibung hauptsächlich zusätzliche Restriktionen für die Anwender*innen, nicht aber mögliche Verbesserungen für die Risikoregulierung. Dies hemmte die Weiterentwicklung der Vorschläge. Weitere Entwicklungen sind notwendig, um die Risikoregulierung von Saatgutbeizen voranzutreiben, u.a. in der Information der Landwirte und in der Unterstützung der Zertifizierung von Saatgut.

Zusammenfassende Darstellung: Kurzbeantwortung der Fragestellungen

Die Ergebnisse der Studie können in Form der Beantwortung der Forschungsfragen zusammengefasst werden:

1. **Für welche Feldkulturen ist ein Kauf von importiertem gebeiztem Saatgut aus dem europäischen Ausland für Landwirt*innen attraktiv bzw. notwendig?**

- Aufgrund bestehender Handels- / Betriebsstrukturen:
  - Getreide, Mais, Raps, Zuckerrübe
- Aufgrund produktionstechnischer Abläufe:
  - Mais, Raps, (Zuckerrübe)
- Aufgrund von fehlender Verfügbarkeit von alternativen Pflanzenschutzmitteln in Deutschland:
  - Mais, Raps

2. Welche Mengen an gebeiztem Saatgut werden je nach Kultur importiert und welche Anteile haben die importierten Mengen an der Gesamtheit des in Deutschland in diesen Kulturen ausgebrachten Saatgutes?

- Getreide
  - Die Gesamtimportmenge von Getreide liegt bei 54.000 t und hat damit nur einen sehr geringen Anteil an der kalkulatorischen Aussaatmenge in Deutschland (< 6 %).
  - Eine Angabe darüber zu machen, welche Anteile des importierten Saatguts bereits gebeizt sind, ist kaum möglich, da der Import durch eine Vielzahl von Händler*innen und z. T. durch die Landwirt*innen selbst erfolgt und etwa 50 % des Getreidesaatguts über Hofbeizung behandelt wird.
- Mais
  - Kalkulatorische Aussaatmenge (2019): 77.913 t
  - Davon kalkulatorische Importmenge von gebeiztem Saatgut: 69.343 t
  - Anteil der gebeizten Importe an der Aussaatmenge: ca. 89 %
- Raps
  - Kalkulatorische Aussaatmenge (2019): 3.411 t
  - Davon kalkulatorische Importmenge von gebeiztem Saatgut: 1.535 t
  - Anteil der gebeizten Importe an der Aussaatmenge: ca. 45 %
- Zuckerrübe
  - Das Saatgut für den Anbau von Zuckerrüben wird vollständig importiert
  - Ob es sich dabei um gebeiztes oder ungebeiztes Saatgut handelt, hängt von dem*der jeweiligen Züchter*innen und dem Standort der Beizstellen ab
  - Anteil der gebeizten Importe an der Aussaatmenge: ca. 20 %

3. Welche Gründe sind ausschlaggebend für den Kauf und die Verwendung von importiertem gebeiztem Saatgut (Preis, Verfügbarkeit etc.)?

- Import aufgrund von bestehenden Handels- / Betriebsstrukturen
- Import aufgrund von produktionstechnischen Abläufen
- Import aufgrund der fehlenden Verfügbarkeit von alternativen Pflanzenschutzmitteln in Deutschland

4. Gibt es in Deutschland regionale Unterschiede bezüglich Kauf und Aussaat von aus dem europäischen Ausland importiertem gebeiztem Saatgut?

- Regionale Unterschiede bei der Aussaat von importiertem gebeiztem Saatgut sind durch die unterschiedlichen Anbauregionen der Feldkulturen begründet.
- Das Auftreten von Schaderregern korreliert im Wesentlichen mit den Anbauregionen der betroffenen Kulturen. In Einzelfällen liegen darüber hinaus regionale Unterschiede durch spezielle Schaderreger vor, für deren Bekämpfung auf Pflanzenschutzmittel aus dem Ausland zurückgegriffen wird.
- Die räumliche Nähe zu Nachbarländern hat bei den Kulturen Mais, Raps und Zuckerrübe nur eine untergeordnete Rolle.

5. Mit welchen Pflanzenschutzmitteln wurde das importierte Saatgut behandelt? Saatgut welcher Kulturen wird in der Regel mit welchen Pflanzenschutzmitteln bzw. Kombinationen mehrerer Pflanzenschutzmittel - getrennt nach in Deutschland gebeiztem Saatgut und importiertem gebeiztem Saatgut - gebeizt und welche Wirkstoffe sind in diesen enthalten?

- Die Kulturen Mais, Raps und Getreide werden generell mit einer Standardbeize (Fungizide) behandelt. Die verwendeten Pflanzenschutzmittel haben (ausgenommen Scenic Gold für Raps) eine Zulassung in Deutschland.
- Bei den Wahlbeizen, die bei Bedarf zusätzlich gebeizt werden, liegen für Mais und Raps keine Zulassungen in Deutschland vor. Das mit diesen Mitteln behandelte Saatgut wird daher vollständig importiert.
- Die Wahlbeizen von Getreide und Zuckerrübe sind in Deutschland zugelassen.

6. Sind im europäischen Ausland Instrumente der Qualitätskontrolle in Beizstellen implementiert und wie sind diese gestaltet und umgesetzt (z. B. Zertifizierungen)?

- Das wesentliche Instrument zur Qualitätskontrolle von gebeiztem Saatgut in Europa ist ESTA. Die nationalen Instrumente der Qualitätskontrolle sind mit ESTA kompatibel oder sind an die Vorgaben von ESTA angelehnt.
- Das in Deutschland ausgebrachte Saatgut ist bei den Kulturen Mais, Raps und Zuckerrübe zu 90 % – 100 % nach ESTA zertifiziert.
- Bei Getreide ist der Anteil an ESTA-zertifiziertem Saatgut noch sehr gering. Es wird prognostiziert, dass dieser Anteil in den kommenden fünf Jahren stark ansteigen wird.

7. Welche zusätzlichen Angaben zur Qualitätsbeschreibung des gebeizten Saatgutes eignen sich, um Saatgut im Handel zu kennzeichnen?

- Die bestehenden Kennzeichnungen von gebeiztem Saatgut werden von einem Großteil der Expert*innen als ausreichen erachtet.
- Die Eignung von zusätzlichen (verpflichtenden) Angaben zur Qualitätsbeschreibung von gebeiztem Saatgut werden von den Stakeholdern der Branche sehr unterschiedlich bewertet.

1 Introduction

1.1 Background of the study

In the authorization procedure for plant protection products under Regulation (EC) No. 1107/2009, the treatment process itself is considered to be an application of a plant protection product. The use of the treated seeds in the field may pose however risks to human and environmental health. Seeds that have been treated in a country of the European Union (EU) with a plant protection product authorized there may be freely traded and sown in the EU. This is also the case if the same product has not been authorized or applied for authorization in the importing country as a seed treatment.

This situation might result in a gap in the current environmental risk assessment and risk mitigation of seed treatment products in a given Member State resulting from specific agricultural and ecological conditions. It is neither possible to estimate the specific risks to the environment from the application of imported treated seeds in Germany, nor to define appropriate risk mitigation measures that might be specifically needed for the condition in Germany. So far, there is no data available on either the amount of treated seeds imported from other EU countries that are sown in Germany or on their share in the total amount of treated seeds sown in Germany. Furthermore, it is unknown for which crops the use of imported treated seeds is preferred or necessary in the different regions of Germany. Information on determining factors for the usage of imported treated seeds is also not available. In addition, knowledge about the active substances and combinations of active substances used for treatment and the quality of the imported treated seeds are important for assessing the possible specific risk to the specific environmental conditions in Germany from sowing imported treated seeds.

These knowledge gaps lead to uncertainties regarding possible specific risks for the environmentally relevant protection goals because of the sowing of imported treated seeds in Germany. Possible specific agricultural and ecological conditions may influence the manifestations of the risks for the environment in Germany and require adapted risk mitigation measures in comparison to the other Member States of the EU.

The aforementioned assessment gaps will be determined and quantified as part of this market analysis. In a further step, possible consequences for risk assessment and risk mitigation at the regulatory level will be identified.

1.2 Aim and questions of the study

This market study aims to provide information to answer the following questions:

1. For which field crops is the purchase of imported treated seeds from other European Member States attractive or necessary for the farmer?
2. What quantities of treated seeds are imported for each crop and what share do the imported quantities have of the total seeds sown in Germany in these crops?
3. What are the reasons for buying and using imported treated seeds (price, availability, etc.)?
4. Are there regional differences in Germany regarding the purchase and sowing of treated seeds imported from other European countries?
5. Which plant protection products were used to treat the imported seeds? Seeds of which crops are usually treated with which plant protection products or combinations of several plant protection products - separated into seeds treated in Germany and imported treated seeds - and which active substances are contained in these?
6. Are quality control instruments implemented in seed treatment facilities in other European countries and how are they designed and implemented (e.g., certifications)?
7. What additional information on the quality description of treated seeds is suitable for labelling traded seeds?

These questions were clarified by researching, reviewing, and evaluating information and literature. Additionally, a survey among relevant stakeholders (including plant breeding institutes, seed treatment facilities, seed traders, selected agricultural enterprises, plant protection services and other authorities) was designed, conducted, and evaluated.

The findings of the study are intended to identify potential risks to the environment, which have not yet been considered in the risk assessment of seed treatment products, and which may arise specifically for the environment in Germany as a result of the sowing of imported treated seeds. Based on these findings, possible solutions for the risk assessment and risk mitigation of treated seeds on a regulatory level will be identified.

2 Methodology

The methodology of the study is based on a multi-stage procedure and the combination of different research methods. The individual work steps were designed and pre-structured in detail during a preparatory work phase. The required data and information was obtained in the following way:

- The identification of plant protection products for seed treatment in Germany and other EU countries was primarily carried out by collecting and evaluating secondary data (section 3.1).
- Initial reasons for importing treated seeds were identified via a literature analysis (section 3.4).
- Based on these results, questionnaires were developed to survey central stakeholders and agencies. Primary data collected in the form of qualitative expert interviews and an online survey of agricultural enterprises and plant protection services were used to explore the central questions in greater depth (section 4).
- The results also served as the basis for a workshop in which possible solutions for risk assessment were discussed (section 6).

The data collection period of the study covered 13 months. The characteristics of the examined sector result in the authorizations for plant protection products being highly dynamic. The plant protection products and their authorizations described in this report refer to the status quo in July 2020. The seed treatment product Lumiposa, for example was authorized in neighboring EU countries at that time but was authorized for crop seed treatment in Germany only at the end of 2020. The results of this study must be considered accordingly in the context described and at the information status indicated.

2.1 Online surveys

The online surveys of agricultural enterprises and plant protection services started on 04.05.2020. For the agricultural enterprise survey, a first reminder email was sent on 28.05.2020. To further increase the response rate, a second reminder email was sent on 31.07.2020. The plant protection services were reminded of the survey by email on 09.06.2020. In addition, a follow-up phone call was also carried out on 16.06.2020 with the plant protection services of all territorial states that had not yet participated in the survey up to this point. Both surveys were closed on 18.08.2020.

A total of 598 agricultural enterprises opened the survey link. The number of responses submitted varied between the questions. All enterprises that did not submit a response to any question were disregarded in the evaluation. The sample size for the survey of agricultural enterprises as of 18.08.2020 was 154.

The plant protection services survey link was opened 91 times. Again, the number of responses varied between the questions in the survey. The sample size at the end of the survey (18.08.2020) was 32. Eleven territorial states and one city-state participated in the survey. The number of participants per state varied between one and seven. The invitation to participate was supplemented by a note to encourage sharing the survey with colleagues at other locations and field offices.

2.2 Expert interviews

The conduction of expert interviews was an additional component of the survey. In the first round of expert interviews, eleven interviews were held. At least one interview was held in each main stakeholder group. The second phase of interviews was based on the results of the interim evaluation. This approach allowed setting priorities for further project development in areas that proved to be particularly relevant to the topic or were still lacking information. A total of 20 interviews were conducted.

The questionnaire was designed to allow an open discussion and set focal points depending on the interviewee. An overview of the number of interviews in each stakeholder group is given in Table 1.

Table 1: Overview of the expert interviews conducted

Stakeholder	Number
Plant breeding institutes	3
Seed treatment facilities	2
Seed traders	2
Farmers	3
Plant protection services	2
Other authorities	2
Scientific institutions	3
Associations	3
Total	**20**

Source: Own illustration AFC (2021)

2.3 Workshop

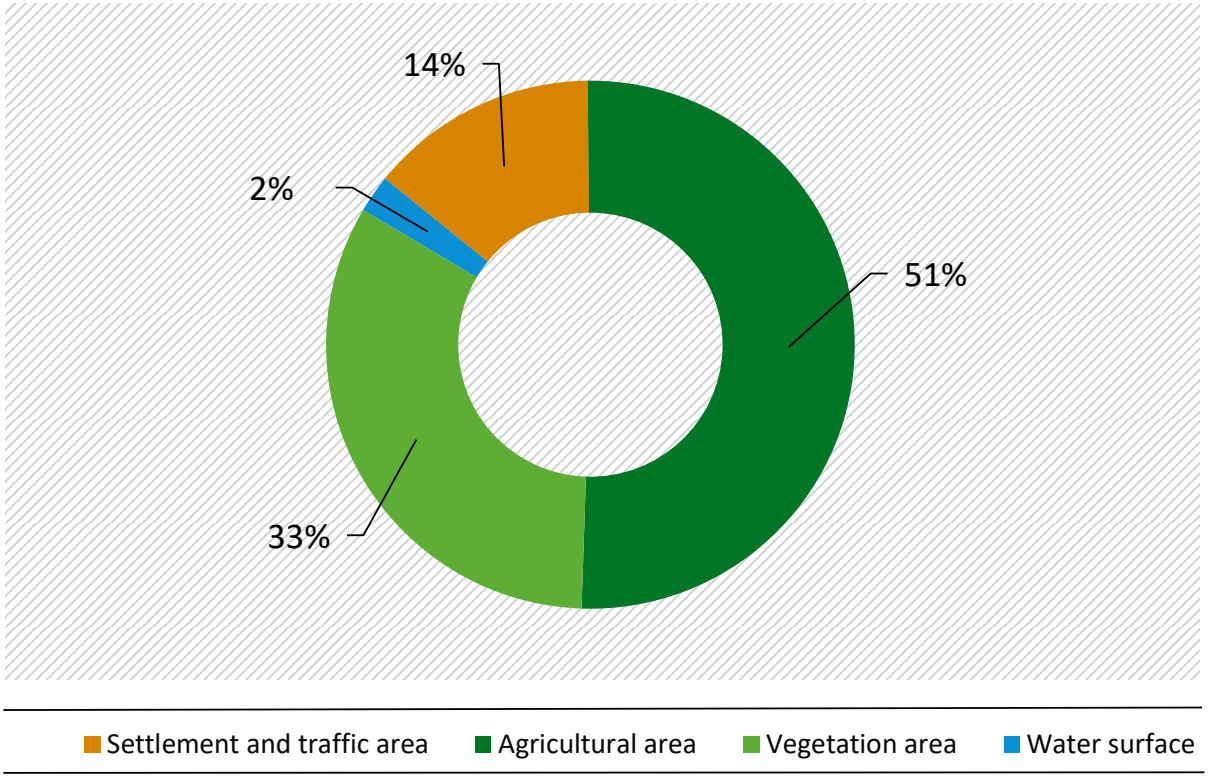
The results of the interviews and surveys also served as the basis for an expert workshop. The aim was to inform experts from the sector about the current status of the project, strengthen the exchange between them and discuss and also supplement the previous research results if deemed necessary. The workshop was intended to discuss potential risks for the environment and to identify possible solutions for risk mitigation.

The workshop was held on 10.12.2020. The Umweltbundesamt (UBA) (German Environment Agency) made suggestions for potential participants to the AFC, which supplemented these suggestions with further potential participants. The invitation to the workshop was sent by the AFC. The results of the workshop are presented in section 6.

3 Relevance of imported treated seeds for German agriculture

In Germany, about half of the total land area (approx. 18.1 million ha are used for agriculture (Figure 1). Around 266,000 farms produce food and renewable raw materials on 11.7 million ha of arable land. The remaining agricultural land is divided into grassland, permanent crops, and horticulture. [2, 3]

Figure 1: Total land use by type in Germany



Source: Own illustration based on Statistisches Bundesamt (2019b): Flächennutzung: Bodennutzung insgesamt nach Nutzungsarten in Deutschland

The main crop groups by cultivated area are cereals (6.09 million ha), plants for green harvesting (3.09 million ha), oil crops (995,300 ha) and root crops (664,900 ha).[4] Most of the agricultural area is cultivated conventionally (90.3 %), whereas organic farming occupies a small share of the total production area (9.7 %) with 1.6 million ha.

In conventional agriculture, chemical plant protection products are used for the safeguarding of yields. An application of plant protection products can take place in various forms and at different times during plant development. Seed treatment is the dressing of seed with a pesticide prior to sowing. Spray applications may also be made to the seed in advance of sowing, but these are also used in subsequent crop management. Crop protection products can also be applied in

[2] Statistisches Bundesamt (2019b): Flächennutzung: Bodennutzung insgesamt nach Nutzungsarten in Deutschland
[3] Statista (2019): Anzahl der Betriebe in der Landwirtschaft in Deutschland in den Jahren 1975 bis 2019
[4] Statistisches Bundesamt (2019a): Feldfrüchte und Grünland: Ackerland nach Hauptfruchtgruppen und Fruchtarten

solid form as granules. However, the main forms of application of plant protection products in agriculture are spraying and seed treatment.

3.1 Plant protection products for seed treatment

The approval of active substances and authorization of plant protection products have been governed since 2011 in the EU Regulation (EC) No. 1107/2009 concerning the placing of plant protection products on the market. At the national level plant protection products are governed by the Pflanzenschutzgesetz (Plant Protection Act), which regulates the responsibilities of authorities in Germany. Further details are regulated in several ordinances, such as the Pflanzenschutzmittelverordnung (Ordinance on Plant Protection Products), the Verordnung über die Prüfung von Pflanzenschutzgeräten (Ordinance on the Testing of Plant Protection Equipment), and the Pflanzenschutz-Sachkundeverordnung (Plant Protection Expertise Ordinance). Furthermore, a national action plan for the sustainable use of plant protection products and rules for good professional practice in plant protection are established.[5]

When applying plant protection products, valid legal regulations must be complied with. Accordingly, a plant protection product may only be used in Germany if it is authorized. The authorization covers its application in the field, the specific crop, and the pest to be controlled.

Special regulations from plant protection law also apply to the sale or use of seeds, seedlings, or growing media that have been treated with plant protection products. These products may only contain plant protection products that are authorized in Germany or another EU Member State for use in the relevant crop (seeds, seedlings, or growing medium). As of July 2020, a total of 35 plant protection products are authorized in Germany for the treatment of seeds and seedlings. An overview of the authorized seed treatments is given in Table 2. In addition to the product name, the formulation type, areas of application, and active ingredients are also given. Further information on the plant protection products (pests, product type, and admission period) is provided in the appendix.

Table 2: Authorized plant protection products for seed treatment in Germany

Designation	Formulation type	Field(s) of application	Active ingredient(s)
Arena C	Flowable concentrates for seed treatment (FS)	Rye, triticale, wheat	25 g/l Fludioxonil 5 g/l Tebuconazole
Cedomon	Emulsion for seed treatment (ES)	Spelt, barley	110.4 g/l Pseudomonas chlororaphis strain MA 342
CELEST	FS	Rye, triticale, wheat	25 g/l Fludioxonil
CELEST EXTRA	FS	Rye, triticale, wheat	25 g/l Difenoconazole 25 g/l Fludioxonil
Cerall	FS	Rye, triticale, wheat	200 g/l Pseudomonas chlororaphis strain MA 342
DIFEND EXTRA	FS	Barley, oats, rye, triticale, wheat	25 g/l Difenoconazole 25 g/l Fludioxonil

[5] BfR (2019): Rechtliche Grundlagen im Bereich Pflanzenschutzmittel

Designation	Formulation type	Field(s) of application	Active ingredient(s)
DMM	Wettable powder (WP)	Oilseed rape	500 g/kg Dimethomorph
EfA	FS	Barley, rye, triticale, wheat	37.5 g/l Fluoxastrobin 25 g/l Prothioconazole 3.75 g/l Tebuconazole 10 g/l Triazoxide
EfA Spezial	FS	Rye, triticale, wheat	37.5 g/l Fluoxastrobin 37.5 g/l Prothioconazole 5 g/l Tebuconazole
Emesto Silver	FS	Potato	100 g/l Penflufen 18 g/l Prothioconazole
Force 20 CS	Capsule suspension (CS)	Sugar beet	200 g/l Tefluthrin
Integral Pro	FS	Oilseed rape	6.12 g/kg Bacillus amyloliquefaciens strain MBI 600
Kinto Duo	FS	Barley, oats, rye, triticale, wheat	55.1 g/l Prochloraz (Copper chloride complex) 20 g/l Triticonazole
LANDOR CT	FS	Barley, rye, triticale, wheat	20 g/l Difenoconazole 25 g/l Fludioxonil 5 g/l Tebuconazole
Latitude	FS	Triticale, wheat	125 g/l Silthiofam
Latitude XL	FS	Barley, triticale, wheat	125 g/l Silthiofam
LONGITUDE	FS	Triticale, wheat	125 g/l Silthiofam
Maxim 480 FS	FS	Various horticulture	480 g/l Fludioxonil
Maxim Quattro	FS	Maize	37.5 g/l Fludioxonil 29 g/l Metalaxyl-M 300 g/l Thiabendazole 15 g/l Azoxystrobin
MAXIM XL	FS	Maize, arugula species, sweet maize	25 g/l Fludioxonil 9.69 g/l Metalaxyl-M
Monceren Pro	FS	Potato	250 g/l Pencycuron 8 g/l Prothioconazole
Orius Universal	ES	Barley, oats, rye, triticale, wheat	60 g/l Prochloraz 15 g/l Tebuconazole
Prepper	FS	Wheat	25 g/l Fludioxonil
Redigo M	FS	Maize	20 g/l Metalaxyl 100 g/l Prothioconazole
Rubin Plus	FS	Barley, oats, rye, triticale, wheat	33.3 g/l Fludioxonil 33.3 g/l Fluxapyroxad 33.3 g/l Triticonazole

Designation	Formulation type	Field(s) of application	Active ingredient(s)
Rubin TT	FS	Barley, oats, rye, triticale, wheat	38.6 g/l Prochloraz (Copper chloride complex) 42 g/l Pyrimethanil 25 g/l Triticonazole
Seedron	FS	Barley, oats, rye, triticale, wheat	50 g/l Fludioxonil 10 g/l Tebuconazole
SYD41400F	FS	Barley, oats, rye, triticale, wheat	25 g/l Fludioxonil 25 g/l Sedaxane 20 g/l Triticonazole
Toledo	FS	Wheat, rye, triticale	37.5 g/l Fluoxastrobin 37.5 g/l Prothioconazole
Vibrance 500 FS	FS	Maize	500 g/l Sedaxane
Vibrance SB	FS	Sugar beet, fodder beet	22.5 g/l Fludioxonil 14.4 g/l Metalaxyl-M 15 g/l Sedaxane
Vibrance Trio	FS	Barley, oats, rye, triticale, wheat	25 g/l Fludioxonil 25 g/l Sedaxane 10 g/l Tebuconazole
Tachigaren 70 WP	WS	Sugar beet, fodder beet	700 g/kg Hymexazole
Vibrance XL	FS	Maize	88.27 g/l Fludioxonil 34.24 g/l Metalaxyl-M 176.42 g/l Sedaxane
ZARDEX G	Solution for seed treatment (LS)	Barley, oats	5 g/l Cyproconazole 20 g/l Imazalil (Sulfate)

Source: Own illustration based on BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel, Status of July 2020

In Germany, seeds can be treated and sown with plant protection products authorized by the Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (BVL) (Federal Office of Consumer Protection and Food Safety). However, the planting of treated seedlings, the use of treated growing media or the sowing of treated seeds do not constitute applications of plant protection products in the legal sense. According to the legislator, the application of plant protection products already took place at an earlier stage, e.g., when the seeds were treated.[6]

Accordingly, sowing seeds that have been treated in other EU Member States with a plant protection product authorized there may also be imported and used in Germany - irrespective of whether the plant protection product is authorized in Germany or not.

[6] BVL (2018b): Jahresbericht Pflanzenschutz–Kontrollprogramm 2017

According to the participants of the survey, treated seeds are mainly used in the crops cereals, maize, oilseed rape and sugar beet. They identified six products without authorization in Germany used for the treatment of seeds from cereals, corn, oilseed rape and sugar beet, which are sown in Germany. These products are discharged into the environment in Germany via imports.

Table 3 lists these products including their formulation type, field(s) of application and active ingredient(s) as of July 2020. Further information (disease, product type and manufacturer) on the plant protection products is provided in the appendix.

Table 3: Plant protection products for seed treatment without authorization in Germany

Designation	Formulation type	Field(s) of application	Active ingredient(s)
Force 20 CS	CS	Maize	200 g/l Tefluthrin
Lumiposa 625	FS	Oilseed rape	625 g/l Cyantraniliprole
Korit 420 FS	FS	Maize	420 g/l Ziram
Scenic Gold	FS	Oilseed rape	200 g/l Fluopicolid 150 g/l Fluoxastrobin
Sonido	FS	Maize	400 g/l Thiacloprid
Vibrance Gold	FS	Barley, oats, rye, triticale, wheat	50 g/l Sedaxane 25 g/l Fludioxonil 25 g/l Difenoconazole

Source: Own illustration based on Bundesamt für Ernährungssicherheit Österreich (2020): Pflanzenschutzregister; Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (2020): Le catalogue des produits phytopharmaceutiques et de leurs usages, des matières fertilisantes et des supports de culture autorisés en France; Ministerstwo Rolnictwa i Rozwoju Wsi (2020): Rejestr Środków Ochrony Roślin, Status of July 2020

According to Article 53 of Regulation (EC) No. 1107/2009, the BVL may authorize plant protection products for limited and controlled use and a maximum of 120 days at short notice if a hazard cannot be averted otherwise. Due to this regulation, also the following plant protection products were available for seed treatment as of July 2020 (Table 4).

Table 4: Emergency authorizations according to Art. 53 Regulation (EC) No. 1107/2009

Designation	Admission period	Quantity / treatment area	Field(s) of application	Active ingredient(s)
Vibrance OSR	01.06.20 – 28.09.20	7,500 l 428,000 ha	Oilseed rape	24 g/l Fludioxonil 96.9 g/l Metalaxyl-M 100 g/l Sedaxane
Korit 420 FS	13.04.20 – 10.08.20	36,750 l 210,000 ha	Maize	420 g/l Ziram
TMTD 98 %	15.07.20 – 11.11.20	326,120 kg	Oilseed rape	980 g/l Thiram

Source: Own illustration based on BVL (2020b): Zulassungen für Notfallsituationen, Status of July 2020

The products listed in this chapter represent the spectrum of available seed treatments in Germany as of July 2020. In practice, specific seed treatment products and combinations are

predominant. Depending on the crop, these can be subdivided into the standard treatment and optional treatments. A standard treatment is used to treat almost all (conventional) seeds of the main crops. It is limited to two or three fungicidal products per crop, which have a similar spectrum of activity. Optional seed treatments can be used to serve specific seed requirements. Insecticides, bird repellents and special fungicides are combined with the standard seed treatment as needed.[7] Table 5 presents an overview of the common seed treatments (combinations) for the main crops. The overview was generated via a market analysis of the products offered by seed traders and verified during the interviews. The specific situation for the individual crops is presented in more detail in section 4.

Table 5: Standard and optional seed treatments used for the four major crops in Germany

Crop	Standard seed treatments (all types)	Optional seed treatments
Maize	Maxim Quattro or Maxim XL or Redigo M (Fungicides)	Sonido or Force 20 CS (Insecticides) Korit 420 FS (Bird repellent)
Oilseed rape	Scenic Gold or Integral Pro (Fungicides)	Lumiposa 625 (Insecticides)
Cereals	CELEST or Rubin TT (Fungicides)	Landor CT and / or Vibrance Trio and / or Latitude (Fungicides)
Sugar beet		Force 20 CS (Insekticide) Vibrance SB and / or Tachigaren 70 WB (Fungicides)

Sources (Selection): myagrar (2020): Übersicht über gebeiztes Raps- und Zuckerrübensaatgut; BayWa (2020): Empfehlungen Saatgut-beizen; Agravis (2020): Empfehlungen Saatgutbeizen; ATR-Landhandel (2020a): Saatgutbeizen Mais; ATR-Landhandel (2020b): Saatgutbeizen Raps; Strube (2020): Saatgutbeizen Zuckerrüben.

According to several experts interviewed, multiple treatments (several treatment processes for one seed batch) are carried out only in exceptional cases. Accordingly, combinations of seed treatment products are treated in one process. This is due to price and process factors. In addition, the treatment quality is considered to be higher if the seeds are treated completely in one process. Oilseed rape is currently an exception in this context. The individual components of certain treatment combinations are approved in different EU countries. The use of these combinations requires the seeds to be treated in different countries with the respective authorized products.

Most of the interviewees also made a clear statement on the use of stickers[8]: these additives are used as default by all facilities in the treatment process or are already included in the seed treatment products. Seeds can also be dressed in nutrients, but this is limited to certain high-quality varieties. Some interviewees added that the use of nutrients will become more important in the future.

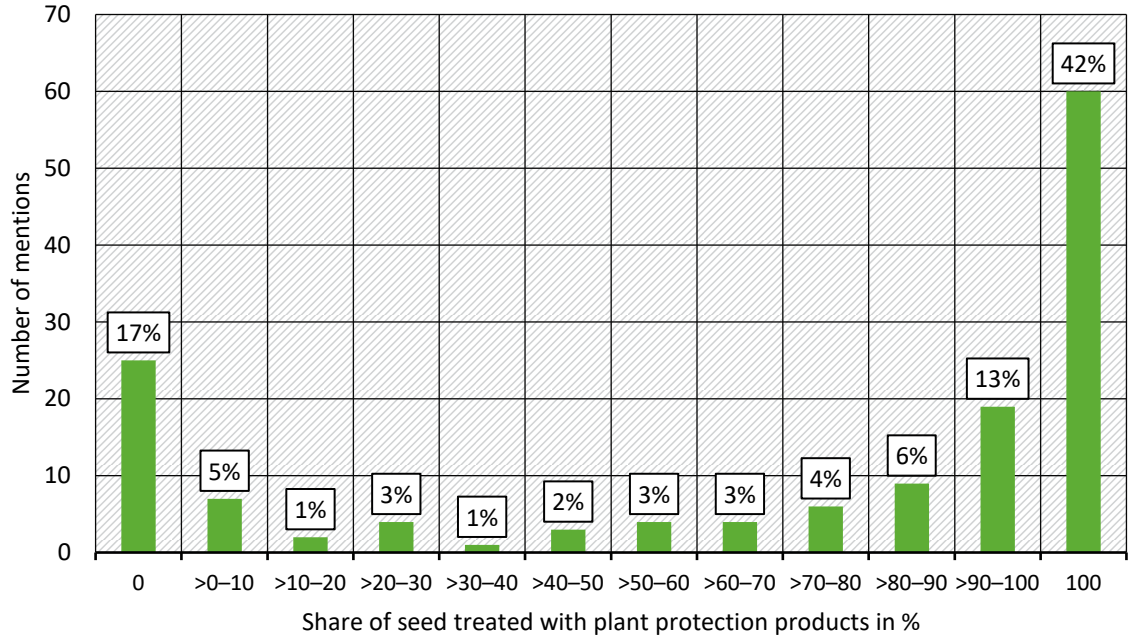
[7] depending on region, company-specific problems, willingness to pay, etc.
[8] Stickers, also called adhesives, are present in the seed treatments to reduce dust abrasion.

3.2 Relevance of treated seeds for German agriculture

Seeds treated with plant protection products are of great importance for German agriculture. This is shown by the results of the online survey of farmers and the statements of the experts interviewed, which are consistent with the results of the online survey.

About 55 % of the farmers reported that more than 90 % of the seeds used on their farms were treated with pesticides. 42 % of the farmers stated, that all the seeds applied were treated. Only 17 % of the farmers stated that treated seeds were not used. This includes organic farmers. The exact distribution of the answers is shown in Figure 2.

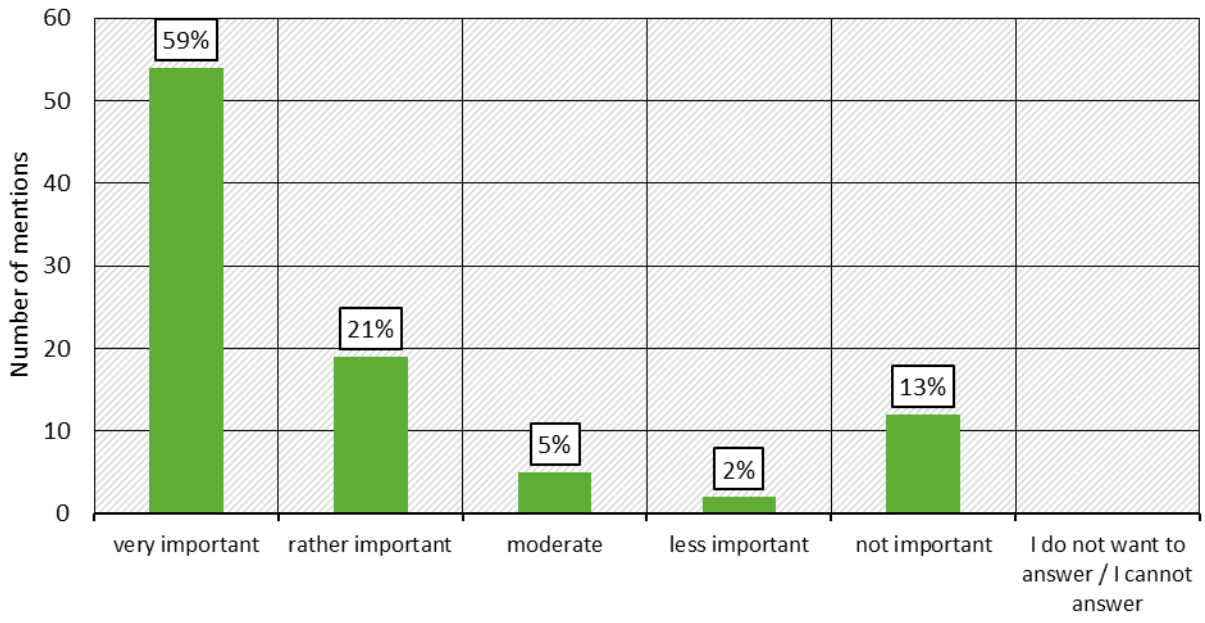
Figure 2: The frequencies with which different proportions of the seeds of the farms are treated with plant protection products according to the number of mentions by agricultural enterprises



Source: AFC (2020): Online survey of agricultural enterprises (2020); N=144
Question: What is the relative proportion of seeds treated with pesticides in relation to the total amount of seeds you use on your farm?

In addition to the proportion of treated seeds, the relevance of treated seeds for the operational success of the agricultural enterprises was also surveyed (Figure 3). This aspect was rated as very important (59 %) or rather important (21 %) by most of the agricultural enterprises surveyed. Only 13 % of the respondents stated that treated seeds are not at all important for their farm's success. It should be noted that organic farms also participated in the survey.

Figure 3: The relevance of using treated seeds for operational success according to the number of mentions by agricultural enterprises

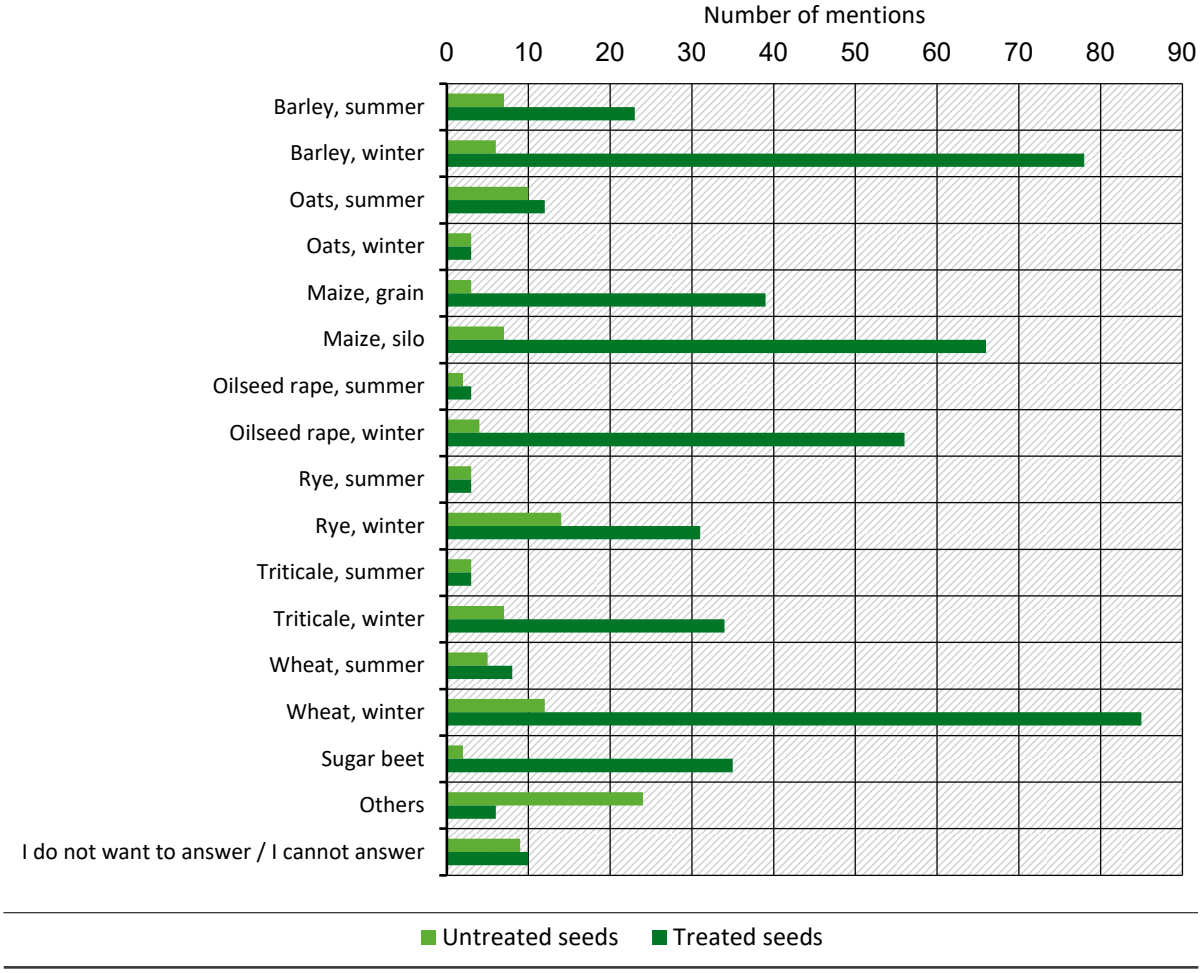


Source: AFC (2020): Online survey of agricultural enterprises (2020); N=92

Question: Related to your farm: How important is the use of treated seeds for your farm's success?

According to the participants of the survey, treated seeds are mainly used in the crops cereals, maize, oilseed rape and sugar beet. Potatoes, aromatic herbs, lettuce, and various vegetable crops were also mentioned as other crops (included under 'Others' in Figure 4). The ratio of treated and untreated seeds used by the agricultural enterprises varied greatly between the crops. For example, in sugar beet, winter oilseed rape, winter barley, grain maize, and silage maize, only a small share of respondents indicated that untreated seeds were used. The largest share of the usage of untreated seeds was for the crops spring triticale, spring rye, winter oats, spring oats and spring oilseed rape (Figure 4).

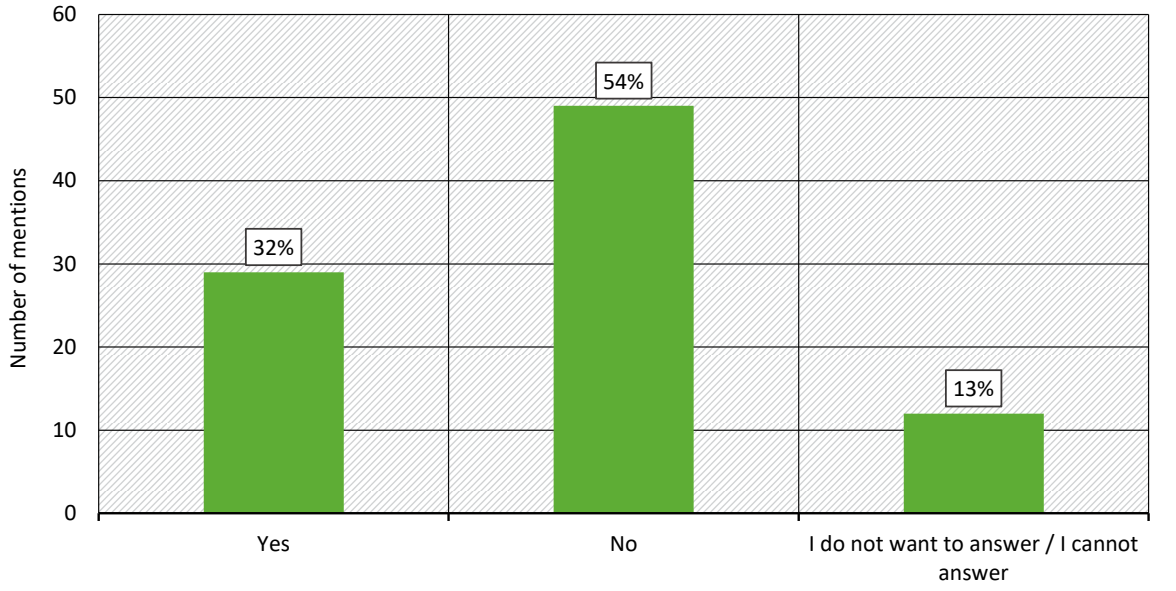
Figure 4: The proportions of the use of treated and non-treated seeds broken down by crops according to the number of mentions by agricultural enterprises



Source: AFC (2020): Online survey of agricultural enterprises (2020); N=116 / N=53 (Multiple answers possible)
Questions: For which crops do you use seeds which have been treated with pesticides? / For which crops do you use seeds which have not been treated with pesticides?

More than half (54 %) of the farmers surveyed stated that they were unable to achieve optimum field management with the plant protection products available for seed treatment. About 32 % of the respondents considered the availability as sufficient, 13 % could not make a clear statement on this question (Figure 5).

Figure 5: The possibility of optimal field management with available plant protection products for seed treatment according to the number of mentions by agricultural enterprises

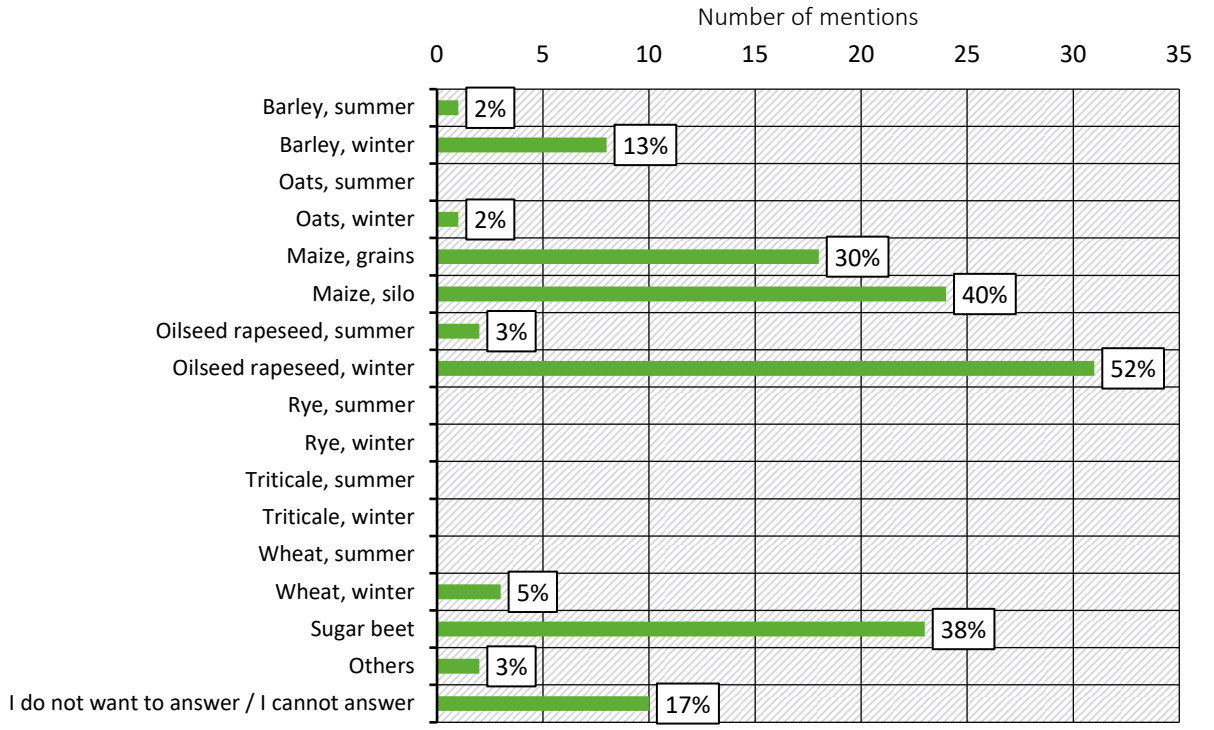


Source: AFC (2020): Online survey of agricultural enterprises (2019); N=90

Question: Is optimal field management possible with the plant protection products available to you for seed treatment?

The farms that were not able to achieve optimal field management with the available plant protection products for seed treatment were surveyed additionally about the crops where deficiencies existed. The results are presented in Figure 6. The most relevant crops were winter oilseed rape, silage maize, sugar beet and grain maize.

Figure 6: Field crops with a lack of availability of plant protection products for seed treatment according to the number of mentions from agricultural enterprises



Source: AFC (2020): Online survey of agricultural enterprises (2019); N=90

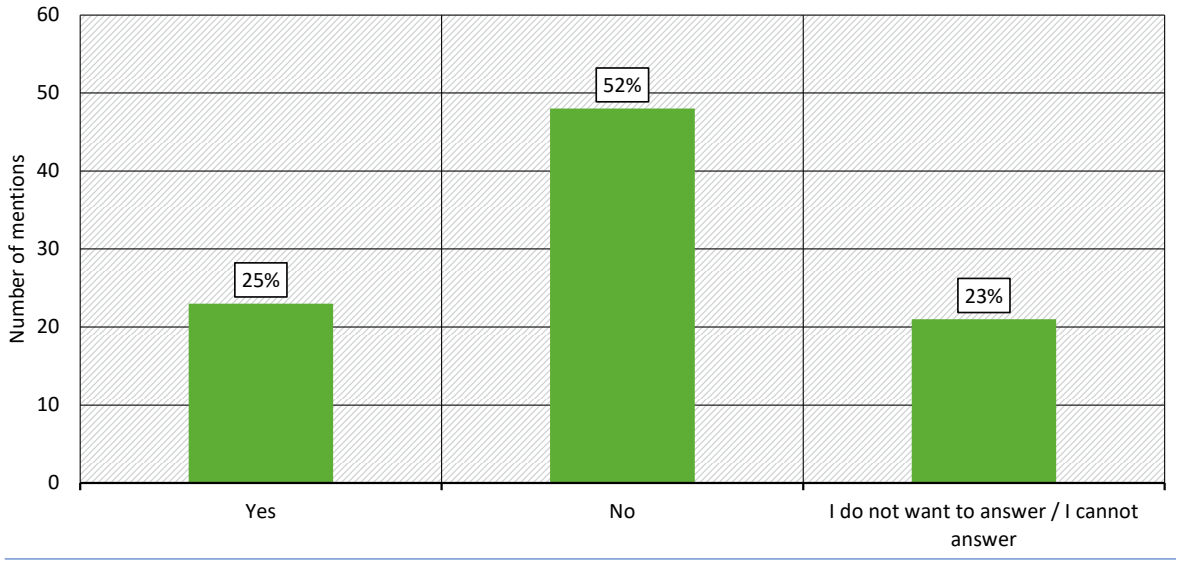
Question: If optimal field management is not possible, for which crops are there deficits?

3.3 Relevance of the import of treated seeds

Based on the online surveys and the expert interviews, it can be concluded that imported treated seeds are of great importance for the cultivation of certain crops, both quantitatively and qualitatively.

More than half of the agricultural enterprises surveyed stated that they did not purchase any seeds which had been treated in other EU countries. In contrast, 25 % of the farmers explicitly stated that they had purchased treated seeds from other EU countries (Figure 7). The participants from plant protection services of the federal states stated that some of the farmers do not know in which country the purchased seeds were treated. By purchasing seeds from German traders, farmers may assume that seeds have been treated domestically.

Figure 7: The relevance of seed imports from non-EU countries according to the number of mentions from agricultural enterprises



Source: AFC (2020): Online survey of agricultural enterprises (2020); N=92
Question: Have you purchased seeds that were treated in other EU countries?

The main countries supplying seeds are France and Poland, which were named most frequently in the survey of both participants of agricultural enterprises and from plant protection services, with 15 and five (France) and 14 and four (Poland) responses, respectively. Austria was also identified as an important trading partner for seeds, with four responses from plant protection services. In the online survey, eight producers indicated that they purchase seeds from Austria. A linking feature of countries of procurement is their direct proximity to Germany. The neighboring countries Belgium, the Netherlands, Luxembourg, and the Czech Republic were also named as countries of procurement in the survey, although with lower frequencies, as can be seen in Table 6.

It should be emphasized that 42 % of the agricultural enterprises were unable or unwilling to provide information on the origin of the imported seeds.

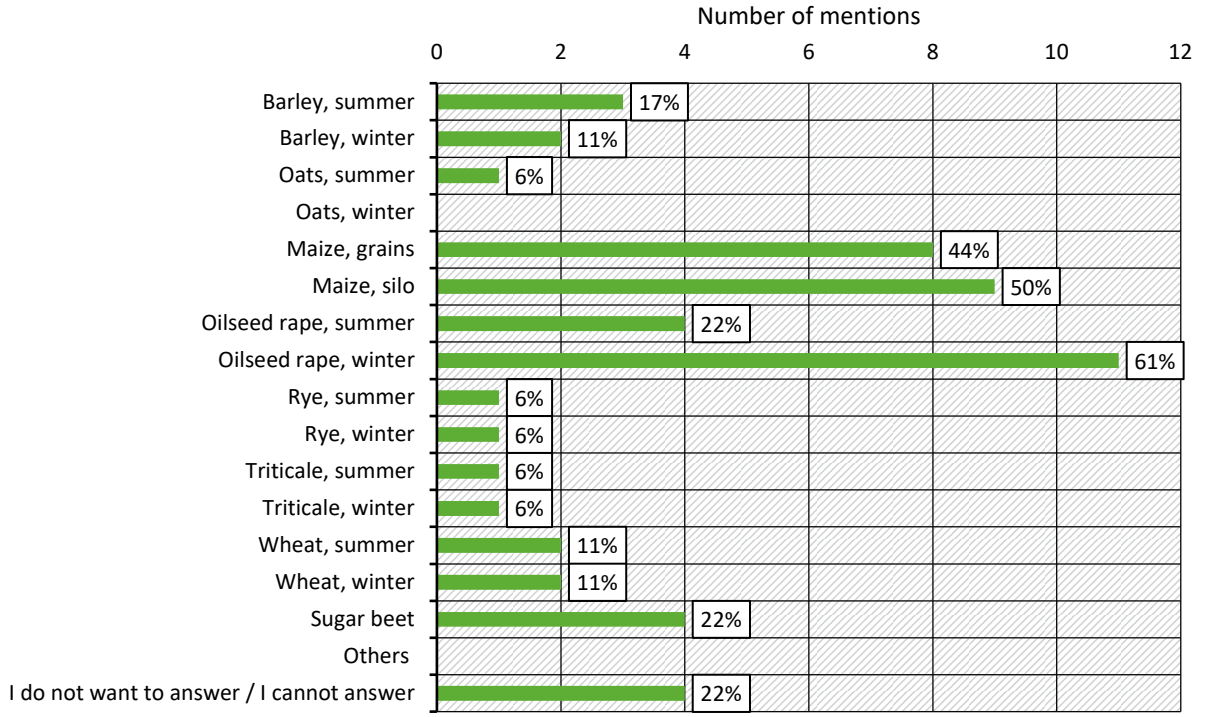
Table 6: EU countries from which treated seeds are sourced according to the number of mentions from agricultural enterprises and plant protection services

Country	Number of mentions Agricultural enterprises	Number of mentions Plant protection services
Austria	8	4
Belgium	-	1
Czech Republic	1	2
France	15	5
Hungary	3	2
Latvia	1	-
Lithuania	1	-
Luxembourg	1	-
The Netherlands	3	1
Poland	14	4
Romania	2	1
Slovakia	2	-
Slovenia	2	-
I do not want to answer / I cannot answer	42	-

Sources: AFC (2020): Online survey of agricultural enterprises (2020); N=79 (Multiple answers possible) / Online survey plant protection services (2020); N=9 (Multiple answers possible)
Question in each case: From which other EU countries are treated seeds sourced?

According to the participants from plant protection services, treated oilseed rape (61 %) and maize seeds (50 % for silage and 44 % for grain maize) are particularly often purchased from abroad. Sugar beet seeds were cited as an important import commodity by about one-quarter of the participants of plant protection services surveyed.

Figure 8: The relevance of an import of treated seeds broken down by crop according to the number of mentions of from plant protection services



Source: AFC (2020): Online survey plant protection services (2020); N=18 (Multiple answers possible)
Question: With reference to Germany as a whole: For which crops is the use of imported treated seeds from other EU countries attractive or necessary?

In general, the necessity of importing treated seeds was emphasized by all interview partners based on different reasons (see section 3.4).

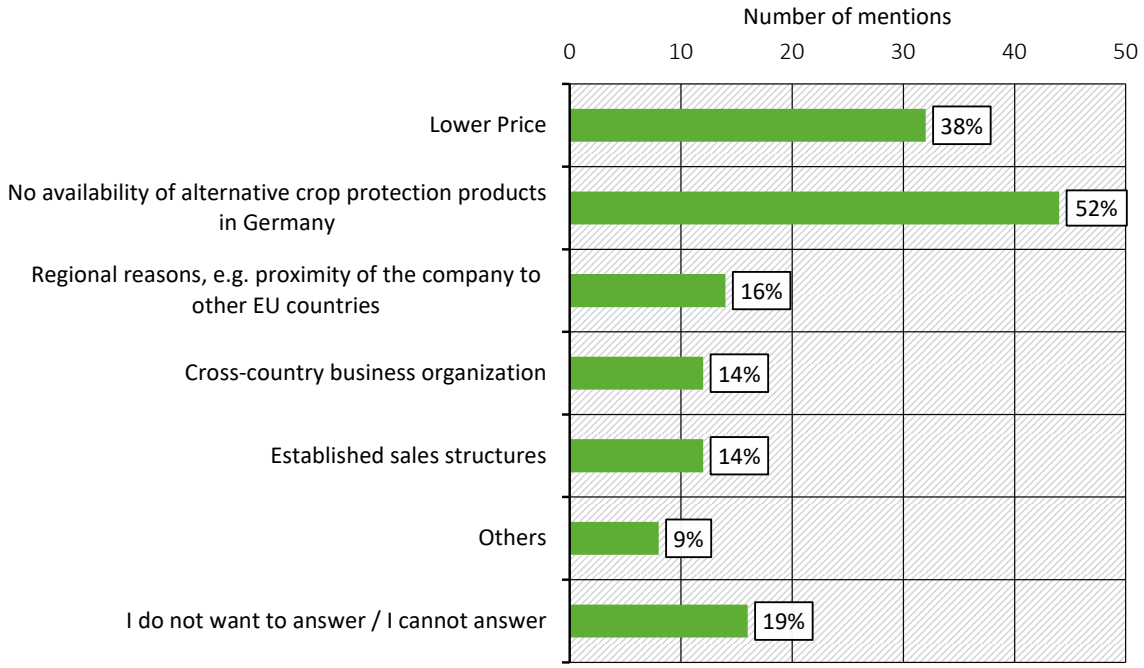
3.4 Reasons for the purchase and use of imported treated seeds

The reasons for an import of treated seeds are manifold. The following main reasons were identified from the literature analysis[9]:

- Lower price
- No availability of alternative plant protection products in Germany
- Cross-country business organization
- Established sales structures

These reasons were confirmed in the online survey from participants from agricultural enterprises. With 44 mentions (52 %), the lack of availability of alternative plant protection products in Germany was most frequently cited as a relevant reason. A lower price was mentioned by 32 participants (38 %). Figure 9 presents the complete survey results on the reasons for using treated seeds.

Figure 9: The relevance of different reasons for the import of treated seeds according to the number of mentions from agricultural enterprises

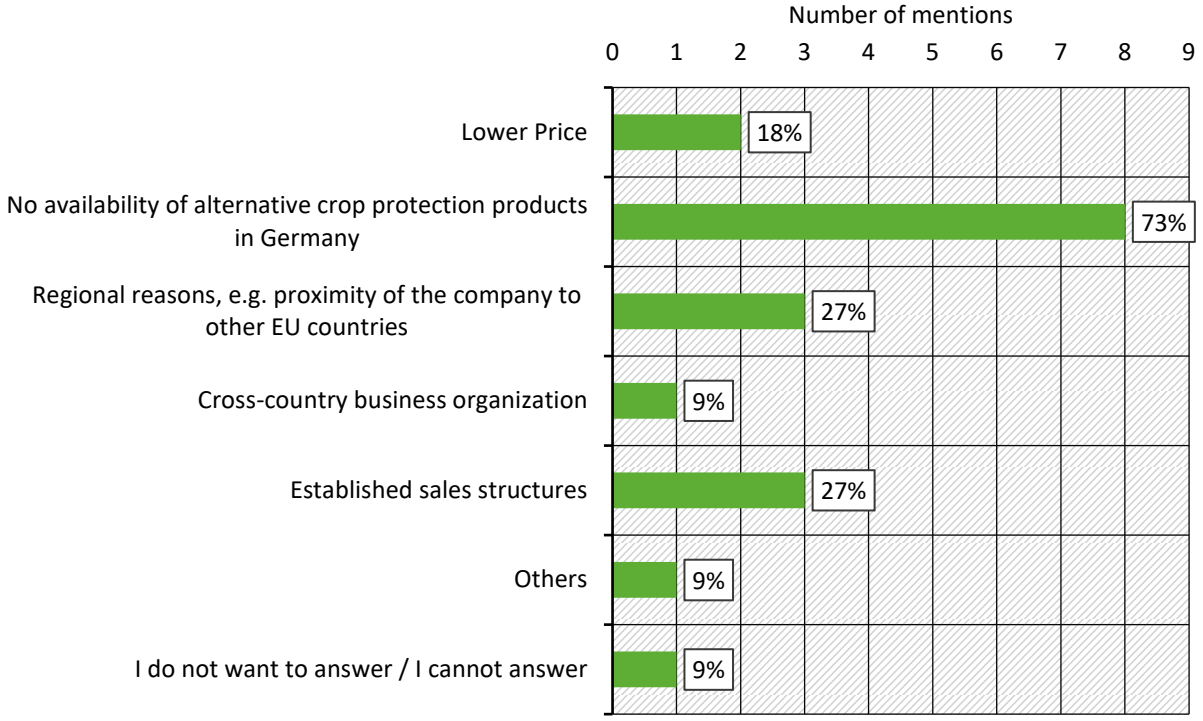


Source: AFC (2020): Online survey of agricultural enterprises (2019); N=85 (Multiple answers possible)
Question: In your opinion, what could be the reasons for treated seeds being sourced from other EU countries for use in Germany?

[9] Included e.g.: agrarheute (2017): Rapsbeize Lumiposa: Landhandel importiert polnisches Saatgut; agrarheute (2019b): Diese Beizen sind in Mais noch erlaubt; KWS (2019) Saatgutqualität und -produktion Zuckerrübe; Landwirtschaftskammer Niedersachsen (2020): Hinweise zum integrierten Pflanzenschutz

The lack of availability of alternative seed treatment products in Germany is also named most frequently by the plant protection services as a relevant reason for importing treated seeds, with eight mentions (73 %). The relevance of a lower price however is significantly less in the estimation of the plant protection services compared to the agricultural enterprises. Only two participants (18 %) mentioned this aspect. A complete overview of the results is given in Figure 10.

Figure 10: The relevance of different reasons for the import of treated seeds according to the number of mentions from plant protection services



Source: AFC (2020): Online survey of plant protection services (2020); N=11 (multiple answers possible).
Question: What are the main reasons for sourcing treated seeds from other EU countries for use in Germany?

According to the results of the conducted interviews, the reasons for importing treated seeds should be considered in a differentiated manner. For example, there are incentives that are based on existing trade or operational structures, irrespective of the seed treatment products used. These include the geographical proximity of farms to other EU countries, a transnational farm organization and established distribution structures.

As an additional reason for the import of treated seeds, several interview partners mentioned production processes.[10] This refers to the multiplication of certain field crops generally taken place in other European Member States due to climatic conditions. Apart from climatic conditions, seeds are also multiplied abroad because of regulations concerning minimum distances between multiplication sites and other fields of the same crop. As part of the production process, the seed treatment is often carried out in the same country as the seed multiplication process. This procedure is economically more favorable for seed producers. The price of imported treated seeds is therefore lower (compared to seeds multiplied in other EU countries and treated domestically).[11] The seed institutes, seed treatment plants and seed

[10] In the online survey of farms, this aspect was also mentioned by two participants as a reason for importing treated seed (free text field under 'Others')
[11] This statement applies only to a limited extent to sugar beet seed.

traders interviewed noted that farmers generally have little influence on the origin of the purchased seeds. The reason of getting a lower price when buying imported treated seeds is rooted at the level of production and is due to technical production processes.

According to the interviewed participants from agricultural enterprises, the price is more relevant for the purchase decision than the country of origin. Germany is seen as a high price region for seed treatment by the interviewees.

The lack of availability of alternative plant protection products in Germany was mentioned by all interview partners as a reason for additional imports of treated seeds. Here, additional import means that these imports are not carried out due to existing trade/ farm structures or technical production processes, but rather to acquire seeds treated with plant protection products authorized in other EU countries but not in Germany.

As a result of the study, the following reasons can be summarized for the purchase and use of imported treated seeds:

- Import due to existing trade or business structures
- Import due to technical production processes
- Import due to the lack of availability of alternative seed treatment products in Germany.

For the future, individual experts see further reasons for imports of treated seeds, which are caused by higher requirements for the application of seeds treated in Germany. The risk mitigation condition NH 681 was mentioned as an example. It prohibits the sowing of treated seeds in winds with speeds of more than 5 m/s. This risk mitigation measure currently applies exclusively to the corresponding product authorizations in Germany. Seeds that have been treated with identical products abroad and are marketable in Germany are not affected by this risk mitigation measure. This may result in increased demand for treated seeds from abroad.

4 Import of treated seeds concerning major crops

Due to the different characteristics and requirements concerning climate and soil as well as regional cultivation decisions, the import of treated seeds varies depending on the crops. Due to the different local conditions, special cultivation regions for the individual crops have developed in Germany. Accordingly, the cultivation densities of the individual crops vary between federal states. Depending on the need to use imported treated seeds, their share in sowing also varies between different regions.

The individual setting concerning the import of treated seeds of the major crops is described in the following. Respective relevant reasons for differences in the import are also presented.

4.1 Cereals

Cultivation situation in Germany

Cereals are the most important crop group in Germany in terms of cultivation area. Wheat, rye, barley, oats, or triticale are grown on around 52 % of the arable land in Germany.[12] In 2020, a total of 39.1 million tons (t) were harvested from fields in Germany. Winter wheat is the cereal crop with the largest area under cultivation (2.8 million ha), followed by winter barley with 1.3 million ha.[13] Cereals are mainly used to produce animal feed (57 %), one-fifth of the harvest is processed industrially. Food production accounts for 18 % of the total demand.[14] According to estimates, organically grown cereals only play a minor role with a share of about 5 % of the total cultivation area.[15]

In Germany, cereal seeds were produced on an area of around 125,000 ha in 2020, of which 10,500 ha were used to produce organic seeds (approx. 8.5 %).[16, 17] Depending on the crop grown, different minimum distances from fields with the same crop must be maintained in the multiplication areas, as otherwise cross-pollination may occur. If the minimum distances are not maintained, the field inspection by the seed certification authority may result in partial or total rejection of the multiplication project, since cross-pollination cannot be ruled out and this deficiency cannot be compensated for in retrospect.[18]

Reasons for importing treated seeds

- Import due to existing trade or business structures

According to the seed traders and associations interviewed, cross-border trade takes place by default due to spatial proximity to neighboring countries or due to a cross-border business structure. Especially in the case of cereals, transports are only economical over short distances due to high transportation costs (high sowing quantities) and low margins. Overall, according to

[12] Own calculation based on Statistisches Bundesamt (2019a): Feldfrüchte und Grünland: Ackerland nach Hauptfruchtgruppen und Fruchtarten
[13] BMEL (2020): Erntebericht 2020 – Mengen und Preise
[14] BLE (2018): Bericht zur Markt- und Versorgungslage Getreide 2018
[15] Agrarheute (2019a): Biogetreide: Fläche wächst, Erträge nicht
[16] Own calculation based on BSA (2020): Zur Feldbesichtigung gemeldete Saatgutvermehrungsflächen 2020
[17] The differentiation is made based on the voluntary information provided by applicants as part of the application for seed certification. The recorded areas of organic seed multiplication therefore do not claim to be complete. The certification bodies are not obliged to check the accuracy of the voluntary information provided by the applicants.
[18] Landwirtschaftskammer Nordrhein-Westfalen (2007): Mindestentfernungen von Vermehrungsbeständen

the interviewed experts, imports of treated cereal seeds fluctuate depending on supply and demand. Decisive factors include the annually varying climatic conditions and the resulting seed volumes of German producers.

- Import due to technical production processes

In the case of cereals, special production processes are not the reason for importing seeds.

- Import due to a lack of availability of alternative plant protection products in Germany

For cereals, many products with fungicidal active ingredients are authorized for use as seed treatments in Germany. In other EU countries, the product Vibrance Gold has been authorized, however the active ingredients sedaxane, fludioxonil and difenoconazole are also included as active ingredients in products authorized in Germany. Insecticidal seed treatments are currently not authorized for use in cereals throughout Europe. The lack of availability of seed treatment products in Germany compared to other EU countries is therefore not an incentive for the import of cereal seeds (Table 7).

Table 7: Overview of available plant protection products for the treatment of cereal seeds in Germany

Disease (*pathogens*)	Active ingredient(s)	Products
Fungal diseases: - Bunt (*Tilletia tritici* and *Tilletia laevis*) - Smut (*Ustilaginomycetes*) - Loose wheat smut (*Ustilago tritici*) - Snow mold (*Microdochium nivale*, *Globisporangium spp.,* and *Typhula spp.*) - Blackleg (*Leptosphaeria maculans*) - Brown patch (*Rhizoctonia solani*) - Yellow patch (*Rhizoctonia cerealis*) - Leaf and glume blotch (*Parastagonospora nodorum*) - Net blotch (*Pyrenophora teres*) - Stripe disease (*Gonatophragmium*) - Covered smut (*Ustilago hordei*) (only Barley) - Snow rot (*Typhula incarnata*) (only Barley) - *Fusarium* species - *Urocystis occulta*	Fungicidal active ingredients: - Fludioxonil - Tebuconazole - Difenoconazole - Prothioconazole - Tebuconazole - Triazoxide - Pseudomonas chlororaphis - Prochloraz - Silthiofam - Fluxapyroxad - Pyrimethanil - Triticonazole - Sedaxane	Arena C CELEST CELEST EXTRA Cerall DIFEND Extra EfA EfA Spezial Kinto Duo Landor CT Latitude Latitude XL LONGITUDE Orius Universal Prepper Rubin Plus Rubin TT Seedron SYD41400F* SYD41110F* Toledo Vibrance Trio Vibrance Gold (Not authorized in Germany)

Source: Own illustration based on BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel; Bundesamt für Ernährungssicherheit Österreich (2020): Pflanzenschutzregister.

Note: Crops considered: wheat, barley, rye, triticale, oats, spelt. Status of July 2020

*: Authorized in Germany, but the product is not marketed. Status of July 2020

Plant protection products used in practice for seed treatment

Cereal seeds usually undergo a standard seed treatment with fungicidal active ingredients. Depending on the seed treatment facility, the seeds may be treated with different products which may differ in their active ingredient composition but target the same diseases. Especially for cereal crops, it is common for the farmers themselves to determine which products will be used to treat the seeds. This is the case if the seeds are multiplied by the farmers themselves. Farmers can also purchase cereal seeds from distributors. The two largest seed distributors for cereals are BayWa AG and Agravis Raiffeisen AG. BayWa treats the distributed seeds by default with the fungicide RubinTT (BASF) and Agravis with the fungicide CELEST (Syngenta). Both products can therefore be counted among the common standard seed treatments for cereals. The products Landor CT (Syngenta) and/or Vibrance Trio (Syngenta) and/or Latitude (Certis) are commonly used as optional seed treatments. Differences occur between the individual cereal types.

Table 8: Standard and optional seed treatments used for cereal seeds in Germany

Crop	Standard seed treatments (all types)	Optional seed treatments
Cereals	CELEST or Rubin TT (Fungicide)	Landor CT and / or Vibrance Trio and / or Latitude (Fungicide)

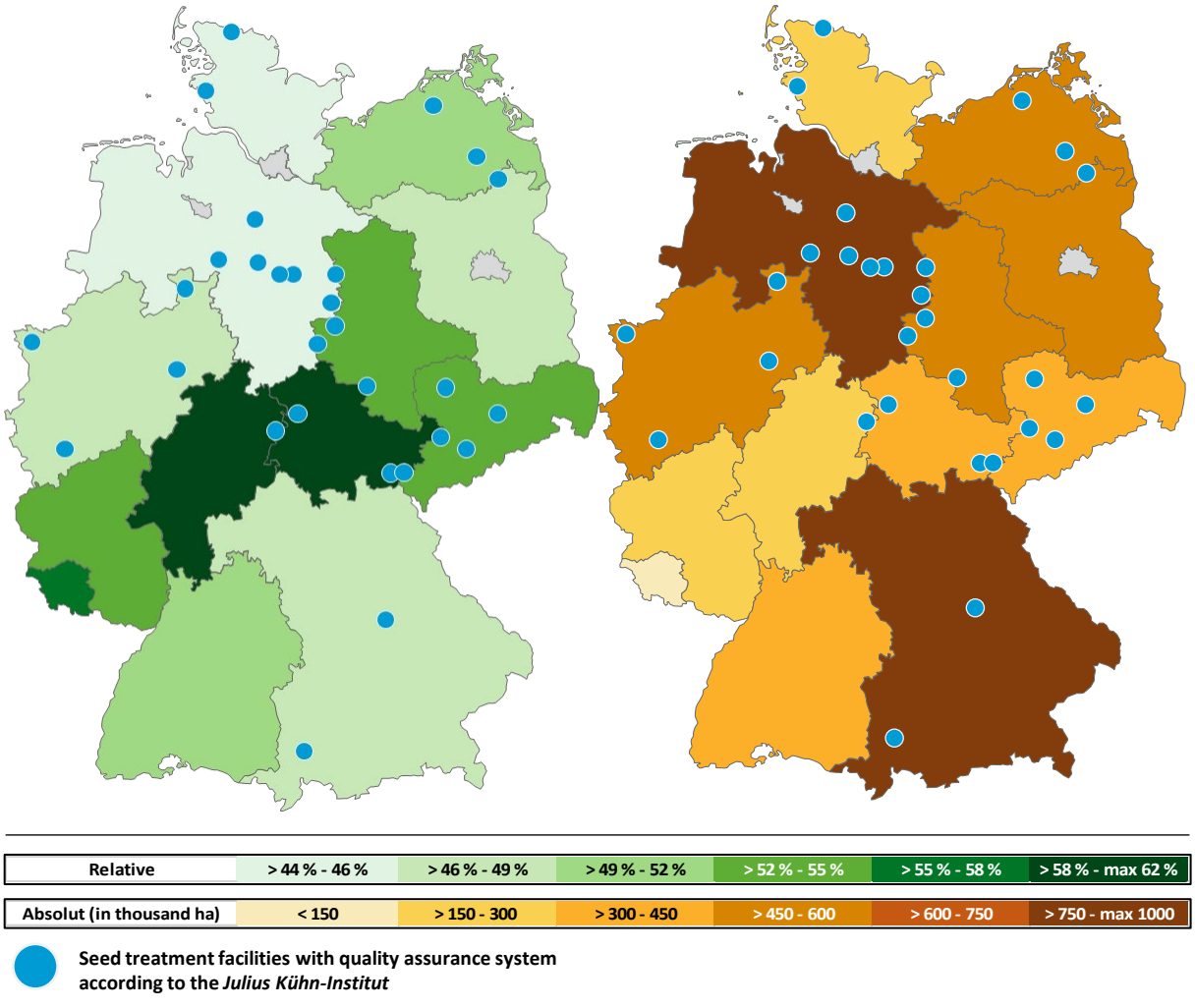
Sources (selection): BayWa AG (2020): Empfehlungen Saatgutbeizen; Agravis Raiffeisen AG (2020): Empfehlungen Saatgutbeizen

Regional differences in the sowing of imported seeds

According to several experts from plant protection services and agricultural associations, most cereals are multiplied and cultivated regionally. In border areas, seeds are also imported from neighboring countries. The occurrence of pathogens correlates with the cultivation regions of the crop.

Figure 11 shows the relative and absolute acreage of cereals by federal state in 2019 as well as the locations of seed treatment facilities equipped with quality assurance systems for dust reduction according to the JKI. In eight of the federal states, cereal varieties are cultivated on at least 50 % of the cropland. The relative acreage is greatest in the central states of Germany (Hesse and Thuringia). The most extensive cultivation areas for cereals in absolute terms are in the largest German states in terms of area, Bavaria, and Lower Saxony. More than 750,000 ha of cereal crops are cultivated there. The smaller the federal state, the lower is the absolute area under cereal cultivation.

Figure 11: Relative and absolute acreages of cereals (Wheat, rye, barley, oats, and triticale) and seed treatment facilities with quality assurance systems according to the JKI



Source: Own illustration based on Bundesamt (2020): Statistisches Jahrbuch 2019, p. 499 ff.; JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung.
Note: Crops considered: wheat, rye, barley, oats, and triticale

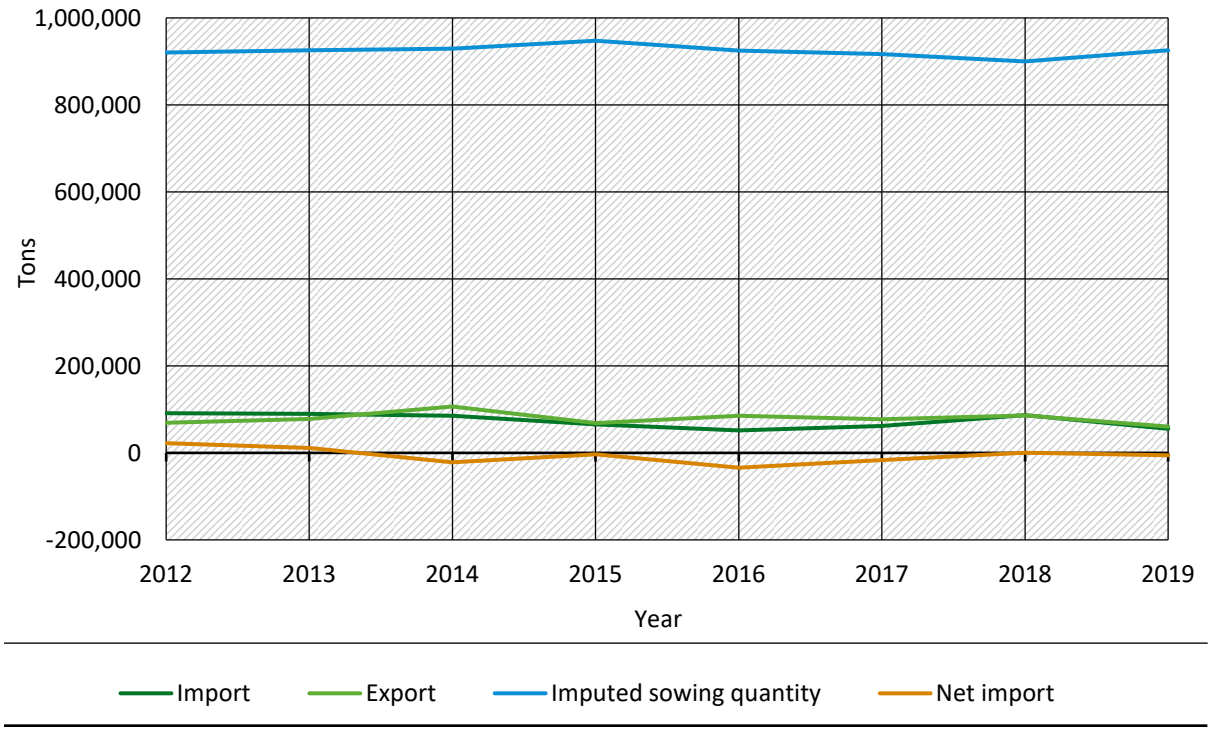
According to the Julius Kühn-Institut (JKI), cereal seeds are treated with plant protection products in 31 German seed treatment facilities that are equipped with quality assurance systems for dust reduction. The distribution of these facilities displays a predominant focus on the northern and eastern regions of Germany. Almost half of the seed treatment facilities are located in Lower Saxony, Saxony-Anhalt and Saxony. Few of these treatment facilities are in central, western, and southern Germany. The density of the facilities roughly reflects the main cereal cultivation regions in Germany. Bavaria is an exception: despite the high absolute acreage, only two of the listed treatment facilities are located there. However, processing in certified facilities does not represent an exclusive possibility to treat seeds. According to one interviewee, cereal seeds often remain on the farm as farm-saved seeds and can be treated there accordingly. A statement on the proportion and extent of on-farm treatment could not be made by the experts.

Import volumes of (treated) seeds

The statistics on seed trade do not differentiate between treated and untreated seeds. Nevertheless, the import and export volumes can be used to conclude the relevance of seed imports and the import countries relevant in terms of volume (concerning the individual field crops). The data for the import and export quantities is derived from the foreign trade statistics of the Federal Statistical Office.[19] A detailed overview with a breakdown by country is provided in the appendix. For better context concerning the foreign trade quantities, an additional imputed sowing quantity was determined based on the cultivation area of the years 2012 to 2019[20] and the average sowing rate per crop.[21]

An overview of the imputed sowing volume for cereals as well as the import and export volumes including net imports of cereals is shown in Figure 12. The analysis includes the cereals wheat, barley, rye, and oats. Individual analyses for the cereal types are given in the appendix. The imputed sowing volume in 2019 was approx. 926,000 t. Import and export volumes in the same year comprised about 54,000 t and 59,000 t, respectively. Major trading partners for imports were France (26 %), Austria (22 %) and Poland (21 %). The largest buyers of German cereal seeds were the Netherlands (53 %) and Belgium (12 %).

Figure 12: Cereals: import, export, imputed sowing quantity, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

According to several plant protection services and seed traders, cereal seeds are imported both already treated and untreated. It is not possible to determine the exact proportion of treated seeds since very small quantities of seeds are imported by many traders and in some cases by

[19] Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis
[20] Statistisches Bundesamt, Statistisches Jahrbuch der Jahre 2012 bis 2019
[21] Raiffeisen (2020): Ackermanager

the farmers themselves. Another interviewed expert estimated, that about 50 % of the cereal seeds in the EU are farm-saved seeds, the status of their treatment is unclear. The remaining 50 % comprises certified cereal seeds, which are mainly locally treated, i.e., they are treated mainly in the proximity of the area where it will be sown. It is estimated that cereal seeds are only imported into Germany by farmers who produce in a range of up to about 50 to 80 km to the border.

Summary Cereals

From the results of the analysis and foreign trade statistics, it can be concluded that for cereals, the import of seeds in general and the import of treated seeds only play a minor role. In general, seed multiplication and seed treatment for cultivation in Germany take place domestically. There are seed treatment products in other EU countries that are not authorized in Germany, but these do not contain any other active ingredients compared to the seed treatment products authorized in Germany and therefore do not provide an incentive for farmers to import treated seeds from abroad.

4.2 Maize

Cultivation situation in Germany

Maize is the world's most important coarse grain crop. In Germany, maize plants are grown on 23 % of the arable land, and most of them are harvested as silage maize (85 %). The acreage is expected to be 2.72 million ha in 2020. This is an increase of 3.1 % compared to the previous year and in line with the steady increase in acreage over the last years.[22] Harvest volumes in 2019 were at 86.7 million t for silage maize and 3.6 million t for grain maize.[23] Maize is used as animal feed, raw material for industrial products (e.g., starch) and as an energy supplier in the renewable raw materials sector.[24] The share of cropland on which organic maize was cultivated amounted to about 40,000 ha (about 1.5 %) in 2018. Considering the total crop cultivation area in Germany, this is only a very small share, but over the last few years a clear upwards trend in this sector could be recognized.[25] With the increasing number of organic poultry farms, the demand for organic grain maize has also gradually increased, resulting in more grain corn than silage corn currently being harvested from organic corn fields.[26]

Today, maize is largely multiplied as a hybrid seed (two maize breeding lines are crossbred with each other). In seed multiplication, it is particularly important to maintain specified minimum distances from other maize fields to prevent cross-pollination resulting in contamination of the seeds. An adequate water supply for the seed maize fields is essential, as the plants are very sensitive to drought.

Reasons for importing treated seeds

- Import due to existing trade or business structures

According to the seed traders and associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or due to a cross-border

[22] Deutsches Maiskomitee e.V. (2020): Maisanbaufläche in Deutschland
[23] Statistisches Bundesamt (2019a): Feldfrüchte und Grünland
[24] Proplanta (n.d): Wirtschaftliche Bedeutung Mais
[25] Agrarheute (2018): Anbau von Ökomais steigt
[26] Ökolandbau.de (2017): Ökologischer Maisanbau

business structure. As this trade concerns all field crops, maize seeds are also imported due to existing trade and business structures.

- Import due to technical production processes

Maize has high demands on climatic conditions for seed multiplication. For this reason, seed multiplication within Germany has hardly been possible. In the Freiburg-Krozingen area, seeds can be produced on a multiplication area of around 3,500 ha. This amount corresponds to about 18 % of the annual maize seed demand in Germany. Apart from climatic conditions, experts state that seeds are also multiplied abroad due to minimum distances to be maintained between multiplication areas and other fields of the same crop. As part of the production processes, the seed treatment is often also carried out in the country of origin of the multiplication as it is economically more favourable for seed producers in this way. The price of imported treated seeds is thus lower (compared to seed multiplied in other European countries and treated domestically). As a result, most of the supply is ensured by seed imports from France, Hungary, Austria, and Romania. [27] Slovakia and Serbia were named as further production countries by one seed trader interviewed.

[27] Deutsches Maiskomitee e.V.: Saatmaisvermehrung

- Import due to a lack of availability of alternative plant protection products in Germany

For maize, a wide range of authorized seed treatment products with fungicidal active ingredients is available in Germany. With VOTiVO, a product with a nematicidal active ingredient is also available on the German market. The situation is different for products with insecticidal or repellent activity. Currently, no plant protection products with a corresponding active ingredient are authorized in Germany. Seeds treated with the seed treatment products Sonido (active ingredient thiacloprid) against wireworms and Korit 420 FS (active ingredient ziram) against bird damage can be purchased via seed traders from other EU countries. Farmers are therefore dependent on imports from other EU countries for the usage of seeds treated with insecticidal and repellent active ingredients (Table 9).

Table 9: Overview of available plant protection products for the treatment of maize seeds in Germany

Disease (*pathogens*)	Active ingredient(s)	Products
Fungal diseases: - Brown patch (*Rhizoctonia solani*) - Head smut (*Sphacelotheca reiliana*) - *Fusarium* species - *Phytium* species	Fungicidal active ingredients: - Fludioxonil - Metalaxyl-M - Metalaxyl - Prothioconazole - Sedaxane - Thiabendazole - Azoxystrobin	Maxim Quattro Maxim XL Redigo M Vibrance 500 FS Vibrance XL
Insects: - Wireworm	Insecticidal active ingredients: -Thiacloprid (Not available in any seed treatments authorized in Germany) -Tefluthrin (Not available in any seed treatments authorized in Germany)	Sonido (Not available in any seed treatments authorized in Germany) Force 20 CS (Not available in any seed treatments authorized in Germany)
Wildlife damage: - Bird feeding	Repellent active ingredient: - Ziram (Not available in any seed treatments authorized in Germany)	Korit 420 FS (Not available in any seed treatments authorized in Germany)
Nematodes: - Migratory root nematodes - Root-knot nematode (*Meloidogyne hapla*) - Cyst-forming root nematodes (*Heterodera schachtii*)	Nematicidal active ingredients: - Bacillus firmus strain	VOTiVO

Source: Own illustration based on BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel; Bundesamt für Ernährungssicherheit Österreich (2020): Pflanzenschutzregister; Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (2020): Le catalogue des produits phytopharmaceutiques et de leurs usages, des matières fertilisantes et des supports de culture autorisés en France, Status of July 2020

Plant protection products used in practice for seed treatment

For maize, the standard seed treatment with fungicidal active ingredients is usually applied, which may vary depending on the seed treatment facility. These treatments may differ in their active ingredient composition, but the spectrum of activity is the same. Maize is usually treated with the fungicides Maxim XL, Maxim Quattro (both Syngenta) or Redigo M (Bayer). In addition, it is common to use one of the insecticides Sonido (Bayer) or Force 20 CS (Syngenta) in combination with the standard treatments, if needed. The repellent Korit (Kwizda Agro) is used against bird damage when it appears necessary.

Table 10: Standard seed treatments used for maize seeds in Germany

Crop	Standard seed treatments (all types)	Optional seed treatments
Maize	Maxim Quattro or Maxim XL or Redigo M (Fungicide)	Sonido or Force 20 CS (Insecticide) Korit (Bird repellent)

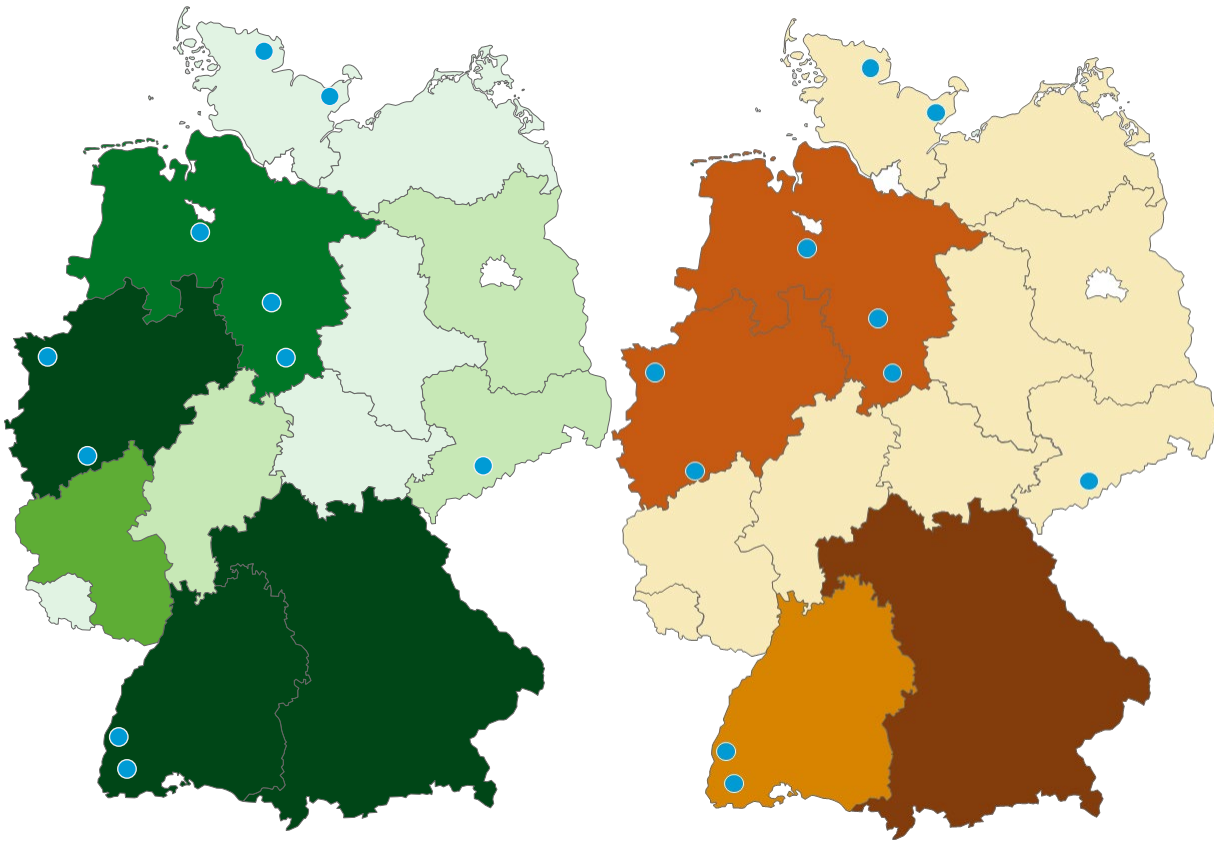
Source (Selection); BayWa (2020): Empfehlungen Saatgutbeizen; Agravis (2020): Empfehlungen Saatgutbeizen; ATR-Landhandel (2020a): Saatgutbeizen Mais

Regional differences in the sowing of imported seeds

Regional differences in the sowing of imported treated seeds are due to the differences in cultivation of the two maize types in the regions.

Figure 13 presents the percentage of grain maize of the total arable area, as well as the absolute area under cultivation of maize divided by federal states for the year 2019. In North Rhine-Westphalia, Baden-Württemberg and Bavaria, grain maize is cultivated on at least 5 % of the arable land. The largest cultivated areas in absolute terms are located in Bavaria, followed by Lower Saxony and North Rhine-Westphalia. In Bavaria, more than 100,000 ha are used for grain maize production. A cultivation focus within Germany cannot be identified. The smaller states in the western centre of Germany (Saarland, Rhineland-Palatinate, Hesse) as well as the eastern states (Saxony, Saxony-Anhalt, Thuringia, Brandenburg, Mecklenburg-Western Pomerania) produce grain maize on only a few hectares.

Figure 13: Relative and absolute acreages of grain maize and seed treatment facilities equipped with quality assurance systems according to the JKI



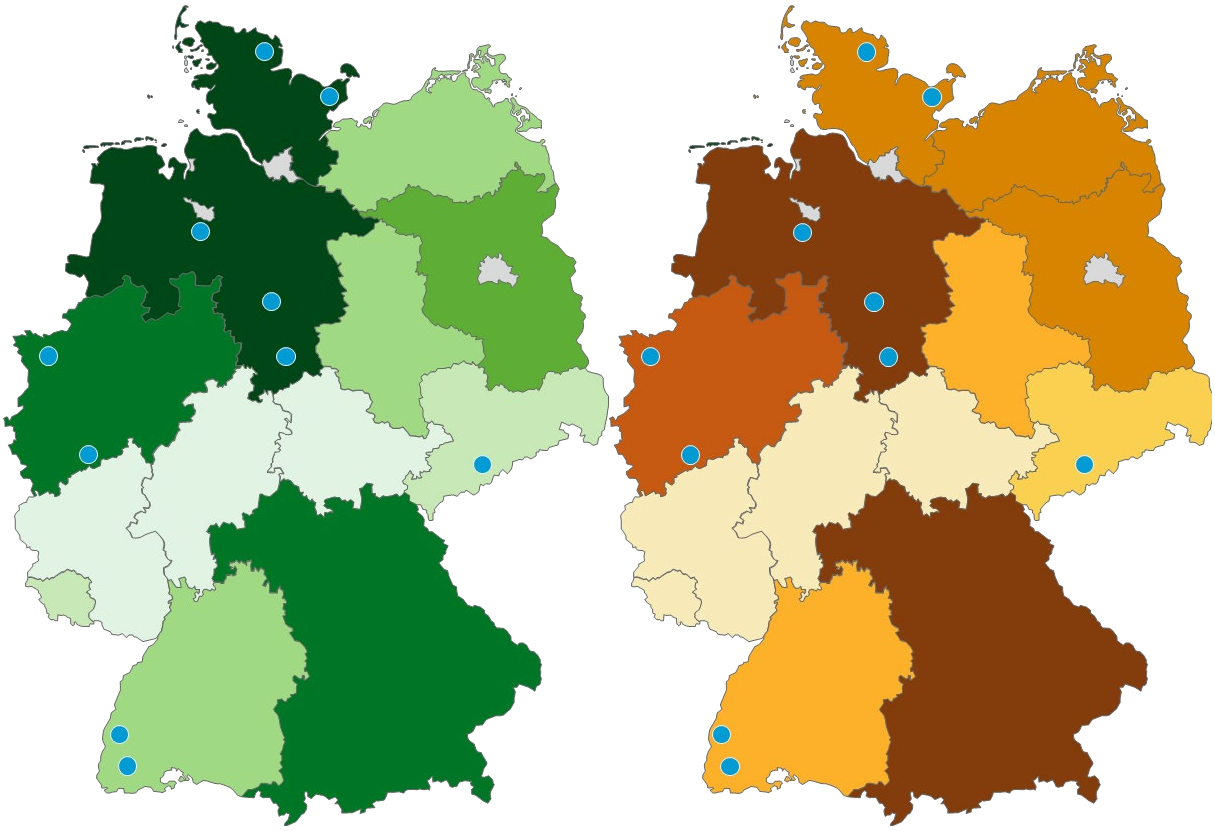
Relative	> 0% - 1%	> 1% - 2%	> 2% - 3%	> 3% - 4%,	> 4% - 5%	> 5% - max 9%
Absolut (in thousand ha)	< 20	> 20 - 40	> 40 - 60	> 60 - 80	> 80 - 100	> 100 - max 120

Seed treatment facilities with quality assurance system according to the *Julius Kühn-Institut*

Source: Own illustration based on Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.; JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung.

In Figure 14 the percentage of silo maize area of the total arable area, as well as the absolute area by federal states for the year 2019 are depicted. In Schleswig-Holstein, Lower Saxony, North Rhine-Westphalia and Bavaria, silo maize is grown on at least one-fifth of the arable land. The largest cultivation areas in absolute terms are in Lower Saxony and Bavaria; more than 250,000 ha are used for silo production. Again, maize production plays a minor role in the smaller states in the middle of Germany (Saarland, Rhineland-Palatinate, Hesse).

Figure 14: Relative and absolute acreages of silo maize and seed treatment facilities



Source: Own illustration based on Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.; JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung.

The JKI maintains a list of seed treatment facilities equipped with quality assurance systems that treat maize seeds in Germany. Five seed treatment facilities are located in northern Germany, two in the south and two in the west, only one is in the east. There is no seed treatment facility in Bavaria, although it has a high absolute share of maize area. According to several experts, the geographical proximity to neighboring countries only plays a minor role regarding the possibility of importing treated seeds.

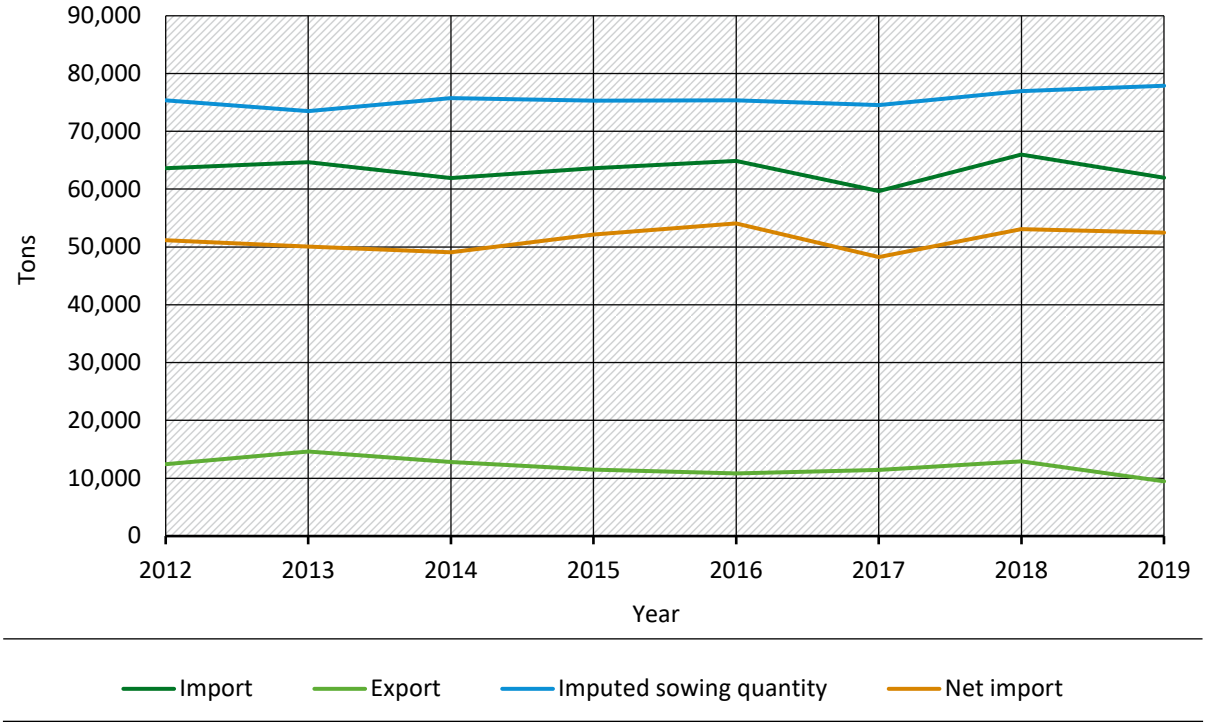
Contrary, the occurrence of pathogens has a clearer influence on the purchase of imported treated seeds. The occurrence of pests correlates with the growing regions of the affected crops, but there are also differences for individual pests. According to an interviewed trader, the seed treatment product Korit 420 FS, which is used as a repellent against bird damage and is not

authorized in Germany, was used on about 70 % of the maize cultivation area in the south of Germany, compared to 35 % in the north. Almost the same estimate for the usage in the south was given by an interviewed participant from a plant protection service. The participant stated that the proportion in this region was 34 %. According to several interviewees, the seed treatment products Sonido and Force 20 CS were used on about 10 % of the maize cultivation area in Germany.

Import volumes of (treated) seeds

The total maize seed demand in Germany has remained nearly constant since 2012, at about 78,000 t (2019). Accordingly, no major changes have occurred in foreign trade since 2012. Imports in 2019 were about 62,000 t with France (69 %) and Austria (20 %) as the main exporting countries. Maize seed exports to other EU countries were about 9,500 t in 2019 (Figure 15).

Figure 15: Maize: import, export, imputed sowing quantity, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

The interviewed participants from seed treatment facilities, seed traders and plant protection services stated only slight differences in their assessment of the share of imported treated seeds concerning the total amount of maize seeds sown in Germany. Based on the sowing in the 2019 / 2020 marketing year, a share of about 89 % of the maize seeds was imported. The estimates of the experts are in line with the results of the statistical analysis. According to the interviewees, the imported seeds are usually already treated with pesticides.

- Imputed sowing quantity (2019): 77,913 t
- Of which imputed import volume of treated seeds: 69,343 t
- Share of treated imported seeds of the total sowing quantity: approx. 89 %

Summary: Maize

Maize seeds are mainly sourced from abroad. The main reason for this is the climatic requirement for the multiplication of the crop. For economic reasons, seed treatment often takes place near the multiplication site. Accordingly, German producers mainly obtain treated seeds from other EU countries. An additional import incentive is caused by seed treatment products against bird damage and wireworm available in other EU countries but not in Germany.

4.3 Oilseed rape

Cultivation situation and use in Germany

In 2020, oilseed rape was the world's second most important oilseed crop with 370.4 million t following soybean in terms of quantity. In Germany, oilseed rape is the most important oil-producing crop. In 2020, the area under cultivation in Germany was 954,200 ha. In the years 1999 to 2018, the area under cultivation had not fallen below the limit of one million hectares.[28] The decline in land area in recent years is also reflected in the total yield. In 2015, German farmers produced 5 million t of oilseed rape; compared to 3.3 million t in 2020.[29] Winter oilseed rape is commonly cultivated in Germany. Summer oilseed rape has a subordinate role in terms of quantity.[30]

First and foremost, oilseed rape oil is extracted from oilseed rape, which is used as edible oil, animal feed and biofuel. Furthermore, the oil of the plant is used in the chemical industry and serves as a base material for paints, plastics, and cold foam.

The by-products of the oil extraction are oilseed rape cake or oilseed rape extraction meal, depending on the processing method. These products are used as high-protein animal feed. Another by-product of the oil processing into biodiesel is glycerine, which is further processed as animal feed or in the chemical industries.[31]

In 2015, organic oilseed rape was cultivated on 2,600 ha in Germany. It accounted for 0.2 % of the total German oilseed rape acreage.[32] Seed multiplication areas for oilseed rape in Germany used a total of 6,550 ha in 2020, of which nine hectares were used to multiply organic seeds.[33]

Reasons for importing treated seeds

- Import due to existing trade or business structures

According to the traders and participants from associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or due to a cross-border business structure. This trade concerns all field crops, which is why oilseed rape is also imported due to existing trade and business structures.

[28] BMEL (2020): Erntebericht 2020 – Mengen und Preise
[29] Agarheute (2020): Raps: 100.000 ha mehr Anbaufläche
[30] Statistisches Bundesamt (2019b): Flächennutzung: Bodennutzung insgesamt nach Nutzungsarten in Deutschland
[31] Amt für Statistik Berlin-Brandenburg (2006): Raps
[32] Ökolandbau.de (2015a): Ökologischer Rapsanbau
[33] BSA (2020): Zur Feldbesichtigung gemeldete Saatgutvermehrungsflächen 2020

- Import due to technical production processes

Other EU countries play an important role in seed production in oilseed rape. A large part of the seed production of oilseed rape takes place in France. Some interviewees pointed out that there are better possibilities for keeping the minimum distances between multiplication fields and field stands in France.

- Import due to the lack of availability of alternative plant protection products in Germany

Among the existing oilseed rape treatments, there is currently no insecticide with authorization in Germany. Lumiposa 265 (active ingredient cyantraniliprole), an insecticidal active ingredient, is authorized for oilseed rape in other EU countries. Regarding fungicidal seed treatments, Integral Pro (active ingredient Bacillus amyloliquefaciens strain MBI 600) is a biological product available for seed treatment in Germany. The product Scenic Gold (active ingredients fluopicolide, fluoxastrobin) has been authorized in other EU countries. Table 11 gives an overview of the plant protection products available for the treatment of oilseed rape. To control the small cabbage fly and the oilseed rape flea, producers have to buy treated seeds from other EU countries.

Table 11: Overview of available plant protection products for the treatment of oilseed rape seeds in Germany

Disease (*pathogens*)	Active ingredient(s)	Products
Fungal diseases: - Blackleg (*Leptosphaeria maculans*) - Damping off (*Alternaria brassicae, A. brassicicola, Rhizoctonia solani*) - Root rot (*Rhizoctonia solani*) - Downy mildew (*Peronospora parasitica*)	Fungicidal active ingredients: - Bacillus amyloliquefaciens strain MBI 600 - Dimethomorph - Fluopicolide (Not available in any seed treatments authorized in Germany) - Fluoxastrobin	Integral Pro DMM Scenic Gold (Not available in any seed treatments authorized in Germany)
Insects: - Small cabbage fly - Cabbage-stem flea beetle	Insecticidal active ingredients: - Cyantraniliprole (Not available in any seed treatments authorized in Germany)	Lumiposa 265 (Not available in any seed treatments authorized in Germany)

Source: Own illustration BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel; Bundesamt für Ernährungssicherheit Österreich (2020): Pflanzenschutzregister; Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail (2020): Ministerstwo Rolnictwa i Rozwoju Wsi (2020): Rejestr Środków Ochrony Roślin, Status July 2020

Plant protection products used in practice for seed treatment

As with cereals and maize, the standard treatment with fungicidal active ingredients is applied to oilseed rape. Depending on the manufacturer of the treated seeds, the seeds may be treated differently. In oilseed rape, the common products are Scenic Gold (Bayer) and Integral Pro (BASF). Last year, TMTD+DMM was still used in the standard seed treatment combination. This combination has been discontinued due to the expiration of the approval for the active ingredient thiram. Following the expiration of the approval for neonicotinoids in oilseed rape, the insecticide Lumiposa 265 FS (DuPont) has gained importance as an adjuvant treatment. It is authorized in Poland, among other EU countries.

Table 12: Standard and optional seed treatments used for oilseed rape seeds in Germany

Crop	Standard seed treatments (all types)	Optional seed treatments
Oilseed rape	Scenic Gold or Integral Pro (Fungicide)	Lumiposa (Insecticide)

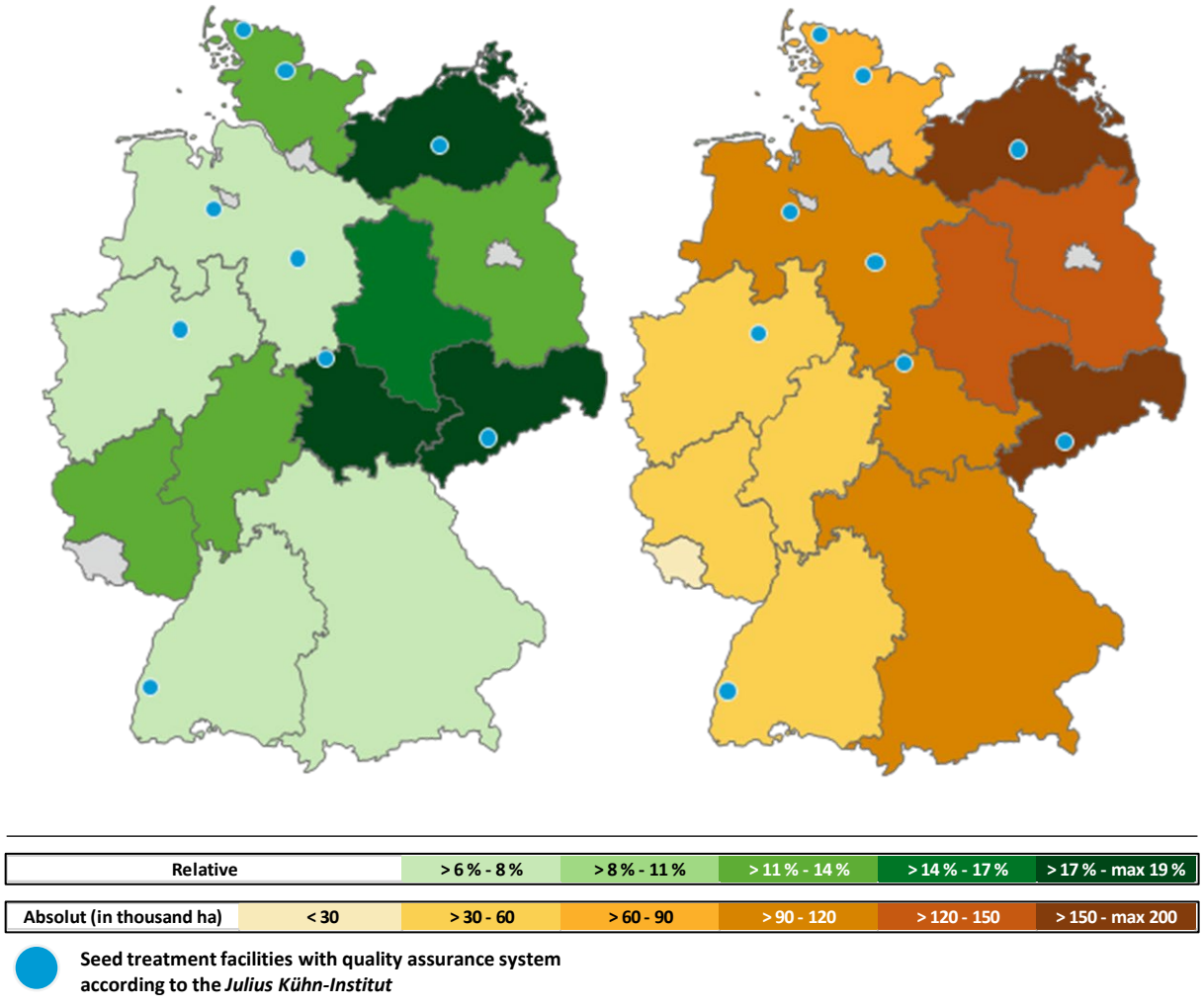
Source: (Selection): myagrar (2020): Übersicht über gebeiztes Raps- und Zuckerrübensaatgut; BayWa (2020): Empfehlungen Saatgutbeizen; Agravis (2020): Empfehlungen Saatgutbeizen; ATR-Landhandel (2020b): Saatgutbeizen Raps

Regional differences in the sowing of imported seeds

Regional differences in the sowing of imported treated seeds are due to the different growing regions of oilseed rape. The occurrence of pathogens correlates with the cultivation regions of the crop.

Figure 16 shows the relative and absolute acreage of oilseed rape by federal state in 2019 as well as the locations of seed treatment facilities equipped with quality assurance systems for dust reduction according the JKI. Oilseed rape is grown on approx. 20 % of the area in Mecklenburg-Western Pomerania, Thuringia, and Saxony. The largest absolute production areas with more than 150,000 ha are in Mecklenburg-Western Pomerania and Saxony. Other important cultivation regions are Saxony-Anhalt and Brandenburg, which is why eastern Germany can be defined as the cultivation focus. In general, the absolute cultivation area increases from west to east.

Figure 16: Relative and absolute acreages of oilseed rape and seed treatment facilities



Source: Own illustration based on Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.; JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung.

Seed treatment facilities equipped with quality assurance systems for dust reduction are mainly located in the north of Germany (five treatment facilities) The other parts of Germany south, east, west and in the center the JKI lists only one treatment facility each. According to several experts, the spatial proximity to neighboring countries only plays a minor role regarding the possibility of importing treated seeds.

There are regional differences in the distribution of individual pests in oilseed rape areas, which also influences the import volumes of treated seed. The pests are generally widespread throughout Germany, but the control threshold is exceeded in the main cultivation areas. This makes the use of appropriate treatment products in these regions particularly attractive. One trader interviewed estimated that Lumiposa 625 was used on about 5 % of oilseed rape areas in southern Germany, compared to about 55 % in the north. This order of magnitude was confirmed in interviews with participants from agricultural enterprises and plant protection services.

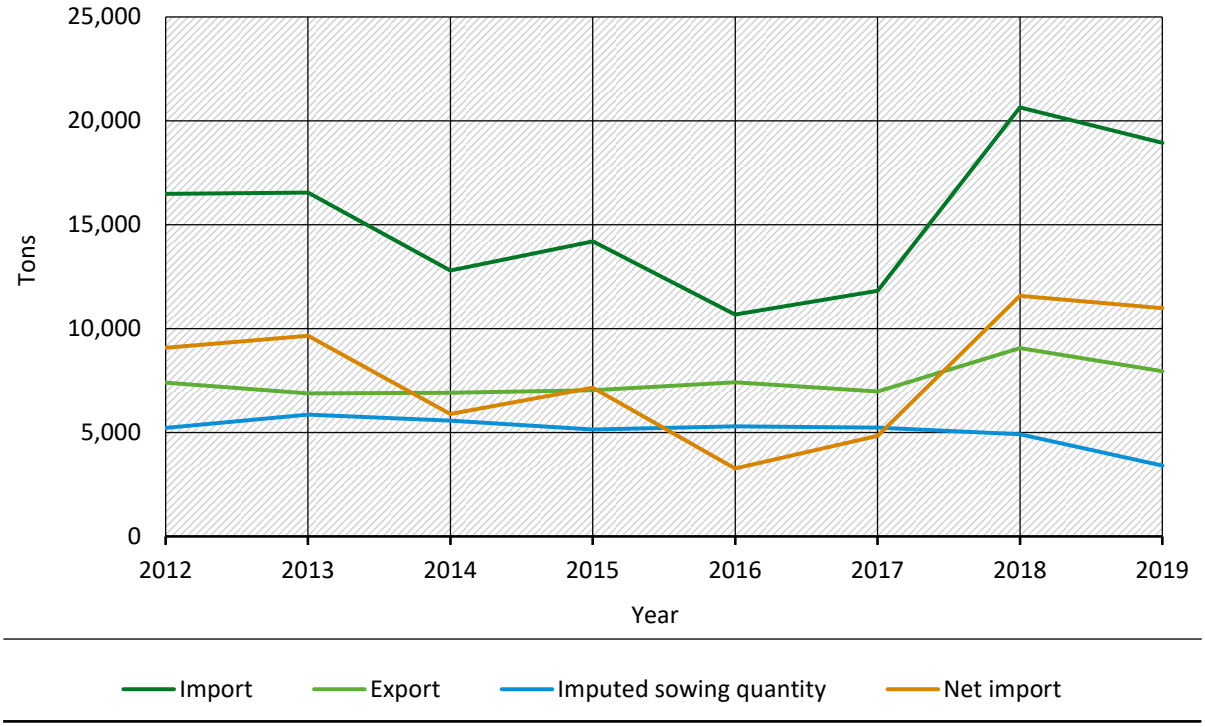
Import volumes of (treated) seeds

Figure 17 shows the development of the imputed seed volume and foreign trade. From 2018 to 2019, there was a decrease in the quantity of seeds sown from about 4,900 t to about 3,400 t. The import of oilseed rape almost doubled from about 12,000 t in 2017 to about 20,500 t in 2018.

According to the expert interviews with associations and plant protection services, the reason for the sharp increase in seed imports was the ban on neonicotinoid seed treatments and the lack of an effective alternative insecticidal treatment in Germany, as well as the discontinuation of the broadly effective fungicidal treatment TMDT. Reason for this is the non-renewal of the EU active ingredient approval for thiram in 2019 with simultaneous authorizations for insecticidal and broad-spectrum fungicidal oilseed rape treatments in various EU countries.

The main imports of oilseed rape seeds came from France (65 %), Spain (12 %), the Netherlands (6 %) and Poland (5 %). Imports from Spain and Poland more than doubled compared to the previous year. Exports were mainly to France (24 %) and Poland (22 %).

Figure 17: Oilseed rape: import, export, imputed sowing quantity, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

Regarding oilseed rape, the interviewed participants from seed treatment plants, seed traders and plant protection services were also able to estimate the proportion of imported treated seeds concerning the total amount of seeds sown in these crops with only minor deviations. The estimated share in oilseed rape, based on sowing in the 2019 / 2020 marketing year, is about 45 %. According to several interviewees, the seeds are usually already treated before they are imported into Germany. The resulting data are presented below:

- Imputed sowing rate (2019): 3,411 t

- Of which imputed import volume of treated seeds: 1,535 t
- Proportion of treated imports in the sowing quantity: approx. 45 %

Summary: Oilseed rape

As with maize, most oilseed rape is produced abroad. The reason, among others, is the areas required to comply with ensuring the minimum distances. The share of imported seeds is not as high as of maize seeds; about half of the seeds are produced in Germany. The attractiveness of importing treated oilseed rape seeds is high due to the availability of an insecticide in other EU countries that is not authorized in Germany. Seed producers therefore buy treated seeds e.g., from Poland, as otherwise the control of the small cabbage fly is no longer possible.[34]

4.4 Sugar beet

Cultivation situation and use in Germany

Sugar beet is the economically most important subspecies of the beta beet group and the main supplier of sugar in temperate latitudes. Around one-fifth of the sugar currently produced worldwide is obtained from sugar beet. The area under cultivation in Germany is currently around 386,400 ha. [35] The below-average harvest of 26.2 million t in the drought year 2018 was followed by a slightly above-average harvest of 29.7 million t in 2019.[36]

Processing beets into sugar produces beet pulp as a by-product, which is used as animal feed, especially for ruminants, due to its high nutritional value. Beets are also increasingly used as a renewable raw material to produce e.g., ethanol (bioethanol). Sugar beet is also an energy-rich and rapidly fermentable substrate to produce biogas.

Sugar beet cultivation occupies a niche within organic agriculture in Germany: in 2015, organic sugar beet was grown on only 1,300 ha (< 1 %). [37]

Sugar beet is a biennial plant. After forming the storage root in the first year (vegetative development), it can only shoot and form seed plants in the second year of vegetation after a cold stimulus (vernalization) that lasts for several weeks. As with maize, female plants in seed production are pollinated by the variety-specific pollen donor plants. After flowering, the pollen donor is removed from the multiplication areas. Only the seeds on the maternal variety component are harvested. The harvest time in the European production areas is from mid-July to early August. After harvesting, the first quality check of the seeds is carried out. Moisture content is measured immediately after threshing, and if necessary, the crop is dried to below 10 % moisture.[38]

Seed multiplication is almost non-existent in Germany due to the climatic conditions. Seeds are produced on less than 31 ha. [39] At present, organic seeds are not multiplied in Germany.

[34] Topagrar online (2020): Bei uns verboten, in Polen erlaubt - Hersteller lassen Raps im Nachbarland beizen
[35] Statistisches Bundesamt (2019a): Feldfrüchte und Grünland
[36] BLE (2020): Bericht zur Markt- und Versorgungslage Zucker
[37] Ökolandbau.de (2015b): Zuckerrüben
[38] KWS Saatgutqualität und -produktion Zuckerrübe
[39] BSA (2020): Zur Feldbesichtigung gemeldete Saatgutvermehrungsflächen 2020

Reasons for importing treated seeds

- Import due to existing trade or business structures

According to the traders and associations interviewed, cross-border trade takes place by default due to geographical proximity to neighbouring countries or due to a cross-border operating structure. This trade affects all field crops, which is why sugar beet seeds are also imported due to existing trade and operational structures.

- Import due to technical production processes

Sugar beet seed production within the EU takes place almost exclusively in northern Italy and southwestern France due to climatic requirements. [40] All seeds are therefore imported due to this technical production process.

- Import due to the lack of availability of alternative plant protection products in Germany

Plant protection products with fungicidal, insecticidal and nematicidal activity are currently available in Germany for the cultivation of sugar beet and fodder beet. Relevant products from other EU countries (without authorization in Germany) could not be identified (Table 13). Therefore, due to the lack of availability of alternative plant protection products, imports are not relevant for sugar beet.

Table 13: Overview of available plant protection products for the treatment of sugar beet seeds in Germany

Disease (*pathogens*)	Active ingredient(s)	Products
Fungal diseases: - Rhizoctonia crown rot (*Rhizoctonia solani*) - Root rot (*Rhizoctonia solani*) - Zonate leaf spot (*Phoma betae*) - Damping off (*Aphanomyces species*) - Aphanomyces root rot (*Aphanomyces species*) - *Pythium* species	Fungicidal active ingredients: - Fludioxonil - Metalaxyl-M - Sedaxane - Hymexazole	Tachigaren 70 WB Vibrance SB
Insects: - Pygmy beetle - Wireworm	Insecticidal active ingredients: - Tefluthrin	Force 20 CS
Nematodes: - Stem nematode (*Ditylenchus dipsaci*) - Root-knot nematode (*Meloidogyne hapla*) - Cyst-forming root nematodes (*Heterodera schachtii*)	Nematicidal active ingredients: - *Bacillus firmus* strain	VOTiVO

Source: Own illustration based on BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel.

[40] SESVanderHave (2020): Saatguterzeugung; Strube D&S (2020): Rübenfibel 2019/20; KWS (2020): Saatgutqualität und -produktion Zuckerrübe

Table 14: Standard and optional seed treatments used for sugar beet seeds in Germany

Crop	Standard seed treatments (all types)	Optional seed treatments
Sugar beet		Force 20 CS (Insecticide) Vibrance SB and / or Tachigaren 70 WB (Fungicides)

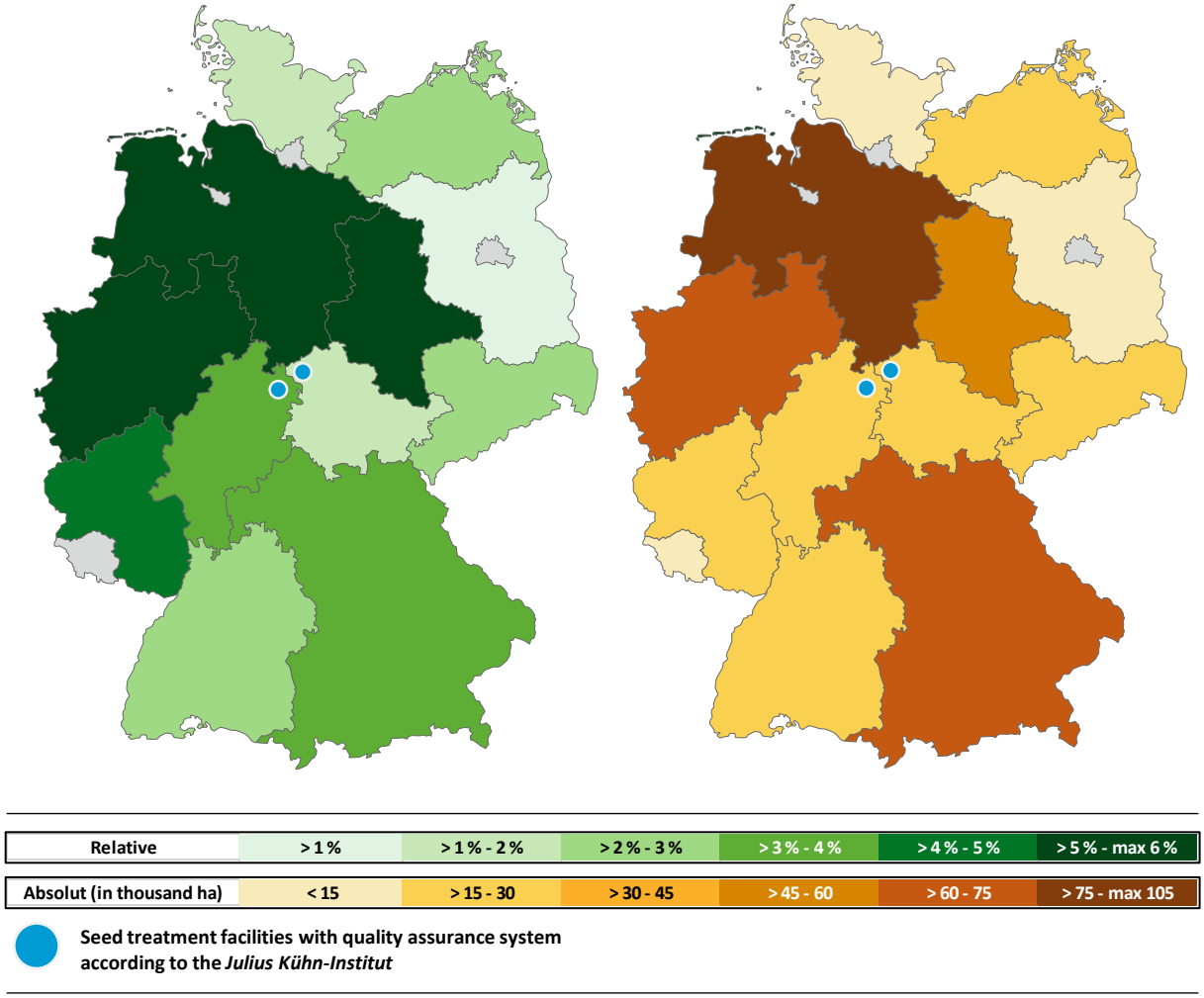
Sources (Selection): myagrar (2020): Übersicht über gebeiztes Raps- und Zuckerrübensaatgut; (2020): Saatgutbeizen Zuckerrüben.

Regional differences in the sowing of imported seeds

Regional differences in the sowing of imported treated seeds are due to the different sugar beet growing regions.

Figure 18 presents the percentage of sugar beet area in total arable land and the absolute sugar beet area, broken down to each federal state for 2019. The crop generally occupies significantly smaller areas than cereals, maize, or oilseed rape. Compared with other crops, sugar beet is found on 6 % of fields in Lower Saxony, North Rhine-Westphalia, and Saxony-Anhalt. Lower Saxony is also the region with the largest production area in absolute terms with 105,000 ha. This is followed by North Rhine-Westphalia and Bavaria, which cultivate more than 60,000 ha each. Apart from Bavaria, the main focus of production is in northwestern Germany.

Figure 18: Relative and absolute acreages of sugar beet and seed treatment facilities



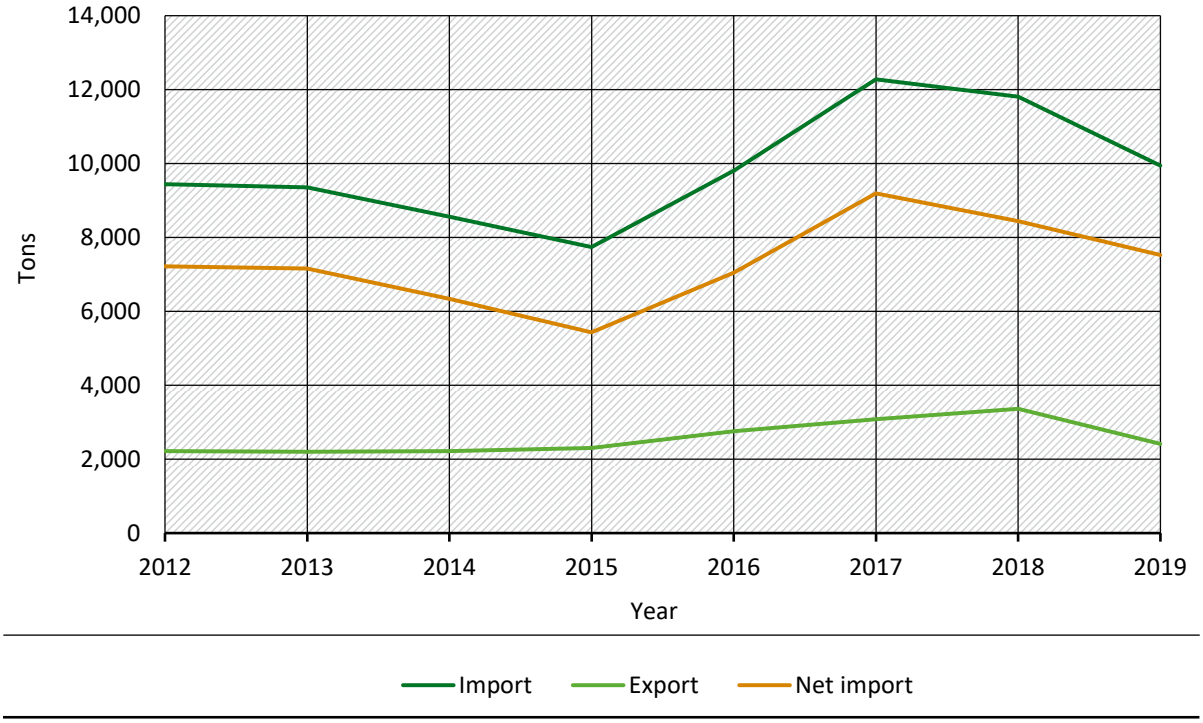
Source: Own illustration based on Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung.

Within the borders of Germany, two seed treatment facilities equipped with quality assurance systems for dust reduction that treat sugar beet seeds exist. These are located south of the main production area in central Germany.

Import volumes of (treated) seeds

It is not possible to quantify the quantity of seeds sown, since it is sown in a casing (consisting of the treatment, among other things) and there is no specific weight for the sugar beet seeds that can be adequately compared with the commercial quantities. Import volumes varied in recent years. In 2015, a total of 7,700 t of seeds were imported, whereas in 2017 12,800 t were imported (see Figure 19). Imports are almost exclusively coming from Italy (52 %) and France (46 %), the countries where the bulk of European sugar beet seed production takes place. About 2,200 t per year have been exported since 2012. An increase has been recorded since 2015 up to a value of about 3,400 t in 2018. In 2019, about 2,400 t were exported. Exports were mainly to France (42 %), Poland (14 %) and the Netherlands (12 %)

Figure 19: Sugar beet: import, export, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

- Share of treated imports in the sowing quantity: approx. 20 %

Summary: Sugar beets

Sugar beet has specific climatic requirements for the place of multiplication that are hardly feasible in Germany. Seeds produced in Italy and France are imported to Germany treated or untreated, depending on the breeder. The market for sugar beet seeds is dominated by a few large breeders. This is also reflected in the small number of treatment facilities in Germany. The active ingredients in the seed treatments permitted in Germany do not differ from those permitted in other EU countries. The share of already treated imports concerning the total amount of seeds sown in Germany is at about 20 %.

5 Quality control and quality description of treated seeds

The treatment of seeds can be a key technology for achieving an optimum protective effect during the germination and juvenile development of crops. From an environmental point of view, the direct application at the point of action of the active ingredient and lower application rates per hectare to archive the intended effect are an advantage compared to the application by spraying.

However, during the sowing of treated seeds dust containing active substance is released and causes dust drift. The amount of dust deposition and therefore also deposition of active substance due to this exposure pathway depends on the seed treatment quality. In the past, the drift of dust-containing active substances has led to damages to bee colonies in some regions of Germany. This has led to more intensive use of dust-reducing methods in the treatment process and to the introduction of certifications for treated seeds.

5.1 Quality assurance of treatment facilities in Germany

The Julius Kühn-Institut

Seed treatment facilities in Germany can be certified by the Institute for Application Technology in Plant Protection of the Julius Kühn Institut or the SeedGuard GmbH as so-called Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung (seed treatment facilities with quality assurance systems for dust mitigation). This requires the seed treatment facility to meet increased standards concerning the process technology used, process sequences and their documentation.

These requirements for process flow and technology are aimed at minimizing the release of dust generated during seed treatment, storage, and transport. Depending on the active ingredients of the plant protection product the BVL grants authorization exclusively for use in seed treatment facilities with quality assurance systems for dust reduction following the JKI (application provision NT6991). The inspection of the treatment facilities to obtain certification of seed treatment facilities with quality assurance systems for dust mitigation can be carried out either by the JKI itself or by the SeedGuard GmbH. [41] A list of seed treatment facilities that meet the increased quality requirements is given in the appendix.

The SeedGuard GmbH

In 2011 leading multiplication and breeding organizations, seed processing companies and trade organizations in the German seed industry founded the SeedGuard Gesellschaft für Saatgutqualiät mbH (Society for Seed Quality) as a certification system for seed treatment. The purpose of certification under the SeedGuard GmbH system is to ensure a high level of environmental and health protection during the seed treatment process and the resulting treated seeds. Certifications by the SeedGuard GmbH are done voluntarily. Companies must comply with specific criteria for production. In return, participating seed treatment facilities receive the right to use a quality seal. In addition to the certification services, participants are informed about current developments and relevant topics in the field of seed treatment and receive documents for the implementation and verification of the SeedGuard GmbH system. [42] The requirements for seed treatment facilities are identical to the testing requirements of the JKI. As soon as a seed treatment facility has been certified by SeedGuard GmbH or has successfully passed a JKI test, it is automatically included in the list of seed treatment facilities

[41] Julius Kühn-Institut (o.J.): Saatgutbehandlungseinrichtungen (Beizstellen)
[42] Gesellschaft für Saatgutqualität mbH (o.J.): Wir über uns

equipped with quality assurance systems for dust mitigation of the JKI and thus meets the requirements for compliance with the BVL application provision NT6991. The entry in the list by the JKI is valid for three years.

Process of certification / inspection of treatment facilities

An application by a seed treatment facility for certification by the JKI or SeedGuard GmbH must be accompanied by a process description and a facility description, e.g., in the form of a schematic drawing. The process description covers both the process within the seed treatment facility and the preceding seed treatment.

Checklists drawn up by experts from the regulatory authorities and seed production associations are used to check the treatment facilities. The checklists differ in a few points depending on the crop. In general, the treatment facilities are inspected according to the following inspection specifications:

1. Sample dressing and functional testing of existing formulations
2. Sharing of the recipe
3. Work order
4. Seed supply to the seed treatment machine; seed delivery
5. Facilities, equipment, machinery
6. Supply/ dosage of treatment products, auxiliaries, and additives
7. Seed post-treatment / sieving
8. Sampling of the seed after treatment / before bagging
9. Seed packaging
10. Quality management, handling of faulty batches
11. Training of personnel, certificate of competence
12. Plant protection storage, transport, disposal
13. Storage and transport

When evaluating the test criteria, a distinction is made between k.o. criteria (k.o.), critical criteria (k.k.), and non-critical. The k.o. criteria can only be evaluated as fulfilled or not fulfilled. All applicable k.o. criteria must be 100 % fulfilled. Critical criteria can be evaluated as fulfilled or not fulfilled. At least 66 % of all applicable critical criteria must be fulfilled. Non-critical criteria are considered recommendations and are not included in the overall evaluation but must be checked. Corrective measures are indicated. [43]

[43] JKI (2016): Verfahren und Anforderungen an Saatgutbehandlungseinrichtungen zur Eintragung in die Liste der Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung

In addition to the test criteria of the checklist, the JKI specifies the Heubach value that must be complied with, the frequency of the Heubach analyses and the reserve sample of the seeds. The values differ depending on the type of crop.

Table 15: Specifications for the Heubach analyses of the JKI

Crop	Reference Heubach value	Frequency Heubach analysis
Cereals	5 g / ha	One test per 500 t, at least three tests per season
Oilseed rape	0.5 g / 700,000 Grains	Once a week
Maize	0.75 g / 100,000 Grains	Once a week (Exception Mesurol: each batch must be sampled)
Sugar beet	0.25 g / 100,000 Grains	Every 14 days

Source: JKI (2016): Verfahren und Anforderungen an Saatgutbehandlungseinrichtungen zur Eintragung in die Liste der Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung

Table 16: Specifications for reserve samples of the JKI

Crop	Sample Size	Storage periods
Cereals	min. 500 g	min. 12 months
Oilseed rape	min. 500 g	min. 6 months
Maize	min. 1 kg	min. 12 months
Sugar beet	min. 500 g	min. 6 months

Source: JKI (2016): Verfahren und Anforderungen an Saatgutbehandlungseinrichtungen zur Eintragung in die Liste der Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung

5.2 European system for quality control in treatment facilities

In Europe, the main quality control tool in seed treatment facilities is the European Seed Treatment Assurance Scheme (ESTA). The ESTA is a European quality assurance scheme developed by the European Seed Association (ESA) for the use of plant protection products in seed treatment and the handling and use of treated seeds. The ESTA is designed to ensure that seed treatments meet legislative and industry requirements. The independently operating quality assurance system has been developed based on official standards and norms. Cooperations with national quality assurance systems (e.g., SeedGuard GmbH in Germany) are an essential part of the ESTA. Transparency, regular training of auditors and continuous review and improvement of standards are important elements of the system.

The ESTAs' tasks include the process description, in which measures for quality assurance of the seeds are defined. The risk analysis identifies problems in the process. The core tasks are the control of documents and records as well as the elimination of occurring irregularities by corrective or preventive measures.

The ESTA certification is based on the following standards:

- ISO/IEC 17065:2012: Requirement for certification bodies
- ISTA International Rules for Seed Testing: Rules for random sampling
- Heubach value: Euroseeds reference method for determining the fine dust content of seeds treated with seed dressings
- Euroseeds reference value 'Industry dust reference values'
- COMMISSION DIRECTIVE 2010/21/EU of 12 March 2010 amending Annex I to Council Directive 91/414/EEC as regards the specific provisions concerning clothianidin, thiamethoxam, fipronil and imidacloprid

The organization of the ESTA certification is presented in Figure 20. The ESTA headquarters in Brussels, consisting of the board and managers, appoints country-based agents who are authorized to designate certifying bodies. Furthermore, the ESTA headquarters sets standards that the certifying bodies must meet. The certifying bodies carry out audits at the seed enterprises / seed treatment facilities and can then issue them with the ESTA seal of authorization.

Figure 20: Organization of the ESTA certification

Source: Own illustration based on Euroseeds (2020b): ESTA-Governance.

Certification bodies should provide the following data about the certified enterprises to the ESTA headquarters annually via the agents: Name, address, legal structure, ESTA certificate incl. expiration date, an annual evaluation of audits, certificates issued and withdrawn incl. date, and scope (culture) of the certificate. Table 17 presents the agents responsible for the different EU Member States. The SeedGuard GmbH quality assurance system is based in Germany.

Table 17: ESTA agents

Agents	Country
Agricultural Industries Confederation (AIC)	Great Britain
Asociación Nacional de Obtentores Vegetales (ANOVE)	Spain
Assosementi	Italy
Fajtaoltalmi nonprofit kft.	Hungary
Polish Seed Trade Association (PIN)	Poland
SeedGuard GmbH	Germany
Union Francaise des Semenciers (UFS)	France

Source: Own illustration based on Euroseeds (2020e): How ESTA works for the treatment sites

The ESTA has a total of eleven certification bodies (Table 18). Four of those are located in Germany. The certification bodies are not bound to their respective countries; a German authorization body can also certify treatment facilities in other EU countries.

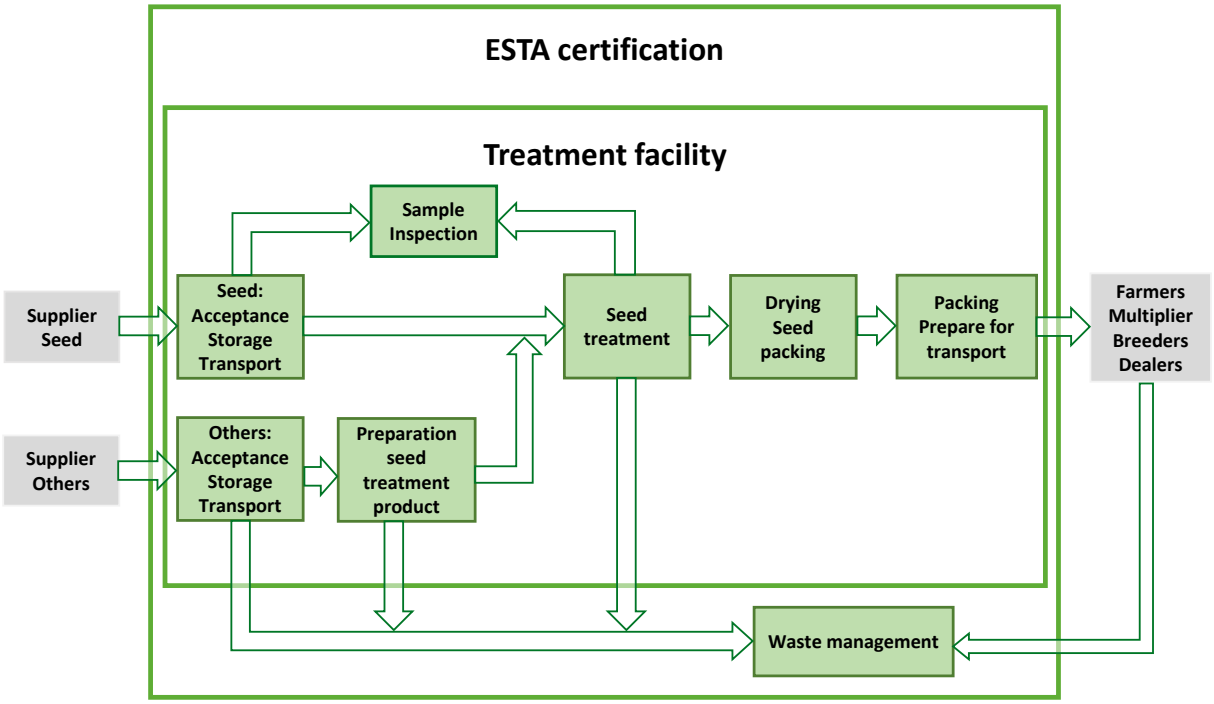
Table 18: ESTA certification bodies

Certification body	Country
SGS Germany GmbH	Germany
DEKRA Certification GmbH	Germany
DIN CERTCO Gesellschaft für Konformitätsbewertung mbH	Germany
ADIA-Zert Gesellschaft für Audit- und Zertifizierungsdienstleistungen in der Agrar- und Ernährungswirtschaft mbH	Germany
GNIS- Service Officiel de Controle et de Certification (SOC)	France
ECAS B.V.	The Netherlands
KIWI Agri Food	Great Britain
COBICO SP. Z O.O.	Poland
QA Solutions SP. Z O.O.	Poland
TÜV Rheinland Polska SP. Z O.O.	Poland
AGES Österreichische Agentur für Gesundheit und Ernährungssicherheit GmbH	Austria

Source: Own illustration based on Euroseeds (2020d): How ESTA works for the certifying bodies

Figure 21 presents the scope of the ESTA certification. The processes, working conditions and technology within the treatment facility as well as the waste management of the treatment facility and the purchasers of the treated seeds are inspected.

Figure 21: Scope of the ESTA certification



Source: Own illustration based on Euroseeds (2020c): ESTA-Standard

The specific requirements for the seed treatment company are:

1. Seeds to be treated must fulfil crop-specific moisture and purity criteria (damaged seeds, foreign bodies, seeds of other crops, infested seeds).
2. Seed treatment process incl. composition of the treatment and the applied technique must be tested.
3. Safety instructions concerning the applied seed treatment product and its use must be available and ready to hand.
4. Treatment process must be monitored (e.g., visual inspection of the seeds before and after the measure).
5. Seed samples must be drawn and stored according to defined storage conditions and period as well as sample size.
6. Seeds must be tested with the Heubach test (determination of the fine dust content of seeds treated with pesticides); if the value is exceeded, the seeds cannot be placed on the market.
7. Records of the amount of product used per quantity of seeds must be kept for plausibility checks.
8. Measures for waste disposal must be in place and documented.
9. Treated seeds must be labelled according to legal labelling requirements and proof of authorization of the plant protection product must be provided.

10. Ensuring on the part of the seed enterprises that the plant protection product meets the purchase requirements.
11. Treated seeds are sensitive to environmental effects. The transport enterprises are required to ensure gentle transport. The seed enterprises should pack the seeds safely and appropriately.
12. Seeds returned by farmers or traders must be repeatedly tested for these requirements.

The system is based on a checklist that is reviewed by the accreditation bodies when certifying treatment facilities. The checklist is continuously adapted to the current state of research.

Table 19 presents the ESTA-certified seed treatment facilities for the main crops subdivided by country and field crop. In Germany, a total of 42 seed processing facilities are ESTA-certified for maize, oilseed rape, cereals, and sugar beet. Thereby most of the certified seed treatment facilities are in Germany, followed by France (36), Great Britain (27) and Poland (17). The number of seed treatment plants does not provide any information about the amount of seeds treated in the respective countries.

Table 19: ESTA-certified seed processing facilities

Country	Maize	Oilseed rape	Cereals	Sugar beet	Total[44]
Austria	2	-	-	-	2
Belgium	1	-	1	1	2
Denmark	-	1	1	1	3
France	26	14	11	1	36
Germany	10	13	29	2	42
Greece	-	-	1	-	1
Hungary	5	3	-	-	5
Italy	3	-	-	-	3
The Netherlands	-	-	-	-	0
Poland	11	14	5	2	17
Romania	4	-	-	-	4
Serbia	2	-	-	-	2
Slovakia	2	-	-	-	2
Slovenia	1	-	-	-	1
Spain	4	1	4	-	5
Turkey	3	-	-	-	3
Ukraine	3	-	-	-	3
Great Britain	1	17	23	1	27
Total	**78**	**63**	**75**	**8**	**158**

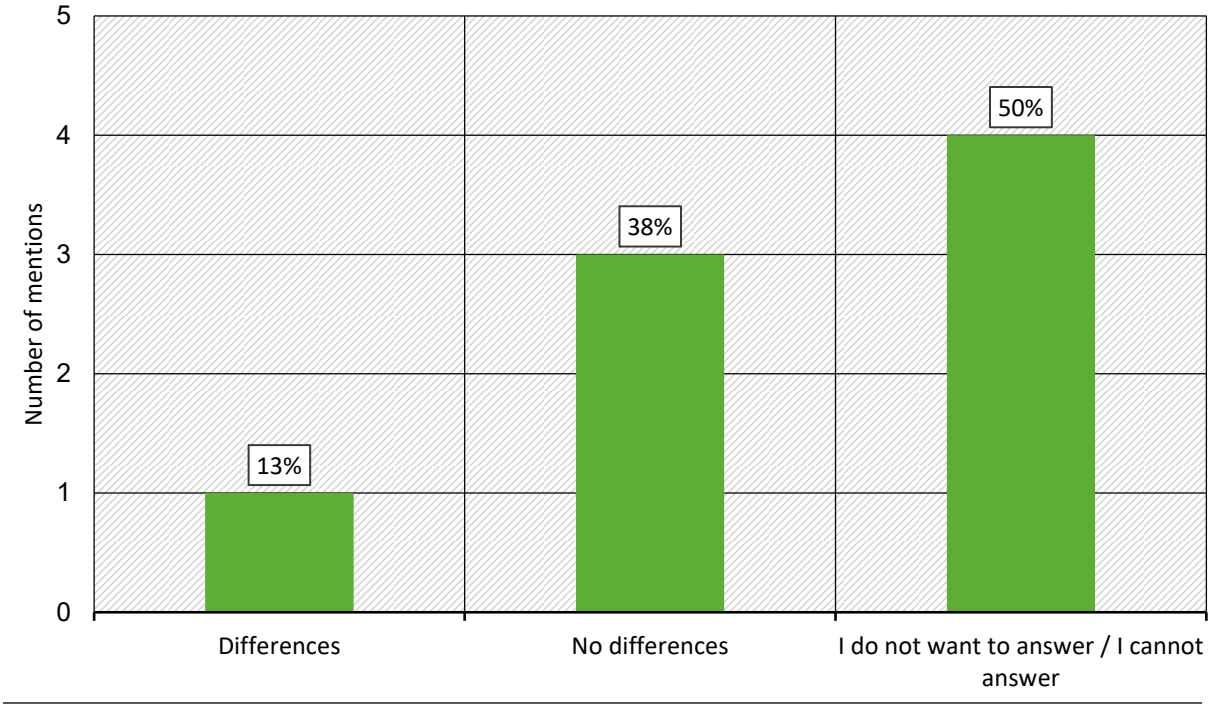
Source: Own illustration based on Euroseeds (2020f): List of certified enterprises, Status September 2020

Treatment facilities in all parts of the world can be certified according to ESTA. The location can therefore also be outside the EU. Currently, treatment facilities in Turkey, Ukraine and Serbia are ESTA-certified. Consequently, according to representatives of the certification system, the UK's exit from the EU is not expected to have any impact on the existing system.

[44] The data is not identical with the sum of the individual values since several crops can also be treated in individual seed processing stations. The figure only takes into account seed treatment facilities in which the crops listed in the table are treated.

Certification according to the ESTA is independent of the location of the treatment facility. A difference in treatment quality can also not be derived from the online survey of participants from plant protection services. Only one participant in the survey stated that there were differences in treatment quality between treated seeds from Germany and other EU countries. Specifically, seeds treated in Germany were seen as having better properties in terms of abrasion resistance, active ingredient distribution and dosage. According to three participants, there are no differences in the treatment quality. It should be noted that half of the participants chose the answer option 'I do not want to answer / I cannot answer' (Figure 22).

Figure 22: Presence of differences in treatment quality (in terms of dust abrasion) between treated seeds from Germany and other EU countries according to the number of mentions from plant protection services.

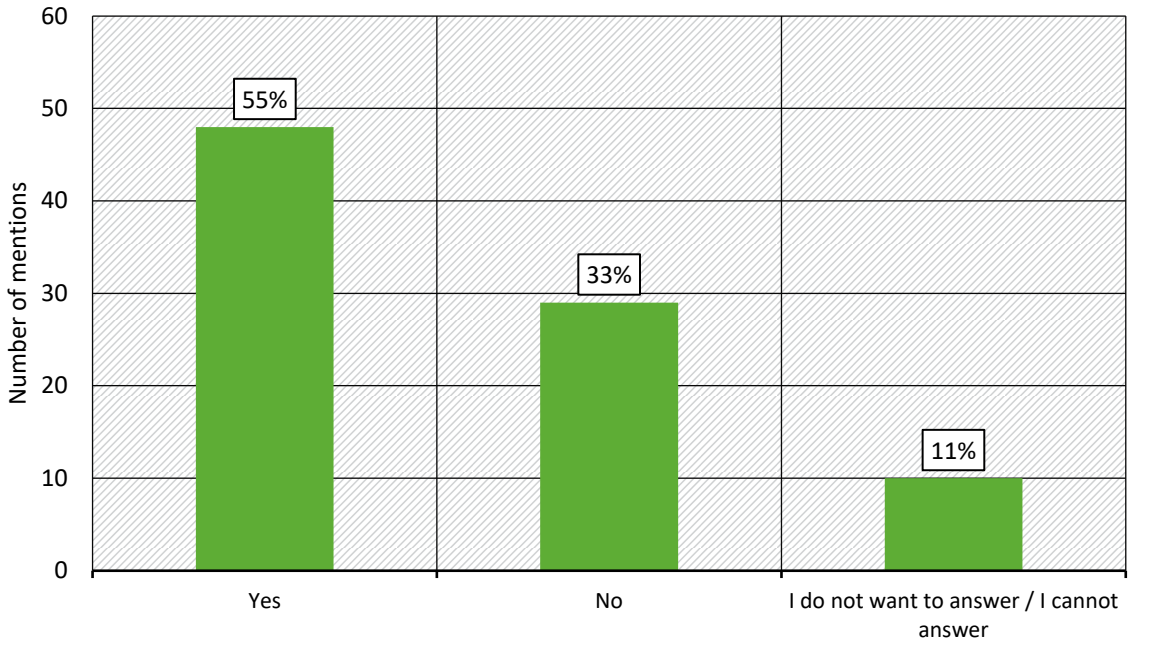


Source: AFC (2020): Online survey of plant protection services; N=8
Question: In your opinion, are there differences in treatment quality (regarding dust abrasion) between treated seeds from Germany and from other EU countries?

It is relevant for the purchase decisions of farms if seeds have been treated in a certified seed treatment facility. Thus, 55 % of the farmers stated that it is important for their purchase decision if treated seeds come from a certified treatment facility. For about one-third of the participants, certification is not important in their purchasing decision (Figure 23).

In the interviews, all farmers stated that they generally associate better seed quality with seeds from certified treatment facilities. A reduction in dust abrasion during sowing is seen as beneficial, but it is not necessarily the decisive reason for purchasing certified seeds.

Figure 23: Relevance of the origin (certified treatment facility) for the purchase decision of treated seeds according to the number of mentions from agricultural enterprises



Source: AFC (2020): Online survey of agricultural enterprises; N=87
Question: Does it play a role in your decision to purchase treated seeds whether the seeds come from a certified treatment facility?

The share of ESTA-certified seeds in Germany is already very high. According to several experts, a very high degree of coverage is achieved in Germany with treated seeds that have been treated in seed treatment facilities with ESTA certification. It is generally agreed that almost 100 % coverage is achieved for oilseed rape and sugar beet. For maize, the percentage is at about 90 %. The data include both domestically treated seeds and imports that have already been treated. The share for cereal seeds is still very low and difficult to quantify. One interviewee reasoned that for cereals, only 75 of the estimated 500 - 1,200 seed treatment facilities based in the EU have ESTA certification. It is predicted by several interviewees that in the next five years the proportion of ESTA-certified cereal seeds will increase sharply. These proportions were confirmed by representatives of the certification system.

According to one interviewee, the national quality control instruments in the EU countries are based on the ESTA standards. The standards are set through the ESTA. However, only the national quality assurance systems in France (PQP, since 2010) and Germany (SeedGuard GmbH, since 2011) are compatible with ESTA standards.

5.3 Information on the quality description of treated seeds for marking in trade

In Germany, the labelling of treated seeds is regulated in §32 SaatgutVO (Seed Ordinance). This paragraph stipulates that certain information must be included on the label. The following information must be provided on the seed label:

- Designation of the plant protection product
- Active ingredient(s)
- Standard phrases concerning safety precautions
- If applicable, risk mitigation measures provided for in the authorization for the plant protection product
- Reference to further information, if applicable

If it is not possible to include all the required information on the label due to the size of the label, the standard phrases regarding safety precautions and risk reduction measures specified with the authorization of the plant protection product may also be printed on the delivery bill or an accompanying document. The treatment agent instructions must be affixed to the package.[45]

According to Seed Ordinance Section 6, § 29, seed treatment facilities are obliged to provide the seeds with prescribed data and key figures:

- EC standard: All data required by directives of the EU law must be present on the label or the package insert (footnote to the EU regulation)
- The name of the EC country in which the authorization took place
- Identification of the recognition body
- Type in Latin and German version
- Variety denomination
- Variety recognition number
- Category of the seeds
- Date of sampling (takes place directly after harvesting the seeds)
- Producing country
- Weight specification of the seed package

According to Seed Ordinance Section 6, §32, the following data must be provided:

- Designation of the plant protection product

[45] BMJV (2018): Verordnung über den Verkehr mit Saatgut landwirtschaftlicher Arten und von Gemüsearten (Saatgutverordnung).

- Contained active ingredients

As voluntary additional data are possible:

- Quality characteristics thousand-grain weight and germination capacity

In addition to the label, there is further information on the package inserts. These relate to the process of treating the seeds with the plant protection product. However, according to the Seed Ordinance, it is not mandatory to provide this information.

- Supplementary information on the seed treatment product (active ingredient concentration, formulation, and mechanism of action)
- Proper use (explanations of mode of action, crop compatibility, spectrum of activity, recommendations for use/indications, special instructions, areas of use and withdrawal periods specified by the regulatory authority)
- Application technology (explanations on miscibility, treatment technology and residual volume utilization)
- Information for safe handling (explanations of classification and labelling according to Regulation (EC) No. 1272/2008 (CLP), hazard statements, precautionary statements, information for the protection of the user and first-aid measures)
- Notes on the protection of the environment (explanations on the protection of surface waters, requirements, and notes for the protection of aquatic organisms, bees and beneficial organisms, and waste disposal)
- General application notes / liability

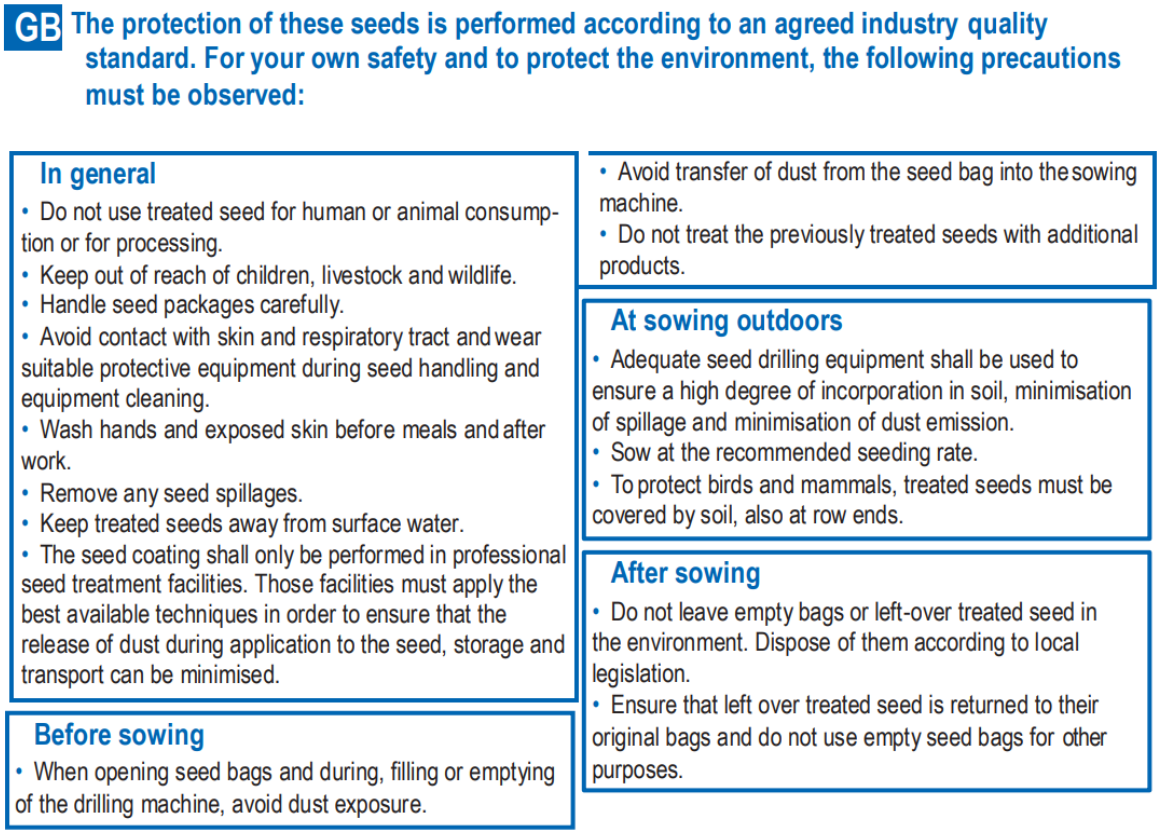
The data listed on the label and the package insert are defined according to national and EU guidelines. However, it is possible to add further quality characteristics. According to the information provided by the plant protection services in the online survey, possible additions to the quality description of the seeds have been suggested:

- Quality seals: Farmers and traders have an interest in the standards to which seeds have been produced and treated. Seals of quality (e.g., ESTA) are intended to ensure the quality of treatment facilities.
- Variety characteristics: Printing of an overview of the characteristics (e.g., stability, time of maturity, etc.) of a variety. The evaluation should be carried out by independent actors such as chambers of agriculture.
- A more precise description of seed quality: Clear standard values are specified in the Seed Marketing Act and other planting material and seed regulations. In addition to the germination capacity already listed, there are clear guide values for varietal purity and foreign matter content. The values for these key figures can be integrated.
- Data on dust abrasion (Heubach value)

- Further information about the breeder, breeding station, multiplication site and treatment facility

Recommendations are given by Euroseeds for the labelling of precautions for the ESTA-certified seeds. The corresponding label is shown in Figure 24.

Figure 24: Recommendation from Euroseeds on the labelling of treated seeds



Source: Euroseeds (2020a): Euroseeds labelling recommendations.

Of the experts interviewed, the majority considered the current information on the quality description to be adequate. Supplementary (mandatory) information was not necessary. In the opinion of one interviewee, however, additional information on the quality description of treated seeds should be implemented on a mandatory basis. The specified quality would then have to be randomly sampled and monitored. Monitoring of treatment quality could be carried out in a similar way to monitoring seed traffic control.

The Heubach value was known to all interview partners. Overall, it is regarded as a good indicator of the treatment quality and is implemented in practical processes. The Heubach a.s. value is viewed critically by several interview partners and described as impractical. The reason given was that the abrasion quantities have fallen sharply in recent years and no measurement of the active substance can take place in the small quantities of dust; the proportion is often below the detection limits. Furthermore, there are currently hardly any suitable methods for determining the active substances. It is difficult to integrate the measurement into the tight time horizon of production and is also very cost intensive. One interviewee mentioned that it might be possible to implement the Heubach a.s. value by calculating a defined worst-case value for the active ingredient in the abraded dust.

6 Uncertainties, potential risks at the national level and discussed measures as solutions for risk regulation of imported treated seeds

To present the results obtained so far and to indicate and discuss solutions for risk regulation, a workshop was conducted with experts from the sector. Of the total of eleven external experts, three each belonged to seed certification institutions, agricultural associations, and plant breeders' associations. One expert was associated with a federal state ministry, another with a plant protection service.

Methodology and agenda

First, the results of the secondary data analysis, online survey and expert interviews were presented by the AFC. Subsequently, the UBA representatives presented possible scenarios regarding the authorization status of seed treatment products in Germany and the associated uncertainties and risk potentials. In addition, possible solutions for risk regulation were outlined (Table 20).

With the help of the discussion based on these findings, the relevance of the study results for the potential risks of the sowing of imported treated seeds was discussed and the proposed solutions for environmental risk assessment and regulation were evaluated and further elaborated. The basis for the discussion was the presented work results of the AFC as well as the level of uncertainty and the potential risks and possible solution proposals for risk regulation indicated by the UBA (Table 21).

Table 20: Workshop agenda and presenting institution

Agenda	Presenting institution
Welcoming and short round of introductions What is the project about? Introduction and background of the project	AFC
Quantities, quality, and relevance of imported treated seeds Presentation of selected work results of the market analysis	AFC
Discussion of the presented work results	AFC
Relevance of results to potential risks of sowing imported treated seeds with discussion	UBA
Identification of possible solutions for risk regulation	UBA
Summary of the results/ short final discussion	AFC

Source: AFC (2020)

Table 21: Potential plant protection product authorization scenarios, the associated levels of uncertainty and risk for the environment and possible solutions indicated by the UBA

#	Scenario	Level of uncertainty and risk potential	Possible solutions for risk regulation
1	**Plant protection product for seed treatment is also authorized in Germany**	**1a: in Germany, no risk mitigation measures were necessary for national authorization** → No uncertainty, no specific risks at national level	→ Not necessary
		1b: Risk mitigation measures are necessary for authorization in Germany and comparable risk mitigation measures are provided for the imported treated seeds (on packaging) → No uncertainty, no specific risks at national level	→ Not necessary
		1c: Risk mitigation measures are necessary for authorization in Germany but no comparable risk mitigation measures are provided for the imported treated seeds (on packaging) → Uncertainty regarding potential risks since the quality is unknown	→ Print information about certification and quality of the imported seeds on the label of the packaging → Indicate the intended uses assessed (general application pattern, GAP) on the packaging → Reduce drift during sowing in general: Risk of dust drift is limited nationally i.e., via risk mitigation measures regarding maximum wind speed during sowing (e.g., NH681: no sowing at wind speed > 5 m/s); the Good Agricultural Practice could address this issue for treated seeds → Continue EU-wide cooperation to increase the quality of seeds in terms of dust abrasion (certification, quality standards) → Raise user awareness of potential risks following the sowing of seeds treated with specific products → Transfer of risk mitigation measures to imported seeds → In case of unacceptable risks, consider restricted import and restricted placing on the market of e.g., seeds of lower quality
2	**Plant protection product for seed treatment has been applied for authorization**	**For use in Germany, unacceptable risks for the environment were identified that could not be mitigated** ➔ Low uncertainty but high risk	→ Raise user awareness of potential risks following the sowing of seeds treated with specific products → Documentation (list) of seed treatment products that were applied for in Germany but were not

#	Scenario	Level of uncertainty and risk potential	Possible solutions for risk regulation
	in Germany, but has not been authorized		authorized due to unacceptable risks to the environment → Strive for further collaboration to achieve authorization in Germany (e.g., propose high quality standards, run specific studies, implement monitoring) → In case of unacceptable risks, consider measures following Article 69 of Regulation (EC) No. 1107/2009 and possible prohibitions/restrictions of import and placing on the market
3	**Plant protection product for seed treatment was not applied for authorization in Germany**	**Environmental risks arising from specific conditions at national level (e.g., concerning dust drift) have not been assessed** → Highest uncertainty, risks unknown; precautionary principle should apply	→ Raise user awareness of potential risks following the sowing of seeds treated with specific products → Apply for authorization in Germany → Environmental risks arising from specific conditions at national level (e.g., concerning dust drift) might be estimated from previous assessments of products containing the active substances → In case of unacceptable risks, consider measures following Article 69 of Regulation (EC) No. 1107/2009 and possible prohibitions/restrictions of import and placing on the market for treated seeds of insufficient quality

Source: UBA: Potenzielle Risiken für die Umwelt und Lösungsvorschläge; UBA modified

The initial basis for the discussion of the different scenarios and the indicated solutions was the uncertainty about potential risks arising in Germany due to specific conditions at national level since the quality of treated seeds regarding abrasion of dust during sowing is mostly unknown for imported treated seeds. In addition to the seed treatment quality, specific conditions of use and specific environmental or agricultural circumstances such as wind speed also play an important role in the extent of the dust abrasion and drift of the active ingredient.

Discussed solution: Declaration on seed quality regarding dust abrasion to create incentives for users

To reduce the uncertainty about potential risks arising in Germany due to specific conditions at national level, the UBA indicated that information about the seed quality could be plaaced on the packaging of the treated seeds. This is intended to create incentives directly for users to purchase seeds with a minimized dust abrasion potential. The perception of reduced risks for the environment would be improved. Additional declaration was also proposed in the form of a QR code.

A participant from the seed certification industry stated that a label is already existing for seeds that have been treated in seed treatment facilities that meet the JKI or the SeedGuard GmbH standards. The participant also expressed concerns about the proposed solution of an additional declaration or label, as such is easily overlooked among the other information and for this reason hardly creates an additional purchase incentive among users. The declaration with the

help of a QR code was not considered to be practical, as experience from food retailing indicated only limited usage. In addition, producers would not decide to buy seeds based on their packaging but order rather in advance based on recommendations, advice, and experience. For this reason, it was considered more appropriate to improve the presentation and dissemination of the benefits of certified seeds.

A participant from a plant breeder association argued that the legal labelling requirement prevented the use of a QR code on the packaging, as any information on the seed packaging had to be accessible to potential users in immediately legible language. In addition, customers would expect a generally high seed quality and thus also a high treatment quality. For this reason, it would make no difference from the users' point of view, whether an internationally active company treated the seed in another EU country or in Germany in a certified facility. The assumption of high quality of the seed would be achieved through trust in the standards of the company, not through an additional declaration for the customer.

Participants from UBA noted that from a regulatory perspective, information for the end consumer on the packaging is essential and should not be considered as placed too late to be implemented (see pictograms for hazards).

Discussed solution: Raise the user awareness of potential risks from sowing seeds treated with specific products

One further proposal was to increase the awareness among users regarding risks arising from the sowing of seeds treated with specific products under specific conditions at national level. Better awareness of potentially high-risk seed treatments under specific national conditions could help to reduce the use and thereby reduce risks for the environment.

A participant from a plant protection service pointed to the already existing knowledge of farmers regarding application instructions and risks when using treated seed. Producers would know, implement, and support environmental measures related to treated seeds. As an example, the appropriate storage, as well as the potential hazard for birds by ingestion of treated seeds were mentioned.

One participant from a plant breeder association added the viewpoint of a qualitative differentiation between seeds treated in Germany and seeds treated in other EU countries and the communication of this could lead to legal problems.

As pointed out by UBA, there are no indications that imported treated seeds have in principle a lower quality compared to seed treated in Germany. However, the uncertainties are higher since information about the quality of the specific seeds is not available. Potentially necessary national risk mitigation measures might not be declared on the packaging of the imported treated seed as would be a requirement for authorization for seed treatments in Germany.

Discussed solution: Transfer of risk mitigation measures to imported seeds

The proposal of transferring risk mitigation measures to imported seeds would apply to products that are authorized also in Germany and would not directly restrict imports. Risk mitigation measures would minimize the potential risks deriving from the specific national conditions and allow for a harmonized authorization of the same products.

According to one participant from a plant protection service, additional requirements would make the implementation more difficult for producers. Existing conditions in connection with seed application, such as the risk mitigation measure limiting the maximum wind speed allowed during sowing of treated seeds (NH681), would already pose a challenge to farmers, as it would restrict the working hours and is not comprehensible for farmers. Appropriate seed treatment

quality would have to be ensured in advance so that possible dust abrasion would be tolerable or covered within the environmental risk assessment. Additional risk mitigation measures would have to be feasible and controllable by plant protection services and the responsible authorities of the federal states.

One participant from UBA pointed out, that the risk mitigation measure regarding maximum wind speed does not pose unreasonable challenges to the farmers as described above. Together with the Deutscher Wetterdienst (German national meteorological service), investigations were carried out to measure the sowing restrictions resulting from this risk mitigation measure. The results showed that there would be a maximum restriction of 5 % of all possible sowing days on which sowing would not be allowed due to wind conditions (not including other limitations because of rain or soil conditions). Due to the risk of soil erosion by wind, no soil management measures are recommended at wind speeds above 5 m/s according to the Good Agricultural Practice. Farmers already consult different services for checking wind speeds in various time frames. Therefore, according to UBA, this risk mitigation measure concerning wind speed can be considered appropriate and does not unreasonably restrict farmers.

Discussed solution: In case of unacceptable risks, consider possible prohibitions / restrictions of import and placing on the market

In case a product was not authorized in Germany because of unacceptable risks deriving from specific national conditions but was authorized in another Member State, prohibition or restriction of import and use could be considered as the last option (following the procedure of Article 69 of Regulation (EC) No. 1107/2009). A restriction could apply for seeds that have not been treated according to the quality standards of SeedGuard GmbH or the JKI.

One participant from an agricultural association and one expert from a plant protection service emphasized the importance of free trade within the EU, which is why they were critical regarding this suggested last measure. National regulations for seed treatment were therefore not considered useful, as they would restrict free trade. To limit potential risks with the help of additional regulations, action would instead need to be taken at EU level.

The UBA supports an EU- wide risk regulation approach; the knowledge about the seed treatment quality is however not sufficiently available within the EU. Therefore, despite the intended harmonization, there might be a need for specific regulations to regulate risks deriving from specific national conditions. National regulations could also create greater fairness concerning the EU-wide competition for seed treatment plants in Germany, as the authorization of some products for seed treatment in Germany is linked to more intensive monitoring, resulting in higher costs for enterprises. The current regulations however lead to the import of seeds treated with the same product from other EU countries to Germany with less intensive monitoring.

Discussed solution: Seek authorization in Germany

To be able to minimize the uncertainties regarding the seeds sown at national level, it was proposed to seek authorization in Germany for products that are imported from other EU countries. In consequence, better knowledge about the treatment quality would be available and national specific conditions could be addressed in national risk mitigation measures.

Two participants from agricultural associations and one expert from a plant protection service considered authorization in Germany for additional seed treatment products to be worth pursuing. This would advance the harmonization of regulations within the EU, which was stated as a long-term goal by nearly all experts participating in the workshop.

However, one participant from an agricultural association noted that the risk assessment of plant protection products in Germany is stricter than in other EU countries. As long as there was no uniform risk assessment in the EU, there would always be seed imports from other countries. The EU-wide uniform user protection was mentioned as a positive counterpart from the participants' point of view. In addition, Germany would have great influence on the authorization of products in other countries due to its position within the Community. This means that commercial enterprises are confronted with uncertainties in the authorization process throughout the EU. An application for authorization in Germany would partly not be worthwhile for internationally operating enterprises for economic reasons.

One participant from a plant protection service, one expert from a plant breeder association and one expert of the certification sector pointed to the ESTA certification, which in their opinion would guarantee a sufficiently high seed treatment quality in other EU countries. The reason given by the experts was the ESTA certification criteria partly being based on the principles of the SeedGuard GmbH certification. A corresponding quality would be achieved by considering the entire production process. Nevertheless, it was relativized that an ESTA certification would not be sufficient to evaluate a seed treatment plant according to the SeedGuard GmbH or the JKI criteria, since the certification requirements according to the SeedGuard GmbH or the JKI are higher than those of the ESTA. From a regulatory point of view, indicating the certification on the seed packaging of all seeds would support the certification efforts and lead to the incremented use of such seeds.

Placing the results of the discussion in the context of the workshop

The workshop aimed to jointly discuss some of the identified issues and indicated possible solutions by the UBA with participants from the practical side. Accordingly, the participants were not uniformly distributed between regulatory agencies and industry, as explained before - but selected to include a high share of representatives from the seed treatment industry sector. At the same time, this was also intended to create an opportunity for further development of the proposals. The discussion was open and reflected in part the specific background of the different participants. Unfortunately, this also hampered the development of further approaches and solutions.

Summary: Workshop

Importing treated seeds creates uncertainties about the risk for the environment at the national level. During the workshop, scenarios with different uncertainties and possible risk levels and the associated indicated possible solutions presented by UBA were discussed with experts from the sector.

UBA proposes to raise the awareness of the environmental risks of treated seeds not authorized in Germany. Moreover, it is suggested to indicate a certification on the packaging. Individual experts did not consider additional seed declaration to be useful, as the decision to purchase is already made before the packaging is viewed. Moreover, additional information on the packaging would be overlooked. The suggestion to make seed users more aware of the risks of using treated seeds was viewed as unnecessary by one participant, as farmers were already aware of the application instructions and risks of using treated seeds. Another point of discussion to minimize risk was to install application requirements to imported seeds. According to one participant, additional requirements would make the implementation more difficult for producers which is why they should be avoided, and sufficient seed quality should be ensured before distribution to the user. The UBA indicates that in the case of unacceptable risk, and following EU procedures, the import and marketing of treated seeds could be restricted as ultima ratio. Two participants were critical of this solution, as it would restrict free trade in the EU. Action would be needed at the EU level rather than at the national level. Almost all experts supported the approach of aiming for uniform authorization in the EU, as this would advance the harmonization of regulations and thus improve the usage of seeds for users. At the same time, better risk regulation would be possible for regulatory authorities. As proposed by UBA, most of the experts were in favour of seeking approval in Germany for seed treatment products used abroad.

Despite an open discussion, some participants saw the UBA's indicated solutions mainly as additional restrictions for users, but not as potential improvements for risk regulation. This hampered the further development of proposals. Further harmonized work is needed to advance the regulation of possible risks arising from treated seeds, including the information of the end users and the advancement of seed quality certifications.

7 Summary presentation - short answers to the questions

1. For which field crops is a purchase of imported treated seeds from other European countries attractive or necessary for the farmer?

- Due to existing trade or business structures
  - Cereals, maize, oilseed rape, sugar beet
- Due to technical production processes
  - Maize, oilseed rape, (sugar beet)
- Due to the lack of availability of alternative plant protection products in Germany
  - Maize, oilseed rape

2. What quantities of treated seeds are imported per crop and what proportions do the imported quantities represent of the total seeds sown in Germany in these crops?

- Cereals
  - The total import volume of grain is 54,000 t and thus has only a very small share in the imputed sowing volume in Germany (< 6 %).
  - It is difficult to say what share of the imported seeds has already been treated, since it is imported by many traders and in some cases by the farmers themselves, and about 50 % of the cereal seeds are treated at the farm.
- Maize
  - Imputed sowing quantity (2019): 77,913 t
  - Of which imputed import volume of treated seeds: 69,343 t
  - Share of treated imports in the sowing volume: approx. 89 %
- Oilseed rape
  - Imputed sowing quantity (2019): 3,411 t
  - Of which imputed import volume of treated seeds: 1,535 t
  - Share of treated imports in the sowing volume: approx. 45 %
- Sugar beet
  - The seeds for growing sugar beet are almost entirely imported.
  - Whether the seed is treated seed or untreated seed depends on the grower and the location of the treatment facilities.
  - Share of treated imports in the sowing volume: approx. 20 %

3. **What are the reasons for buying and using imported treated seeds (price, availability, etc.)?**

- Import due to existing trade or business structures
- Import due to technical production processes
- Import due to the lack of availability of alternative plant protection products in Germany

4. **Are there regional differences in Germany regarding the purchase and sowing of treated seed imported from other European countries?**

- Regional differences in the sowing of imported treated seeds are due to the different growing regions of the field crops.
- The occurrence of pathogens essentially correlates with the growing regions of the affected crops. In individual cases, there are also regional differences due to specific pests, for which plant protection products from abroad are used.
- Geographical proximity to neighbouring countries plays only a minor role for the crops maize, oilseed rape and sugar beet.

5. **With which plant protection products were the imported seeds treated? Seeds of which crops are usually treated with which plant protection products or combinations of several plant protection products - separated into seeds treated in Germany and imported treated seeds - and which active substances are contained in them?**

- The crops maize, oilseed rape and cereals are generally treated with the standard treatment (fungicides). The plant protection products used (except Scenic Gold for oilseed rape) are authorized in Germany.
- In the case of the optional treatments, which are additionally applied as required, there are no authorizations in Germany for maize and oilseed rape. The seeds treated with these products are therefore imported in their entirety.
- The optional treatments of cereals and sugar beet are authorized in Germany.

6. **Are quality control instruments implemented in treatment facilities in other European countries and how are they designed and implemented (e.g., certifications)?**

- The essential instrument for quality control of treated seeds in Europe is the ESTA. The national instruments of quality control are compatible with the ESTA or are based on the specifications of the ESTA.
- The seeds sown in Germany are 90 % - 100 % certified according to the ESTA for the crops maize, oilseed rape and sugar beet.
- For cereals, the share of the ESTA-certified seeds is still very low. It is predicted that this share will increase sharply in the next five years.

7. What additional information on the quality description of treated seeds is suitable for labelling traded seeds?

- The existing labelling of treated seeds is considered sufficient by most of the interviewed experts from the seed sector.
- The suitability of additional (mandatory) information for describing the quality of treated seeds is assessed very differently by stakeholders in the industry.

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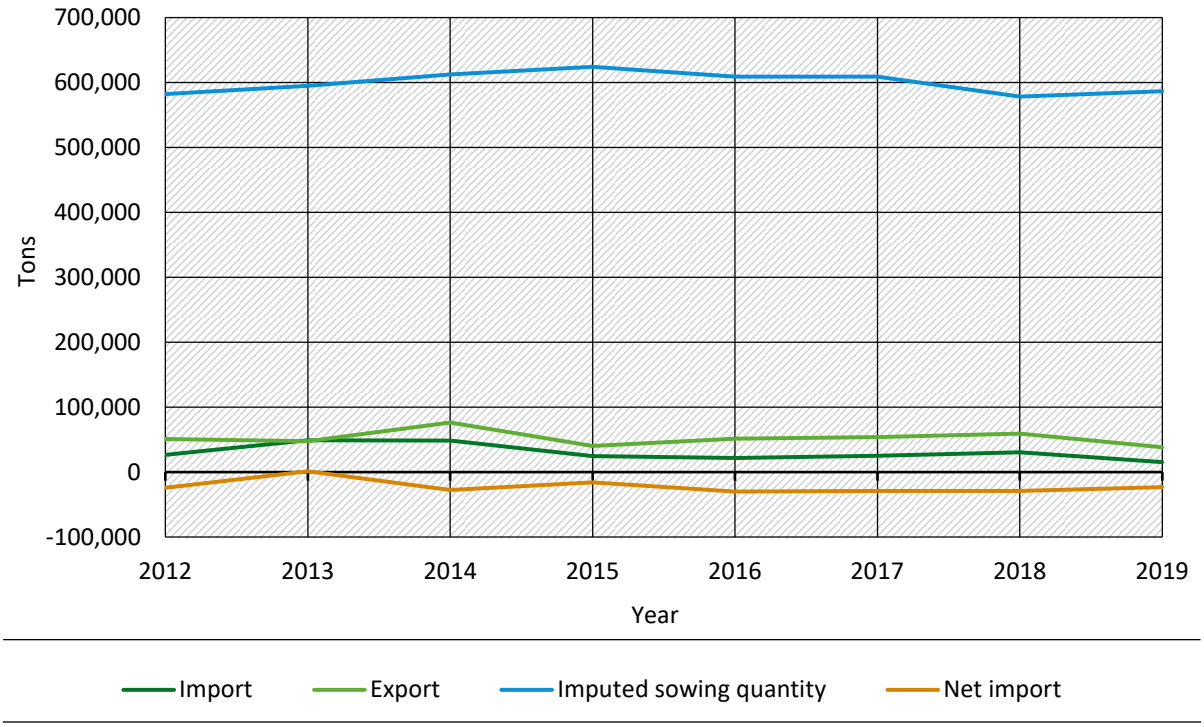
Appendix

Additional information

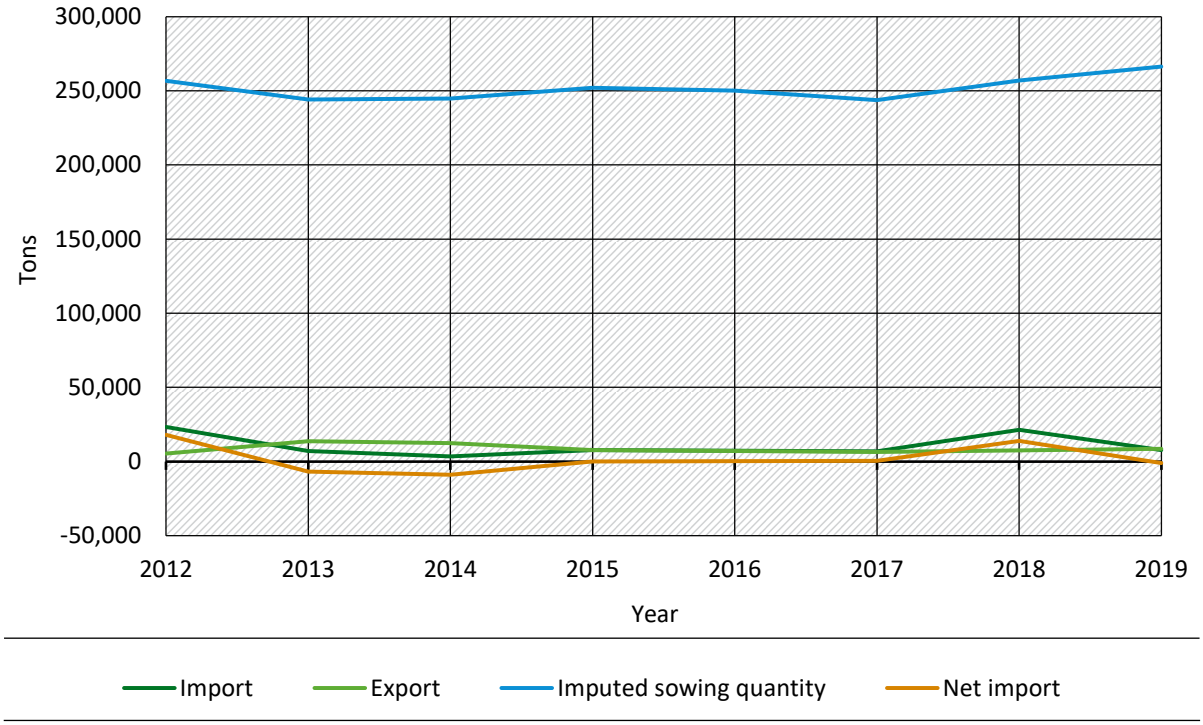
Imputed sowing rate, import, export, and net import of selected cereals

Figure 25: Wheat: imputed sowing rate, import, export, and net import from 2012 – 2019



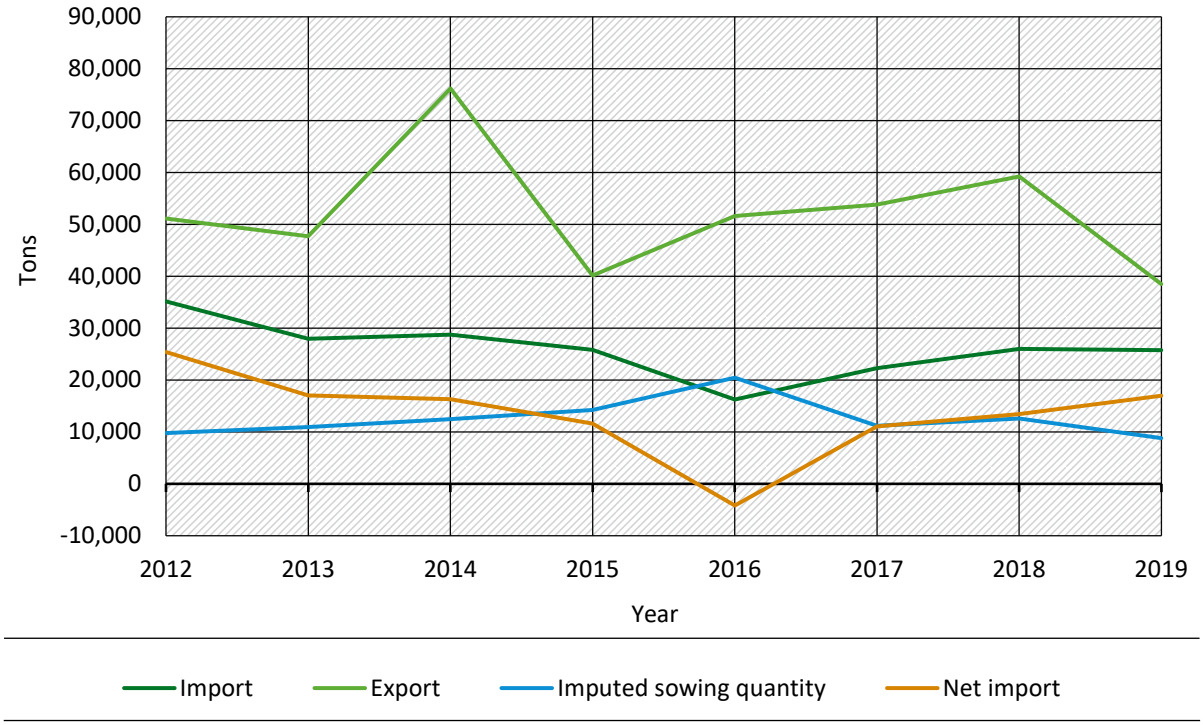
Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

Figure 26: Barley: imputed sowing rate, import, export, and net import from 2012 – 2019



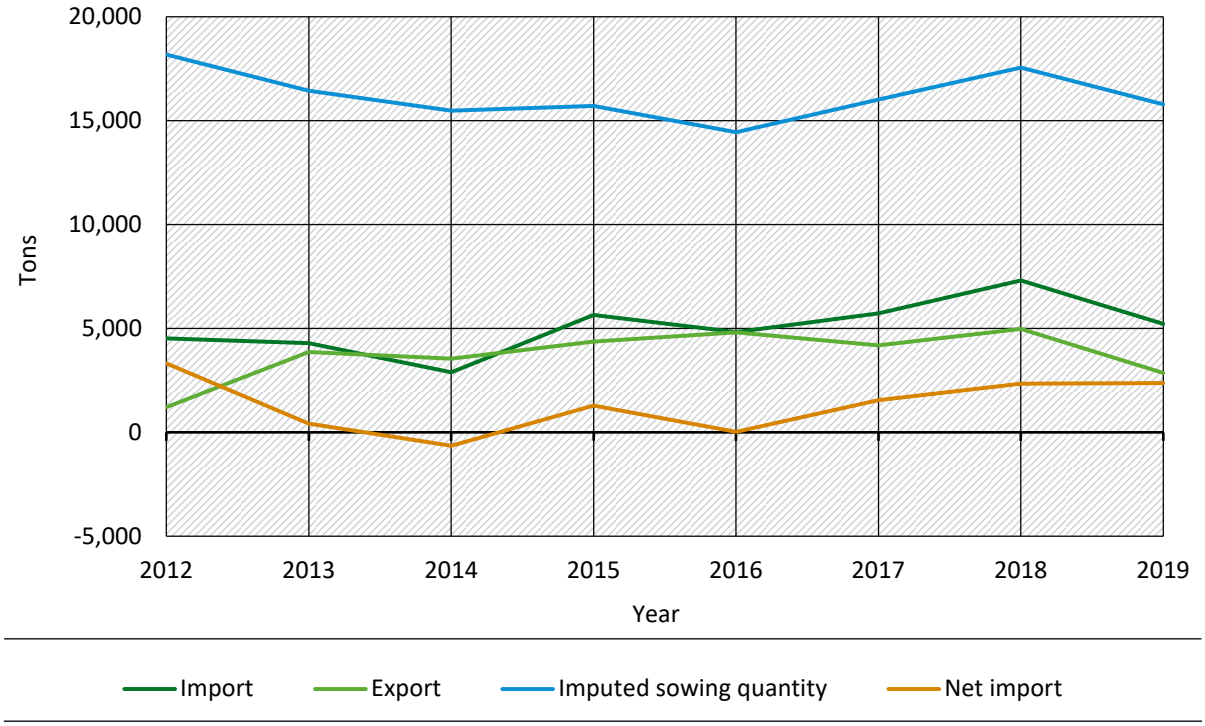
Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

Figure 27: Rye: imputed sowing rate, import, export, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

Figure 28: Oats: imputed sowing rate, import, export, and net import from 2012 – 2019



Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis; Raiffeisen (2020): Ackermanager; Statistisches Bundesamt (2020b): Statistisches Jahrbuch 2019, p. 499 ff.

Import and export volumes of seeds of important field crops by country

Table 22: Maize: import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	6,940	7,086	5,893	7,047	7,799	9,888	10,666	12,632
	Export	293	496	728	443	747	518	675	428
Belgium	Import	4	37	38	160	82	51	51	46
	Export	374	543	487	370	325	134	364	215
Bulgaria	Import	-	-	-	-	-	-	-	-
	Export	1	4	20	4	6	7	109	72
Croatia	Import	-	-	-	3	1	-	-	-
	Export	2	26	4	18	5	1	112	44
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	0	0	0	0	0	-	0	0
Czech Republic	Import	-	185	276	72	153	220	252	205
	Export	376	757	585	1.023	218	709	792	547

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Denmark	Import	40	49	76	68	77	174	191	111
	Export	1,107	1,037	788	629	562	858	1,168	1,480
Estonia	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	0	-	-	-
Finland	Import	-	-	-	-	-	-	-	-
	Export	-	6	-	-	0	2	11	16
France	Import	41,908	49,826	51,506	52,143	49,908	45,101	48,495	42,906
	Export	3,577	2,781	2,362	4,334	3,480	3,592	4,438	2,067
Greece	Import	-	-	-	-	-	-	-	-
	Export	23	143	3	1	1	2	1	1
Hungary	Import	4,365	3,278	1,249	1,648	3,912	1,788	3,951	3,374
	Export	40	103	189	502	120	669	153	216
Ireland	Import	-	-	-	-	-	-	-	-
	Export	172	184	100	0	12	0	12	21
Italy	Import	124	252	212	201	143	64	263	171
	Export	231	328	110	79	197	108	150	156
Latvia	Import	-	-	-	-	-	-	-	-
	Export	46	30	56	21	45	70	109	162
Lithuania	Import	-	-	-	-	-	7	2	12
	Export	422	511	158	91	77	52	94	96
Luxembourg	Import	184	243	155	211	102	91	234	247
	Export	92	89	33	53	73	56	58	71
Malta	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
The Netherlands	Import	4,282	616	450	297	235	181	238	511
	Export	2,029	2,327	3,211	1,675	1,909	2,456	2,250	1,362
Poland	Import	91	39	29	43	105	155	392	216
	Export	2,023	3,440	2,650	1,195	1,095	1,111	953	863
Portugal	Import	-	-	-	-	-	-	-	0
	Export	0	7	0	0	0	29	24	9
Romania	Import	3,454	924	1,098	611	1,619	638	624	746
	Export	467	390	141	35	54	179	149	496

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Sweden	Import	-	4	-	-	0	-	-	-
	Export	51	69	58	42	20	26	65	74
Slovakia	Import	2,223	2,141	907	1,030	754	1,307	646	774
	Export	100	173	270	347	1,166	448	652	356
Slovenia	Import	-	-	-	3	-	-	-	-
	Export	-	26	5	15	17	1	19	-
Spain	Import	3	2	18	69	10	3	0	22
	Export	39	48	103	53	72	41	76	145
United Kingdom	Import	-	4	2	-	11	12	-	10
	Export	974	1,080	748	537	638	382	487	585

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Table 23: Oilseed rape: import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	97	67	97	108	104	36	66	151
	Export	311	541	475	397	245	251	198	189
Belgium	Import	-	-	0	-	0	-	-	23
	Export	21	13	8	3	11	3	7	4
Bulgaria	Import	-	-	4	-	-	-	49	-
	Export	428	280	337	337	327	240	278	161
Croatia	Import	1	31	21	-	31	17	91	44
	Export	14	27	47	31	82	7	74	35
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Czech Republic	Import	106	257	23	45	-	91	76	94
	Export	660	483	580	549	575	449	555	404
Denmark	Import	6	75	360	152	369	1,290	440	411
	Export	125	122	63	303	146	126	89	78
Estonia	Import	-	-	69	-	-	-	-	-
	Export	112	129	192	140	111	227	121	103
Finland	Import	-	-	52	-	-	-	11	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
	Export	78	130	23	105	108	116	83	111
France	Import	11,422	12,597	8,059	11,575	7,868	7,774	17,227	12,324
	Export	420	883	429	804	1,150	1,443	2,647	1,942
Greece	Import	-	-	34	-	-	-	-	11
	Export	5	2	11	17	24	64	89	70
Hungary	Import	2,102	437	682	577	927	675	838	1,008
	Export	283	266	322	360	421	419	404	343
Ireland	Import	-	-	-	-	0	0	32	50
	Export	7	19	16	10	40	46	82	45
Italy	Import	-	-	-	33	21	100	175	-
	Export	20	15	20	7	35	38	50	20
Latvia	Import	-	14	2	11	-	-	-	-
	Export	283	235	249	211	180	134	163	528
Lithuania	Import	49	-	35	24	-	24	12	12
	Export	1,086	708	555	439	487	471	650	96
Luxembourg	Import	23	9	2	7	15	4	6	20
	Export	31	19	23	27	39	40	38	35
Malta	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
The Netherlands	Import	1,641	2,266	2,508	1,312	478	873	826	1,067
	Export	37	58	59	21	33	28	50	20
Poland	Import	41	122	89	133	158	410	537	945
	Export	1,321	1,222	1,416	1,308	1,436	1,299	1,629	1,741
Portugal	Import	-	-	-	-	-	-	-	-
	Export	0	0	0	1	8	20	1	0
Romania	Import	66	34	109	18	64	30	72	50
	Export	551	390	762	667	841	517	887	908
Sweden	Import	758	512	427	-	8	43	-	60
	Export	438	556	432	226	216	197	187	143
Slovakia	Import	-	-	-	19	1	-	5	87
	Export	299	116	185	177	185	156	176	152
Slovenia	Import	36	8	15	8	-	11	-	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
	Export	9	5	3	3	5	-	3	-
Spain	Import	-	-	131	182	635	442	167	2,308
	Export	1	3	61	136	175	186	115	52
United Kingdom	Import	138	116	78	-	-	-	20	4
	Export	861	660	640	765	533	503	487	289

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Table 24: Sugar beet: import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	39	28	19	19	27	63	77	88
	Export	39	42	32	12	3	189	146	52
Belgium	Import	132	1	42	20	116	224	102	100
	Export	187	48	90	53	197	315	288	58
Bulgaria	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	0	-	-	-
Croatia	Import	-	-	-	-	-	-	-	-
	Export	83	74	59	51	85	69	106	20
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Czech Republic	Import	-	3	-	5	-	-	0	0
	Export	117	108	76	146	150	113	182	70
Denmark	Import	18	11	5	2	0	32	97	30
	Export	18	11	5	2	0	32	97	30
Estonia	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Finland	Import	-	-	-	-	-	-	-	-
	Export	17	21	19	21	19	13	11	1
France	Import	5,160	4,681	4,435	4,003	5,138	6,205	4,383	4,528
	Export	715	750	811	969	1,007	927	904	1,024
Greece	Import	-	-	-	2	-	-	16	7
	Export	2	1	3	2	1	0	-	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Hungary	Import	-	1	-	0	-	-	-	-
	Export	40	41	41	20	24	32	35	21
Ireland	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	3
Italy	Import	4,059	4,633	4,046	3,688	4,517	5,755	7,135	5,191
	Export	162	183	141	154	156	142	142	114
Latvia	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Lithuania	Import	-	-	-	-	-	-	-	-
	Export	33	40	41	35	36	44	46	29
Luxembourg	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Malta	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
The Netherlands	Import	11	0	-	-	-	-	2	-
	Export	189	238	287	245	287	346	389	302
Poland	Import	-	-	-	-	5	1	-	-
	Export	260	278	217	233	316	312	340	342
Portugal	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Romania	Import	-	-	-	-	-	-	-	-
	Export	52	65	56	51	51	64	41	48
Sweden	Import	-	-	-	-	1	-	-	-
	Export	44	49	55	39	61	80	82	74
Slovakia	Import	-	1	-	1	-	-	-	-
	Export	33	32	34	41	39	60	99	19
Slovenia	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Spain	Import	-	-	-	-	-	-	-	-
	Export	110	96	105	111	108	114	178	110
United Kingdom	Import	19	-	10	-	-	-	-	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
	Export	54	57	74	63	166	138	108	88

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Table 25: Wheat: import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	4,823	2,370	2,412	3,683	2,997	6,386	5,604	7,587
	Export	1,257	1,109	1,130	1,290	866	936	684	490
Belgium	Import	453	22	32	90	128	113	810	147
	Export	2,232	2,167	8,304	8,319	10,646	8,925	2,738	5,332
Bulgaria	Import	-	-	-	91	-	-	-	-
	Export	29	10	268	156	64	49	76	47
Croatia	Import	-	-	-	-	-	-	-	-
	Export	5	7	36	2	-	1	-	1
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	-	0	0	0	0	0	20	-
Czech Republic	Import	3,858	12,305	11,387	1,066	773	2,642	3,412	459
	Export	681	763	361	388	394	337	674	429
Denmark	Import	3,192	1,612	6,673	4,050	1,793	765	2,228	251
	Export	1,638	3,975	7,983	4,366	2,130	1,730	1,074	992
Estonia	Import	-	173	653	790	482	-	-	-
	Export	5	8	134	4	26	20	15	4
Finland	Import	-	-	-	-	-	-	24	-
	Export	7	10	-	8	2	4	5	3
France	Import	6,126	5,178	9,270	2,924	4,174	2,464	2,967	3,704
	Export	753	1,033	1,829	1,178	953	651	531	176
Greece	Import	-	-	-	1	-	-	-	-
	Export	0	1	23	8	12	8	6	2
Hungary	Import	495	678	262	36	9	135	-	115
	Export	1,139	383	243	293	237	269	522	253
Ireland	Import	442	-	-	-	-	-	215	-
	Export	2	223	9	33	13	3	2	9
Italy	Import	726	1,458	651	1,843	1,897	618	125	165

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
	Export	2,895	613	5,395	471	117	120	385	222
Latvia	Import	243	396	300	100	-	-	-	-
	Export	161	193	312	92	58	247	55	130
Lithuania	Import	127	377	159	3,324	-	814	0	22
	Export	523	872	310	214	139	200	136	39
Luxembourg	Import	30	439	1,262	562	903	348	1,653	554
	Export	416	315	389	598	246	491	551	312
Malta	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
The Netherlands	Import	1,700	16,970	4,503	465	681	1,758	1,712	105
	Export	31,258	32,190	46,692	20,056	31,987	36,491	49,331	28,153
Poland	Import	3,169	4,342	10,110	5,343	3,617	4,530	7,291	471
	Export	5,664	1,931	2,035	1,807	3,024	2,259	1,882	1,379
Portugal	Import	-	-	-	-	-	-	-	-
	Export	0	1	3	2	6	3	20	9
Romania	Import	-	370	-	-	3,900	792	-	-
	Export	385	114	417	197	306	566	210	165
Sweden	Import	122	7	8	25	200	3,580	808	1,619
	Export	805	497	55	18	58	260	92	84
Slovakia	Import	179	2,237	656	48	-	-	500	20
	Export	408	437	164	347	98	168	146	150
Slovenia	Import	-	-	-	-	-	-	-	-
	Export	29	35	15	16	15	11	8	13
Spain	Import	6	0	1	1	1	-	-	-
	Export	2	18	1	27	0	1	1	0
United Kingdom	Import	1,123	2	138	25	49	27	2,938	95
	Export	812	785	91	235	220	62	57	129

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Table 26: Barley : import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	6,506	1,629	1,257	1,013	1,284	1,232	1,903	1,121
	Export	336	1,108	1,036	738	506	236	291	195
Belgium	Import	94	4	3	395	36	24	76	1,041
	Export	153	83	79	253	682	416	538	444
Bulgaria	Import	-	-	-	-	3	72	24	-
	Export	4	8	0	3	0	1	2	8
Croatia	Import	1	-	-	-	-	-	-	-
	Export	8	0	20	4	3	3	4	11
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Czech Republic	Import	1,028	164	134	4	151	27	762	467
	Export	401	239	813	1,138	524	1,055	855	915
Denmark	Import	7,706	1,244	39	333	1,269	645	3,273	976
	Export	442	436	264	917	1,047	640	495	833
Estonia	Import	-	-	-	-	-	55	-	-
	Export	5	8	22	11	33	21	21	3
Finland	Import	-	-	13	24	68	-	-	-
	Export	30	26	23	7	14	1	5	30
France	Import	1,688	591	198	1,511	555	1,305	9,110	1,138
	Export	256	544	388	664	621	937	960	872
Greece	Import	-	-	-	-	-	-	-	-
	Export	59	81	203	250	4	2	2	3
Hungary	Import	17	-	-	-	41	-	82	4
	Export	571	348	180	210	131	135	384	59
Ireland	Import	1,725	-	-	-	-	-	26	-
	Export	181	1,092	90	1	3	34	2	3
Italy	Import	0	0	1	1	1	1	2	0
	Export	48	95	146	99	105	193	629	418
Latvia	Import	-	-	-	-	-	-	-	-
	Export	17	9	18	14	19	17	12	23
Lithuania	Import	-	-	-	-	-	-	-	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
	Export	85	13	42	130	46	26	31	45
Luxembourg	Import	1,749	2,056	1,453	728	2,340	1,000	2,169	1,803
	Export	189	160	118	120	107	133	333	218
Malta	Import	-	-	-	-	-	-	-	-
	Export	0	0	0	0	0	0	1	1
The Netherlands	Import	554	108	4	7	12	32	45	8
	Export	1,282	733	1,309	775	971	814	1,161	1,151
Poland	Import	1,136	961	154	3,695	1,266	1,502	3,415	1,020
	Export	888	471	1,418	1,578	1,341	1,252	1,436	1,492
Portugal	Import	-	-	-	-	-	-	-	-
	Export	10	14	3	5	3	5	5	6
Romania	Import	3	-	-	-	-	-	24	-
	Export	126	157	377	155	100	154	77	159
Sweden	Import	-	-	-	-	-	948	327	-
	Export	134	63	29	87	22	155	43	382
Slovakia	Import	-	-	-	-	147	-	-	-
	Export	77	48	283	374	41	48	20	360
Slovenia	Import	-	-	-	-	-	-	-	-
	Export	8	19	5	0	8	2	3	3
Spain	Import	-	1	4	1	1	1	1	49
	Export	6	57	16	20	47	42	39	17
United Kingdom	Import	1,034	227	66	38	60	16	123	1
	Export	29	7,894	5,484	184	573	167	175	995

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Table 27: Rye: import and export (in tons) by country from 2012 – 2019

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Austria	Import	2,552	1,415	1,507	2,533	2,393	1,833	2,928	2,521
	Export	425	350	474	386	386	369	604	258
Belgium	Import	-	-	-	-	-	-	3	4
	Export	693	965	701	540	877	539	443	684

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
Bulgaria	Import	-	-	-	-	-	-	-	-
	Export	6	-	-	-	2	-	-	-
Croatia	Import	-	-	-	-	-	-	-	-
	Export	18	22	5	17	25	83	72	0
Cyprus	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-
Czech Republic	Import	269	169	618	564	210	382	146	465
	Export	310	415	138	242	125	113	357	290
Denmark	Import	4,233	103	43	116	635	850	1,333	2,121
	Export	545	541	1,124	822	140	422	1,464	210
Estonia	Import	-	-	-	-	97	-	-	-
	Export	-	19	24	44	63	16	333	190
Finland	Import	-	-	-	-	-	-	-	-
	Export	51	-	91	156	328	214	537	123
France	Import	7,774	13,157	13,937	13,612	5,070	8,270	5,935	8,827
	Export	422	324	537	476	689	733	686	1,167
Greece	Import	-	-	-	-	-	-	-	-
	Export	5	-	-	-	4	-	-	-
Hungary	Import	818	843	776	839	957	760	909	1,983
	Export	349	289	274	242	192	233	389	235
Ireland	Import	-	-	-	-	-	-	-	-
	Export	-	-	1	2	5	-	1	116
Italy	Import	-	-	1,682	2,707	1,777	1,246	985	74
	Export	250	230	406	409	150	523	613	285
Latvia	Import	3,703	-	-	-	-	-	-	-
	Export	306	121	284	368	307	455	617	538
Lithuania	Import	1,885	-	147	-	259	110	160	73
	Export	202	9	32	44	18	81	231	68
Luxembourg	Import	990	7	713	2,074	809	339	196	149
	Export	49	13	55	22	37	17	70	81
Malta	Import	-	-	-	-	-	-	-	-
	Export	-	-	-	-	-	-	-	-

Country	Import/Export	2012	2013	2014	2015	2016	2017	2018	2019
The Netherlands	Import	72	4	2	12	-	-	4	-
	Export	1,870	3,250	4,674	6,523	11,802	4,079	1,876	1,107
Poland	Import	12,268	12,230	8,925	3,171	3,988	8,079	12,843	9,224
	Export	2,929	2,952	1,990	1,731	3,267	1,473	2,081	1,721
Portugal	Import	-	-	-	-	-	-	-	-
	Export	0	-	-	-	-	1	3	-
Romania	Import	-	-	142	-	-	-	-	-
	Export	655	20	1	9	19	23	35	-
Sweden	Import	-	-	-	-	-	74	-	-
	Export	13	109	52	-	257	284	513	192
Slovakia	Import	228	23	253	197	25	323	549	227
	Export	241	99	83	99	82	115	168	164
Slovenia	Import	-	-	-	-	-	-	-	-
	Export	51	39	31	30	35	49	29	21
Spain	Import	316	-	-	-	-	-	-	96
	Export	89	807	492	574	225	244	291	319
United Kingdom	Import	22	-	-	-	-	-	-	-
	Export	276	369	959	1,505	1,384	1,137	1,139	1,005

Source: Own illustration based on Statistisches Bundesamt (2020a): Aus- und Einfuhr (Außenhandel): Deutschland, Jahre, Land, Warenverzeichnis

Further information on plant protection products used for seed treatment

Designation	Field(s) of application	Admission period
Arena C (Fungicide)	Rye: Urocystis occulta, Snow mold Triticale: Urocystis occulta, Snow mold Wheat: Bunt, Loose wheat smut, Snow mold, Fusarium culmorum, Septoria nodorum	01.08.2006 - 31.10.2020
Cedomon (Fungicide)	Spelt: Bunt Barley: Net blotch, Stripe disease, Fusarium species	29.10.2007 - 30.04.2021
CELEST (Fungicide)	Rye: Urocystis occulta, Snow mold Triticale: Snow mold Wheat: Bunt, Snow mold, Fusarium culmorum, Septoria nodorum	01.08.2006 - 31.10.2021

Designation	Field(s) of application	Admission period
CELEST EXTRA (Fungicide)	Rye: Snow mold, Urocystis occulta Triticale: Snow mold Wheat: Snow mold, Fusarium culmorum	08.01.2010 - 31.12.2020
Cerall (Fungicide)	Rye: Fusarium species Triticale: Fusarium species Wheat: Bunt, Septoria nodorum, Fusarium species	30.10.2007 - 30.04.2021
DIFEND EXTRA (Fungicide)	Barley: Fusarium species Oats: Fusarium species Rye: Fusarium species Triticale: Fusarium species, Bunt, Smut Wheat: Smut, Fusarium species, Bunt	21.07.2017 - 31.10.2021
DMM	Oilseed rape: Downy mildew	13.04.2007 – 31.07.2021
EfA (Fungicide)	Barley: Stripe disease, Loose wheat smut, Snow mold, Covered smut, Net blotch Rye: Snow mold, Urocystis occulta, Fusarium culmorum Triticale: Fusarium culmorun Wheat: Snow mold, Bunt, Fusarium culmorum, Loose wheat smut, Septoria nodorum	13.10.2011 - 31.12.2021
EfA Spezial (Fungicide)	Rye: Snow mold, Urocystis occulta Triticale: Snow mold Wheat: Bunt, Snow mold, Loose wheat smut, Fusarium culmorum	30.03.2010 - 31.12.2020
Emesto Silver (Fungicide)	Silver scurf, Rhizoctonia solani	24.01.2018 - 31.07.2021
Force 20 CS (Insekticide)	Pygmy beetle, Wireworm	29.03.2017 - 31.12.2027
Integral Pro (Fungicide)	Phoma, Flea beetle	23.10.2018 - 16.09.2027
Kinto Duo (Fungicide)	Barley: Fusarium species, Snow mold, Stripe disease, Loose wheat smut, Covered smut Rye: Snow mold, Fusarium species Triticale: Snow mold, Fusarium species Wheat: Fusarium species, Loose wheat smut, Bunt, Snow mold	21.01.2019 - 30.04.2022
LANDOR CT (Fungicide)	Barley: Fusarium species, Snow mold, Stripe disease, Loose wheat smut, Covered smut Rye: Snow mold, Fusarium species Triticale: Snow mold, Fusarium species Wheat: Fusarium species, Loose wheat smut, Bunt, Snow mold	17.04.2007 - 31.08.2021
Latitude (Fungicide)	Triticale: Blackleg Wheat: Blackleg	03.06.2005 -31.10.2020
Latitude XL (Fungicide)	Blackleg	28.06.2018 - 01.10.2021

Designation	Field(s) of application	Admission period
LONGITUDE (Fungicide)	Blackleg	30.05.2017 - 31.10.2020
Maxim 480 FS (Fungicide)	Phoma species, Botrytis species, Fusarium oxysporum, Rhizoctonia solani, Urocystis occulta, Alternaria species	06.12.2017 - 31.10.2021
Maxim Quattro (Fungicide)	Fusarium infestation, Phytium, Rhizoctonia	18.05.2020-31.05.2021
MAXIM XL (Fungicide)	Maize: Fusarium species, Pythium species Rocket species: Downy mildew species	26.09.2016 - 31.10.2020
Monceren Pro (Fungicide)	Silver scurf	12.11.2012 - 31.12.2022
Orius Universal (Fungicide)	Barley: Loose wheat smut, Snow mold, Stripe disease Oats: Loose wheat smut Rye: Fusarium culmorum, Snow mold, Urocystis occulta Triticale: Fusarium culmorum, Snow mold Wheat: Loose wheat smut, Fusarium culmorum, Snow mold, Septoria nodorum, Bunt	28.08.2012 - 31.12.2022
Prepper (Fungicide)	Fusarium species, Bunt	30.10.2019 - 31.10.2021
Redigo M (Fungicide)	Fusarium species, Phytium species	17.05.2019 - 31.07.2020
Rubin Plus (Fungicide)	Barley: Loose wheat smut, Stripe disease, Snow rot Rye: Fusarium, Loose wheat smut, Urocystis occulta Triticale: Fusarium, Loose wheat smut Wheat: Fusarium, Bunt, Loose wheat smut Snow mold in all crops	24.04.2019 - 31.10.2020
Rubin TT (Fungicide)	Barley: Loose wheat smut, Stripe disease Oats: Loose wheat smut Rye: Snow mold, Urocystis occulta, Fusarium culmorum Triticale: Snow mold, Fusarium culmorum Wheat: Loose wheat smut, Fusarium culmorum, Bunt, Snow mold	29.10.2007 - 30.04.2021
Seedron (Fungicide)	Barley: Fusarium culmorum, Snow mold Oats: Loose wheat smut Rye: Snow mold, Urocystis occulta Triticale: Fusarium culmorum, Snow mold Wheat: Loose wheat smut, Fusarium species, Snow mold, Septoria nodorum, Bunt	09.02.2018 - 31.08.2021
SYD41400F (Fungicide)	Wheat: Loose wheat smut, Rhizoctonia solani, Septoria nodorum, Bunt, Urocystis occulta Rye: Urocystis occulta Triticale: Snow mold	16.05.2019 - 31.10.2020

Designation	Field(s) of application	Admission period
	Barley: Loose wheat smut, Covered smut, Stripe disease Oats: Loose wheat smut	
SYD41110F (Fungicide)	Wheat: Leafe and glume blotch, Fusarium culmorum, Snow mold, Bunt, Smut Rye: Snow mold, Urocystis occulta Triticale: Snow mold	08.01.2010 - 31.12.2020
Toledo (Fungicide)	Wheat: Bunt, Septoria nodorum, Fusarium culmorum, Snow mold, Urocystis occulta Triticale: Snow mold, Fusarium culmorum Rye: Snow mold, Urocystis occulta	02.08.2010 - 31.12.2020
Vibrance 500 FS (Fungicide)	Rhizoctonia solani, Head smut	14.05.2019 - 31.01.2025
Vibrance SB (Fungicide)	Sugar beet: Rhizoctonia solani, Phoma betae, Pythium ultimum Fodder beet: Rhizoctonia solani, Phoma betae, Pythium ultimum	18.12.2018 - 30.06.2020
Vibrance Trio (Fungicide)	Barley: Snow mold, Loose wheat smut, Covered smut, Stripe disease, Typhula incarnata Oats: Loose wheat smut Rye:Snow mold, Urocystis occulta Triticale:Snow mold Wheat: Snow mold, Septoria nodorum, Fusarium culmorum, Fusarium graminearum, Bunt, Loose wheat smut, Rhizoctonia solani, Rhizoctonia cerealis	03.04.2019 - 31.08.2020
Vibrance XL (Fungicide)	Fusarium species, Pythium species, Rhizoctonia solani	22.07.2019 - 31.10.2020
VOTiVO (Nematicide)	Sugar beet: Stem nematode, Root-knot nematode; Cyst-forming root nematodes Fodder beet: Stem nematode, Root-knot nematode, Cyst-forming root nematodes Maize: Migratory root nematodes, Stem nematode, Cyst-forming root nematodes	20.04.2020 - 30.09.2024
Tachigaren 70 WP (Fungicide)	Aphanomyces species, Pythium species	16.10.2017 - 31.05.2022
ZARDEX G (Fungicide)	Barley: Loose wheat smut, Stripe disease Oats: Loose wheat smut	05.09.2011 - 31.12.2021

Source: Own illustration based on BVL (2020a): Verzeichnis zugelassener Pflanzenschutzmittel, Status Juli 2020

List of Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung (Seed treatment facilities with quality assurance systems for dust mitigation) by the JKI

Treatment facility	Place	Crop
Agrarproduktion Zorgeland GmbH	99765 Heringen	Cereals
AGRAVIS Raiffeisen AG	30916 Isernhagen	Cereals, Maize
Agri V-Service GmbH	47665 Sonsbeck	Cereals, Maize
ATR-Landhandel GmbH & Co. KG	25795 Weddingstedt	Cereals
AZW Agrarzentrum Warsleben	39393 Warsleben	Cereals
BayWa Ag Hainichen	09661 Hainichen	Cereals, Maize, Oilseed rape
BayWa AG Obertraubling	93083 Obertraubling	Cereals
BayWa AG Schwabmünchen	86830 Schwabmünchen	Cereals
Beiselen GmbH	01594 Mehlteuer	Cereals
Breun Seed GmbH & Co KG	06484 Quedlinburg	Cereals
Busch Saatgetreide KG	97234 Reichenberg	Cereals
Deutsche Saatveredelung AG	59557 Lippstadt	Oilseed rape
EOPC - Bayer AG Crop Science Division	40789 Monheim	Oilseed rape
HaGe Nordland BT Neubrandenburg	17034 Neubrandenburg	Cereals
Hauptgenossenschaft Nord AG	23738 Lensahn	Maize
Hauptgenossenschaft Nord AG	17166 Teterow	Cereals
Hauptsaat GmbH	31636 Linsburg	Cereals
Hybro Saatzucht Gmbh & Co KG	17291 Schenkenberg	Cereals
KWS LOCHOW GmbH	29303 Bergen	Oilseed rape
KWS Lochow GmbH	31249 Hohenhameln-Bierbergen	Cereals
KWS Saat SE	37555 Einbeck	Maize, Sugar beets
L. Stroetmann GmbH & Co. KG	06268 Querfurt	Cereals
LDL GmbH Saatgutaufbereitung Anderberg	38889 Blankenburg	Cereals, Vegetables
Meiners Saaten GmbH	27243 Dünsen	Maize, Oilseed rape
Norddeutsche Pflanzenzucht Hans-Georg Lembke KG	24363 Holtsee	Oilseed rape
Norddeutsche Pflanzenzucht Hans-Georg Lembke KG	23999 Malchow	Oilseed rape
Nordsaat Saatzucht GmbH	38895 Langenstein	Cereals, Vegetables

Treatment facility	Place	Crop
Ostthüringer Saaten GmbH	07551 Gera	Cereals
P.H. Petersen Saatzucht Lundsgaard GmbH	24977 Grundhof	Cereals, Maize, Oilseed rape
Raiffeisen Waren GmbH	99991 Großengottern	Cereals
Raiffeisen Warengenossenschaft Osthannover eG	31319 Sehnde	Cereals
Raiffeisen Waren-Zentrale Rhein-Main eG	53340 Meckenheim	Cereals, Maize
Silotech GmbH	09236 Claußnitz	Cereals
Silotech GmbH	09244 Lichtenau	Cereals
Südgetreide GmbH & Co. KG	79367 Weisweil	Maize
SUET Saat- und Erntetechnik GmbH	37269 Eschwege	Oilseed rape, Sugar beets, Vegetables
Syngenta Seeds GmbH	32107 Bad Salzuflen	Cereals
van Waveren Saaten GmbH	37124 Rasdorf	Vegetables
Vereinigte Saatzuchten eG	29590 Rätzlingen	Cereals
ZG Raiffeisen	79423 Heitersheim	Oilseed rape
Deutsche Saatveredelung AG	01665 Käbschütztal	Cereals

Source: JKI (2020b): Saatgutbehandlungseinrichtungen mit Qualitätssicherungssystemen zur Staubminderung

Materials of the market study

Online survey materials

Questionnaire agricultural enterprises

Fragebogen landwirtschaftliche Betriebe

Questionnaire plant protection services

Fragebogen Pflanzenschutzdienste

Expert interview materials

Guideline expert interviews

Leitfaden Experteninterviews

Cover letter UBA

Begleitschreiben UBA