

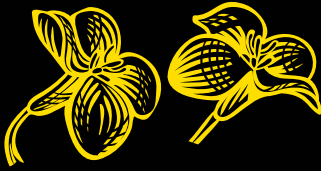
CREATE RELIABLE YIELDS

WITH VARIETIES AND
ADVICE BY RAPOOL



Der Raps

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125 YEARS

OF NORDDEUTSCHE PFLANZENZUCHT

One of the RAPOOL-RING Shareholders is celebrating its 125 anniversary this year. One hundred and twenty-five years full of successful variety breeding, 125 years of progress for agriculture, and 125 years of plant breeding.

THE RAPOOL RING SHAREHOLDER, Norddeutsche Pflanzenzucht Hans-Georg Lembke KG (NPZ), is a private, medium-sized plant breeding company with its headquarters in Hohenlieth near Eckernförde (Schleswig-Holstein). NPZ's second location is on the island of Poel in Malchow (Mecklenburg West Pomerania). This is where the family business originated: Hans Lembke took over his parents' agricultural business in 1897, in the 10th generation, and began the first breeding work in winter oilseed rape 125 years ago. Over 270 employees are working for NPZ and breed winter and spring rapeseed, field beans, peas and forage plants. More than 80 varieties are grown on a significant scale in over 40 countries around the world. Today, Dietmar Brauer is the managing partner. At the same time, he is also one of the managing directors of the RAPOOL-RING.

Over 270 employees are working for NPZ and breed winter and spring rapeseed, field beans, peas and forage plants.



Hans Lembke is monitoring the rapeseed plants in the fields

125 YEARS OF WINTER OILSEED RAPE BREEDING – OLD VIRTUES – NEW VISIONS AND DIGITAL TOOLS

In 1897, the young farmer Hans Lembke had started to select “beautiful rapeseed plants with long pods” in the “Poeler Landsorte” and thus laid the foundation for rapeseed breeding. Hans Lembke used the severe winter of 1908/09 and the strongly varying yields the following years to avoid a zig-zag selection and to improve stability, ripeness, oil content and the branched variety type. In September 1917, the variety which developed in this way was registered in the high breeding register of the Deutsche Landwirtschafts-Gesellschaft under the name „Original Lembkes Winterraps“.

In the 1960s and 1970s, new quality and breeding analysis methods made it possible to reduce the content of erucic acid and the glucosinolate. Both revolutionized the

feeding of animals with rapeseed meal and human nutrition with rapeseed cooking oil from the end of the 1980s.

With the first MSL (Male Sterility Lembke) hybrid varieties from 1996 onwards, the next chapter of success began. On the one hand with a new type of plant for practical use, and on the other hand with increasingly diversified breeding work at three further locations with independent teams of breeders.

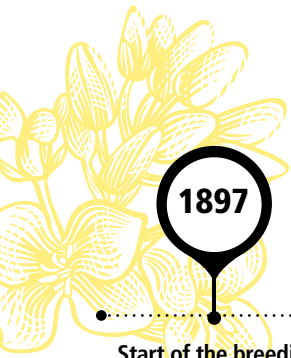
During this, breeding research has been systematically built up within the company since the year 2000. Today, the company has its own laboratories, marker technologies, greenhouse resistance tests, digital data acquisition, sensor technologies and the latest bioinformatics evaluations for research, breeding, seed optimization and quality control form the basis for professional variety development.

Since 2015, the new challenges of climate change signed off, accompanied by cuts in fertilization and crop protection, as well as energy Greenhouse gas savings and the preservation of biodiversity. The classical breeding of NPZ is undergoing an "internal" transformation process to a large amount of data (big data) and a renewed breeding and testing structure to increase the accelerate breeding success. Additional breeding goals such as pest resistance, water

and nutrient efficiency are being pushed, as well as improvements in protein and other ingredients, to find new uses in aquaculture, insect farms and in human nutrition. With new breeding methods these processes could be pushed even faster.

Today, a new cycle of varieties for RAPOOL is underway. This marks a breeding course: yield, stem health, N-efficiency, adaptability to different locations and growing conditions.

TIMELINE



1897

Start of the breeding process by Hans Lembke.

1911

Registration of the first varieties in the DLG High Breeding Register for the "Hans Lembke Malchow/Poel Seed Industry.

1945

Expropriation of the company, since located in Eastern Germany.

1946

Foundation of the company Norddeutsche Pflanzenzucht by Hans-Georg Lembke.

1965

Dietrich Brauer takes over the management of the company.

1974

Foundation of the breeders association RAPOOL-RING.

1992

Reacquisition of the founding site and breeding program after reunification.

1995

World's first MSL winter and spring oilseed rape hybrid.

1998

Dietmar Brauer becomes managing partner.

2001

World's first clubroot – resistant hybrid (MENDEL).

2013

Foundation of NPZ Innovation GmbH as part of the NPZ Group.

2017

Launching of a new phoma resistance – RlmS (KICKER).

2018

First TuYV resistant hybrids (RAGNAR).

2021

Registration of new healthy and efficient hybrids (PiCARD, VESPA).



Dr. Carstel
Oertel

RAPOOL IS LOOKING TO THE FUTURE OF RAPESEED BREEDING TO MEET FARMER NEEDS

With so many changes in the agriculture industry, advanced genetics will be key to better sustainability and higher yields.

THIS PAST YEAR, rapeseed production in EU climbed to a projected 17 million tonnes, exceeding initial expectations for the oil crop, according to Reuters. As the biggest oilseed crop in the EU, serving the food, the biodiesel fuel and livestock feed markets, the need for high-yielding and high-quality oilseed rape varieties is growing.

While the need for high oil crops is present, so are the challenges. Growers are enduring more droughts and high heat conditions, reduced access to pesticides and more pressure to decrease synthetic

fertilizer. All in all, it's going to take strong genetics to address these challenge and demand needs.

"With oilseed rape you can use all or nearly all breeding and genomic technologies invented," says Dr. Carsten Oertel, Oilseed rape breeder at RAPOOL. "And on the worldwide scale, there are more than 1,000 groups doing research on oilseed rape."

BREEDING FOR THE FUTURE

Because it takes 10 to 12 years to bring new varieties to market, the seeds farmers plant today are available because of the foresight of breeders more than one decade ago. In the same sense, breeders today are looking at pest, weather and consumer trends to predict genetic requirements one decade from now.



Dr. Christian Flachenecker



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One of the most important things we're working on is insect resistance.

All genetic tweaks boil down to one key: Will it yield?

“As we know the world population is growing,” says Dr. Christian Flachenecker, Oilseed rape breeder for RAPOOL. “And now we're also facing a reduction in the global surface of agricultural land due to degradation, soil sealing, etc. So, we need to harvest more from a given surface.”

Diseases, insects and weeds don't care about growing populations and reduced hectares. It's up to breeders to rise to the challenge of finding new varieties that showcase tolerances or resistance to common pests so yields continue to grow.

“One of the most important things we're working on is insect resistance,” says Dr. Alexander Döring, Product management International at RAPOOL. “Disease tolerance is something breeders are working on, too, but I'm excited for the possibility of resistance against the cabbage stem flea beetle or the pollen beetle, for example. Currently we are still in basic research, means that it will take many years until we can expect first varieties in the market”.

Whether it's through traditional breeding techniques, novel genomic techniques of genetic engineering, breeders at RAPOOL-RING are exploring many solutions for oilseed rape.

CHALLENGING CROP GENETICS

There are few breeding programs that dedicate all of their time and energy into oilseed rape alone. However, RAPOOL-RING is one of the few, if not the only. This dedication means RAPOOLS' understanding of this complex crop is second-to-none.

“In rapeseed we have more than 101,000 genes,” Oertel says. “This is more or less four times as much as human beings, we have 20,000 to 30,000. This gives you an idea of how complicated this crop really is.

“You need a team of different experts to do a good job bringing new products to market,” he continues. “From genomics, to knowledge of biology, to plant breeding knowledge, technology and data manage—it all has to work together.”

From the research side, It's also a sizeable effort. Greenhouses, climate chambers and in-field trials are just a few of the steps RAPOOL-RING takes to narrow down their breeding pools to bring only the best new varieties to market.

“Our main selection steps are always in the field,” Flachenecker says. At the end of the day, the varieties need to work in real-world scenarios to prove they provide not only high yields but also return on investment for the farmers.

BREEDING FOR MORE TOLERANT GENETICS WILL HELP ADDRESS PEST PRESSURE



As Farm to Fork regulations take hold, farmers need in-crop solutions.

CHANGES ARE COMING to farmers in Europe—whether they like it or not. With Europe’s Green Deal and Farm to Fork strategy, agricultural practices are under scrutiny and changes to farming practices are imminent.

Here’s a quick look at changes coming down the pike:

- Reduce pesticide use by 50%
- Drop fertilizer use by 20% to achieve 50% less nutrient loss
- Boost organic production to 25% of all agricultural land
- Take 10% of land currently farmed out of production

All of this is coming and putting pressure on yields, despite increasing populations and demand. To put it simply, farmers need new solutions.

WHY FARMERS NEED INNOVATION

Regardless of policy, pests and diseases will reoccur every year in varying levels of severity. For farmers, not having access to effective pesticides could mean crops are destroyed by these persistent pests if other resistances or defenses are not created.

“As breeders our job is to provide additional value to farmers with new

genotypes,” says Artur Kozera, product manager at RAPOOL-RING in Poland. “In times of new restrictions of insecticides and other pesticides and the high cost of nitrogen fertilizers, they need genetics that can help.”

If you look at the advancements breeders have made over the past few decades, it’s easy to see how vast the opportunities are for yield growth. This comes from more accurate selections during trials but also from understanding what it takes to achieve high yields.

“Everyone has different challenges,” says Pavel Jezek, product developer at RAPOOL-RING in Czech Republic. “Drought and pressure of flea beetles (*Phyllotreta* and *Psylliodes*), aphids and cabbage root fly—these are the types of issues pulling down yield already at the beginning.”

Yield is a result of three factors: management, genetics and environment.



**Artur Kozera, Product Manager
Oilseed rape RAPOOL Poland**

You control the management; Mother Nature controls the environment and RAPOOL-RING looks to take what control over genetics breeders can to maximize their potential and to work well with the other factors.

SOLUTIONS FOR INCESSANT PEST PRESSURES

Farmers battling flea beetle only have access to two seed treatment products for control, and neither are totally effective. Also, the options of pest control by spraying are limited. As pest pressures continue, this limited access to control methods will only be squeezed tighter with ongoing regulations.

Imagine a future where a beetle biting into a plant and ingesting a naturally occurring bacteria or protein kills the insect. Or picture an oilseed rape variety that is tolerant to critical diseases and survives when neighboring fields cripple under the disease. Also think about what it would mean for overwintering crops such as oilseed rape to be more winter hardy. These are products and potential futures that can be found through breeding.

"We're offering solutions," Kozera says. "There are new kinds of resistances, for example, against viruses and diseases."

Technologies such as there are available in many countries in a GMO-form, but breeders in Europe are looking for natural defenses against pests so the product won't be labeled 'GMO.' RAPOOL-RING is actively researching and commercializing conventionally bred varieties to address insect, virus, and disease pressure.

Using traditional breeding methods increases the likelihood of product approval and the ease at which farmers can sell the grain at the end of the season. In addition,



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We always look for products that are adaptable and continuously look for new solutions for not only today, but generations in the future.

**Pavel Jezek, Product Developer
RAPOOL Czech Republic**

extensive testing means the products will not only show efficacy against target pests but showcase yield advantages. To gain approval in the EU requires products to show superiority over previously available products. "We always look for products that are adaptable and continuously look for new solutions for not only today, but generations in the future," Jezek says. "The future is using breeding to get us closer to nature."

Look for a not-too-distant future of crops that withstand not only weather challenges through genetics, but key pests, too. In a world of reduced pesticides, it's a critical method to help the food system meet population demands.

MILESTONES

IN THE HISTORY OF

RAPOOL

1974

Founding
RAPOOL

1981

00 Rapeseed
Approval

1986

00 Quality
Standard

1995

World's first MSL
winter and spring
rapeseed hybrid

2001

World's first
clubroot-resistant
hybrid (MENDEL)

2005

World's first HOLLI
quality winter oilseed
rape variety

2008

Introduction of
first OGU hybrid
(HORNET)

2008

Registration of VISBY
with new significant
yield improvements
(110% rel.)

2009

First Clearfield™
rapeseed hybrid



2010

Implementation of the specific Phoma resistance trait (Rlm7) in the RAPOOL portfolio

2011

First high erucic hybrid (ERATON)

2013

First semi-dwarf winter rapeseed hybrid

2015

New hybrids with significant yield improvements

2017

Implementation of the specific Phoma resistance trait (Rlm5) in the RAPOOL portfolio

2018

First TuYV resistant hybrids (RAGNAR, TEMPTATION)

2019

New clubroot resistance in the official trials

2020

First hybrids with four specific resistances, BEATRIX CL, MATRIX CL
Clearfield • TuYV • Rlm7
Pod Shatter Resistance

2022

First RAPOOL hybrids with four specific resistances, CROCUS & CROCANT
Clubroot • TuYV • Rlm7
Pod Shatter Resistance

HOW FARMERS CAN EMPOWER THEIR SEED DECISION

By working alongside agronomist and experts, growers can feel confident in their cropping decisions.

IN THE HEART OF LATVIA, Kaspars Antipins and his father work together across their 3,400 hectares to maximize their return on every meter. About 600 kilometers away in Estonia, Mikk Tutt and his father farm about 500 hectares including winter wheat, spring barley, winter barley, rye, winter oilseed rape and peas.

"It's always risky when we look at new varieties," Tutt says. "We prefer the seeds that we have used for many years because we know what to expect but we know each year we need to look at new options to profit from breeding gain, too."

For each of these farmers, hybrid and variety selection each year takes hard work, research and a careful balance. This underscores the importance of not only the information provided by seed companies about varieties, but getting local results, too.

DETERMINE SEED PRIORITIES BEFORE PURCHASE

Just like every field has different characteristics, so does every crop and variety. Once a rotation is established, take time to document needs for each field by crop.

"Until recently, the crop's potential has been our highest consideration for selecting crop varieties," says Antipins. "Now with the changing world situations and attitudes toward pesticides our priorities are changing. The yield potential needs to go hand-in-hand with disease resistance."

One company, RAPOOL RING, is dedicated to not only breeding excellent varieties in yield potential but is



Kaspars Antipins

also searching for insect and disease pest tolerance within the genetics. This would reduce the overall need for pesticides because the plant would have internal protection.

In addition to disease resistance, insect tolerance is also high in the priority list as insect infestation is another serious threat to profitability—especially if pesticide use is shuttered.

“For us in Estonia, winter hardiness is very important also,” Tutt says. “For example, about five years ago we planted six varieties of rapeseed to spread our risk and the only seed that survived was from RAPOOL-RING and that was in minus 20 degrees with no snow to insulate it.”

Another concern for many farmers is fertilizer use, especially with record nitrogen prices this year. Greater efficiency in key crops such as winter oilseed rape, corn and others will be critical to enhancing per hectare profitability.

FIND LOCALIZED RESULTS AND INFORMATION

What works for Tutt in Estonia might not work in Latvia for Antipins, every field—down to the meter—has different needs. Because of this, it’s important to not only work with seed representatives who know the local area but it’s also valuable to test products on owned fields.

“I’m responsible for every management decision on the farm,” Antipins says. “My field is not the same situation as others. For about six years we’ve tried around 20 varieties every year to see them in reality.”

Test plots or side-by-side tests, as they’re referred to in some countries, help showcase stand-out products that actually perform in local conditions. It takes setting aside some acres but can pay in dividends.

“When we have done the test plots we’re finding that, in oilseed rape, RAPOOL-RING is consistently providing the best value,”

Mikk says. “In addition, their agronomists work with my agronomist to find the best varieties for our area.”

It starts by knowing what to expect from seed varieties and finding smart placements on fields. RAPOOL-RING’s agronomic advisors work hand-in-hand with farmers to help them understand how a variety might—or might not—work on their farm. They help create customized solutions so farmers can see what works best for them.

This advisory relationship helps remove some of the guesswork.

Instead of guessing what varieties might work on their farms, Antipins and Mikk review data provided by seed sales representatives to get a better idea of seed adaptability for their hectares. From there they perform their own tests and ultimately isolate seed varieties that are most suited to not only their soils, but their management preferences as well.

“We combine years of data and thousands of research tests to create a wholistic view of what seed varieties will do in certain conditions,” says Jeanne Geißler, RAPOOL RING. “It’s exciting to partner this knowledge with farmers to help them find solutions that work on their fields.”



Mikk Tutt and his father



CRITERIA FOR RAPESEED VARIETY SELECTION IN CLIMATE CHANGE

Simon Kröger, Product Development RAPOOL

WEATHER EXTREMES POSE major challenges for farmers when it comes to rapeseed variety selection. However, this decision has a significant impact on the success and stand management of oilseed rape cultivation throughout the year. New varieties are developed and specifically selected under the changing conditions. The following article provides background information from breeding and decision-making aids for variety selection in practice.

The choice of variety is linked to many important aspects. Weather, sowing time, resistance and many other factors play a role.

Temperature and precipitation—both parameters directly influence the growth of the rapeseed plants—but also the growth and occurrence of the most important pests and fungi in rapeseed cultivation.

SOWING DATE

If you sow early, you should make sure that you choose a variety that does not tend to stem elongation too quickly, thus shortening bud differentiation. This is because this phase is yield-relevant and should be given sufficient time to develop. Whether “early” means the end of July or the middle of August is something everyone should determine for themselves at their own location.

Very vigorous oilseed rape may be reassuring for



Simon Kröger

the farmer, but there is a risk of excessive N uptake in the autumn, which can result in „starvation“ of the crop over the winter. Furthermore, the leaf axillary buds may not get enough light, resulting in poorer branching in spring.

When sowing late, the focus should be on the safe establishment of the stand before winter. Therefore, a fast and vigorous juvenile development is crucial.

RESISTANCES

In the case of early sowings, it is important to ensure that the plants have very good resistance and tolerance to diseases, because diseases are also usually controlled by temperature. The risk of infestation with example clubroot, phoma, verticillium and cylindrosporium increases the earlier the sowing date is set. Mild autumns and winters additionally favour these diseases, so

that they can spread well in the crop.

Due to climate change and the associated changes in weather conditions, oilseed rape varieties must fulfil certain criteria in order to be competitive. Plant breeding has been working for a long time on climate-adapted varieties that, for example, can survive drought at rape sowing time and very warm temperatures until December and still promise a successful rapeseed harvest. For this purpose, candidate varieties are put through their paces in field trials but also in the laboratory. On a so-called temperature gradient table (method to simulate different temperatures), both germination capacity and root development can be tested under different temperature conditions. In this way, variety candidates are selected that germinate even at high temperatures and show good root development.

DRY AREA

MARITIME CLIMATE

EARLY SOWING	LATE SOWING	EARLY SOWING	LATE SOWING
<ul style="list-style-type: none"> • Variety with good germination at high soil temperatures • Medium stem elongation before winter • Medium - late harvest maturity 	<ul style="list-style-type: none"> • Very vigorous variety • Stem elongation no problem • Early maturity for harvest to be less affected by early summer droughts 	<ul style="list-style-type: none"> • Variety with restrained juvenile development and low stem elongation • High tolerance to phoma and LLS • Early maturity for harvest 	<ul style="list-style-type: none"> • Vigorous variety • Early maturity at harvest • High vigour (especially in spring)

Figure 1: Most important characteristics for variety selection – decision tree according to climatic region and time of sowing

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