



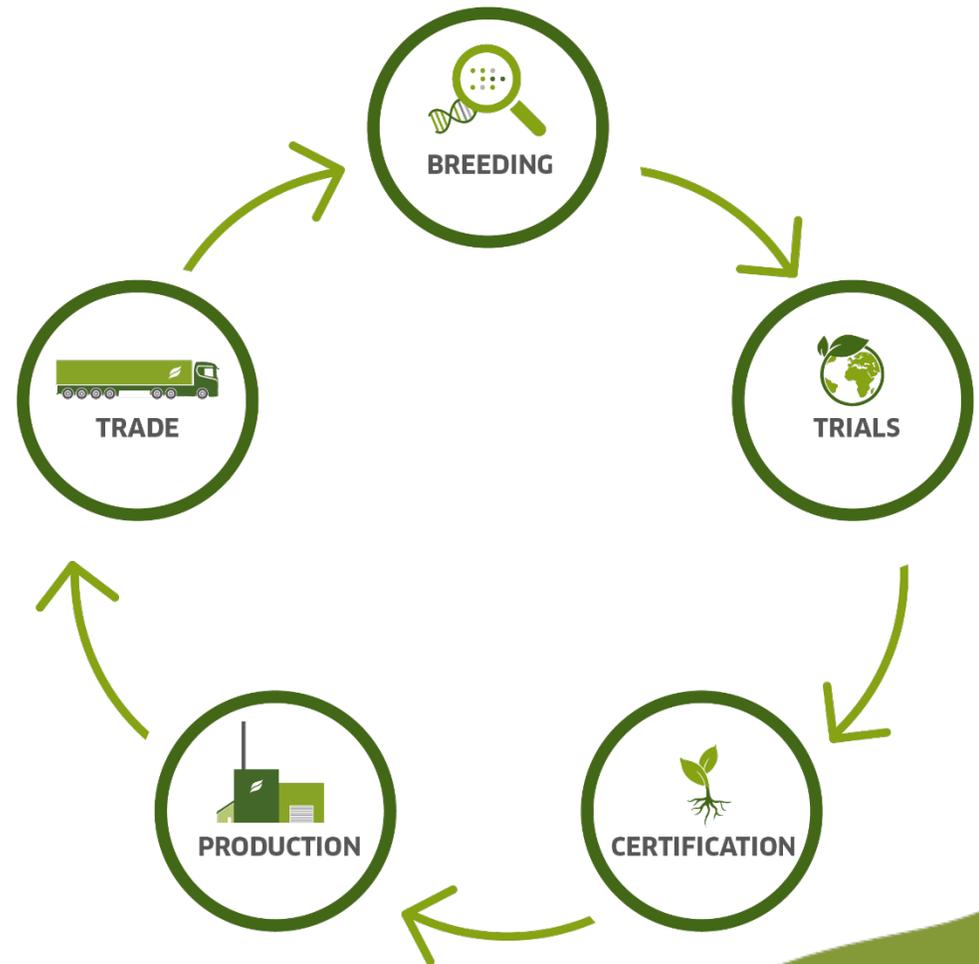
WHAT WILL WE DO, WHEN THE LAST CHEMICAL TREATMENT IS BAND

CEO KIM BONDE PETERSEN



NORDIC SEED MAIN BUSINESS AREA

- Breeding activities
- Variety representation and trials
- Certification of seed / Laboratories
- Production of PBA and Basic seed
- DA, VA, Swedish Agro, Baltic Agro
Hankiiija Ceravis and Agravis
produce more than 220.000 ton of seed



COMMON SEED TREATMENT IN DENMARK

🌿 Celest Formula M

- Winter/Spring wheat
- Winter/Spring barley
- Rye and triticale

🌿 Dose rate: 200 ml/ Dt

🌿 A.i.: Fludioxonil 25 g/l

🌿 Common bunt (*Tilletia tritici* - stinkbrand)

🌿 Fusarium (*Microdochium nivale*, *Fusarium spp* - sneskimmel)

🌿 Redigo

- Winter/Spring wheat
- Winter/Spring barley
- Rye and triticale

🌿 Dose rate: 50 ml/ Dt

🌿 A.i.: Prothioconazol 150 g/l
+ Tebuconazol 20 g/l

🌿 Common bunt (*Tilletia tritici*-Stinkbrand)

🌿 Fusarium (*Microdochium nivale*, *Fusarium spp* - sneskimmel)

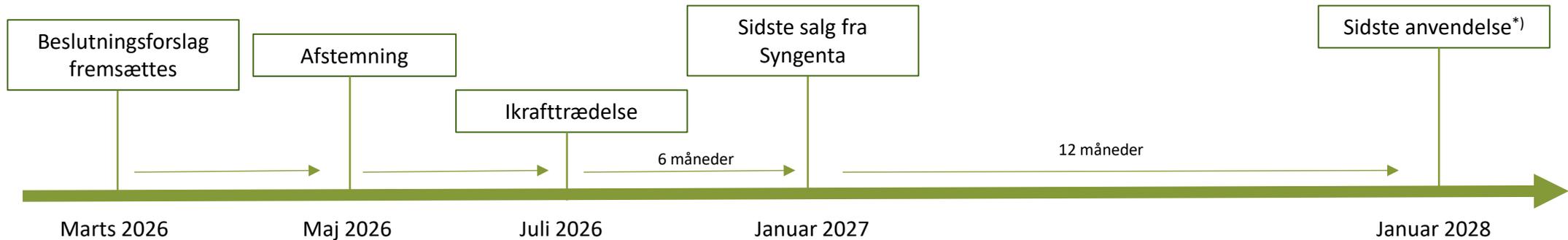
🌿 Loose smut (*Ustilago nuda* - Nøgen bygbrand)



STATUS PÅ CELEST

- Fludioxonil er under revurdering i EU
- Der er endnu ingen beslutning truffet
- Forventet klassificeret som værende hormonforstyrrende (ED = Endocrine Disruption)
- Syngentas forventning er derfor en udfasing af aktiv stoffet, og dermed Celest i EU

Bedste estimat for forventet udfasning ("Basis scenarie")



*) Forventningen er, at det gælder bejdsning og såning

REDIGO PRO TBZ GO OUT AND REDIGO PRO PTZ STAY SOME YEARS

- Redigo forventes at blive genregistreret og fortsætte i en årrække fremover (Redigo Pro med TBZ – forventes at have sidste anvendelse 2027 – måske bedste fald noget af 2028)





HIGHLIGHTING KEY BENEFITS OF PTZ FOR CEREAL SEED TREATMENT – *USTILAGO SPP. (BUNT)*

Nøgen Bygbrand

- Tebuconazole is the best performing ai for the control of bunt diseases, in particular *Ustilago nuda* on barley
- With the expected ban of TBZ, it will be more complex to control *Ustilago spp.*, particularly for barley seed production
- In that context, PTZ at highest possible rate will provide satisfactory control but will need to be combined with other methods (eg agronomical measures for seed production, deeper seed cleaning,...) to reach perfect control, in case of high risk.



PETKUS CM300 HYSEED BIO STEEM



- ✦ 3-5 ton / hour
- ✦ Price ?
- ✦ Energy / 100 kg ?
- ✦ Sampling preparing before treatment ?



E-VITA ELEKTRONTREATMENT



- 10-15 ton / hour
- Price + 3 mill €
- Energy use 3-5 kwh/ 100 kg
- No sampling preparing before treatment

THERMO- SEED STEAM TREATMENT



- ✦ 10-20 ton / hour
- ✦ Price 4-5 mill.€
- ✦ Energy use ?
- ✦ Sampling preparing before treatment 14 days



Ustilago low or no effects in any treatments

Read the table

+ = Effects equivalent to, or better than, conventional seed treatment
 (+) = Positive effects but not always fully equivalent with the best conventional seed treatment
 - = Limited effect
 * = Limited experience

Crop	Pathogen	Disease	Effect TS
Wheat	Tilletia caries	common bunt	+
	Stagonospora nodorum	leaf and glume blotch	+
	Ustilago tritici	loose smut	-
	Fusarium spp.		+
	Fusarium culmorum		+
	Microdochium nivale	snow mold	+
	Claviceps purpurea	ergot	+
	Barley	Drechslera graminea	leaf stripe
Drechslera teres		net blotch	+
Bipolaris sorokiniana			+
Fusarium spp.			+
Ustilago nuda		loose smut	-
Ustilago hordei		covered smut	+*
Rye	Fusarium spp.		(+)
	Microdochium nivale	snow mold	(+)
	Urocystis occulta	stem smut	+*
Triticale	Fusarium spp.		(+)
	Microdochium nivale	snow mold	(+)
	Stagonospora (Septoria)		(+)
Oats	Drechslera avenae	leaf spot	+
	Fusarium spp.		+
	Fusarium graminearum		+
	Ustilago avenae	loose smut	+
Rice	Magnaporthe grisea		+
	Cochliobolus miyabeanus		+
	Gibberella fujikuroi		+
	Aphelenchoides besseyi	white tip nematode	+

TREATMENT WITH COLD PLASMA



- 1-2 ton / day
- Price unknown
- Energy use 3-5 kwh/ 100 kg
- Ustilago ?
- Can be scaled up

What is Cold Plasma?

Cold plasma is a partially ionized gas generated at near-ambient temperatures. When air or specific gases are exposed to high-voltage electrical discharges, they produce a cocktail of **Reactive Oxygen and Nitrogen Species (RONS)** that interact with seed surfaces, effectively neutralizing pathogens without thermal damage to the seed embryo.

Generated Reactive Species (RONS)

NO

NO₂

NO₃

OH[•]

O₃

H₂O₂

ONOO⁻

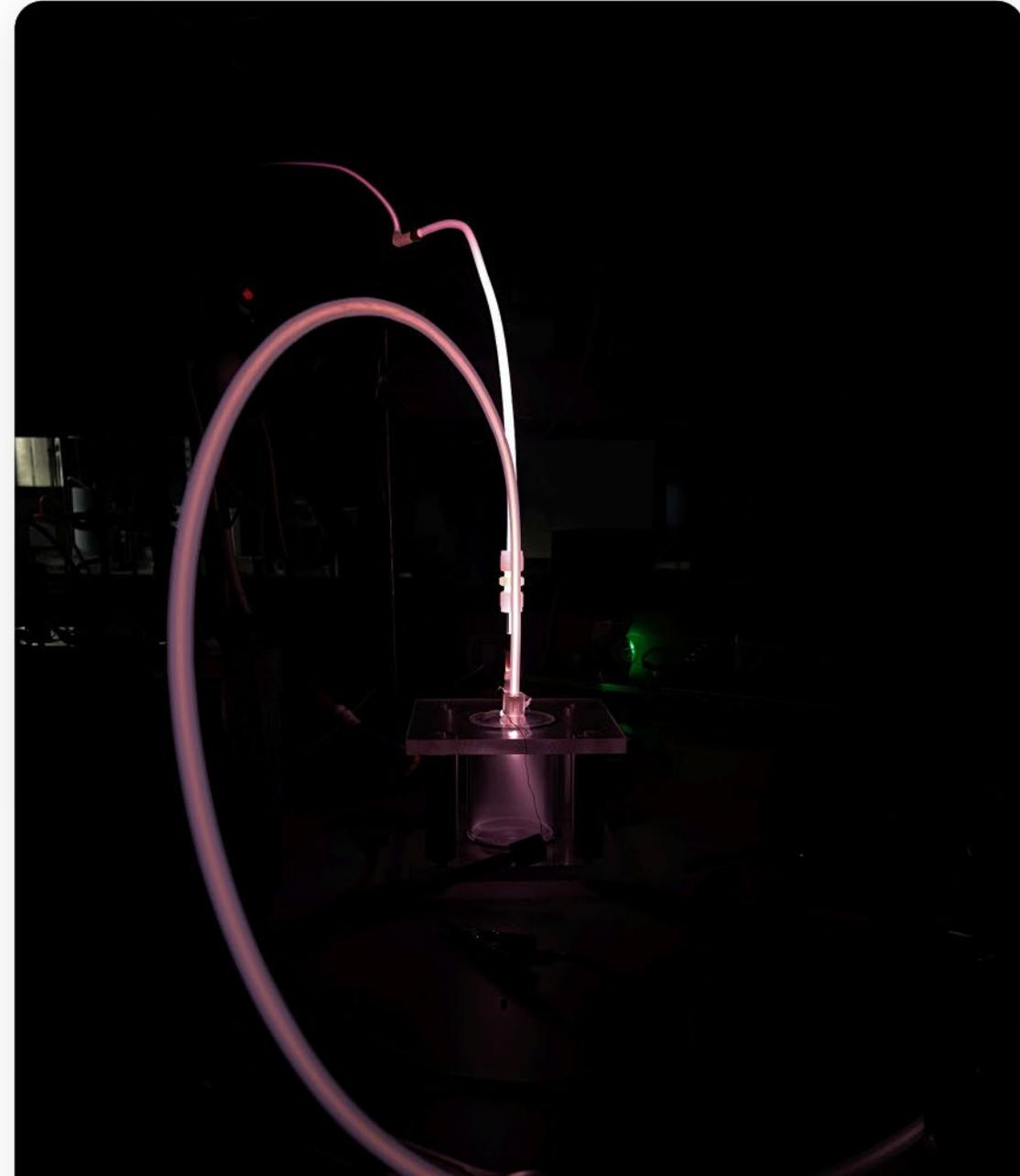
O[•]

¹O₂

These short-lived species induce multi-target oxidative stress on pathogen cell membranes, DNA, and proteins, preventing resistance development.

Approximate Half-Lives of Reactive Species

SPECIES TYPE	MOLECULE	HALF-LIFE (37°C)
Free Radical	O ₂ ^{-•}	10 ⁻⁶ s
Free Radical	OH [•]	10 ⁻⁹ s
Non-Radical	¹ O ₂	10 ⁻⁶ s
Non-Radical	H ₂ O ₂	Chemically stable



Industrial System & Scale-Up Journey

From lab-scale to industrial pilot site capacity



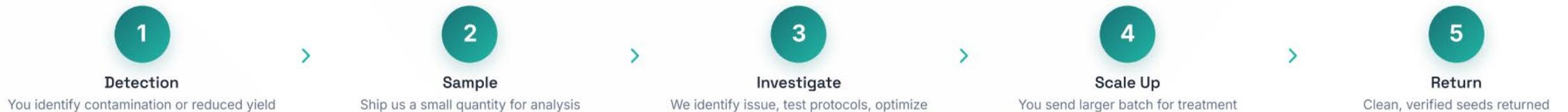
Scale-Up Timeline



Containerized Solution

Fully integrated treatment system in shipping container format. Deployable on-site at seed production facilities.

Service Workflow: 5-Step Process



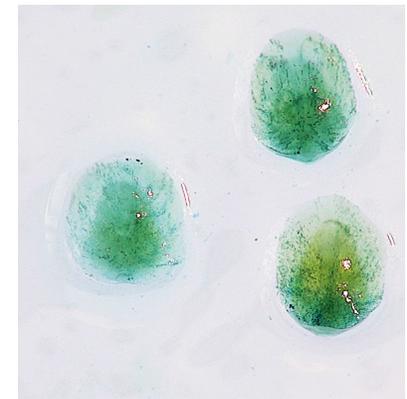
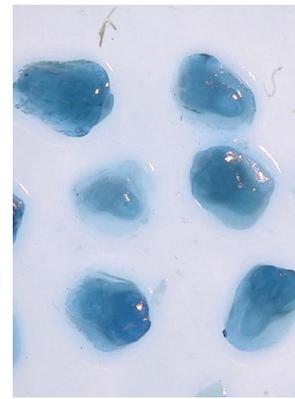
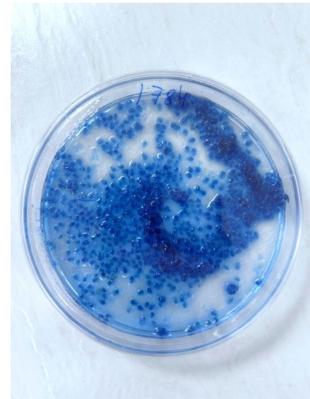
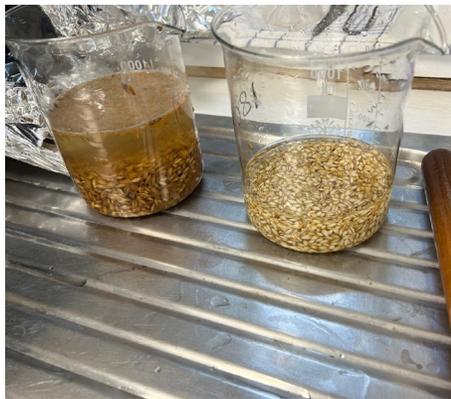
OUR NEW LABORATORY FOR FUNGAL PATHOGEN ANALYSIS



EMBRYO-COUNT METHOD

FOR DETECTION OF *USTILAGO NUDA* IN BARLEY

- We can efficiently isolate embryos from barley kernels for infection testing
- Infected embryos show visible *U. nuda* hyphae in the scutellum (see right-most image)



Art	Dansk	Latin	Nordic Seed
Byg	Bygbladplet	<u>Drechslera teres (Pyrenophora teres)</u>	OSMO
	Bygstribesyge	<u>Drechslera graminea (Pyrenophora graminea)</u>	OSMO
	Bipolaris-Bladplet,	<u>Bipolaris sorokiniana</u>	Doyer
	Fusarium	<u>Fusarium sp.</u>	Doyer
	Nøgen bygbrand	<u>Ustilago nuda</u>	7-013b ISTA
Hvede	Hvedebladplet	<u>Drechslera tritici-repentis (DTR)</u>	Agar
	Bipolaris bladplet	<u>Bipolaris sorokiniana</u>	Agar
	Hvedebrunplet	<u>Stagonospora nodorum (tidl. Septoria nodorum)</u>	Agar
	Fusarium	<u>Fusarium sp.</u>	Agar
	Hvedestinkbrand	<u>Tilletia caries og Tilletia laevis</u>	Washing
	Dværgstinkbrand	<u>Tilletia controversa</u>	Washing
Rug	Fusarium	<u>Fusarium sp.</u>	Agar
	Rugstængelbrand	<u>Urocystis occulta</u>	Washing
Havre	Fusarium	<u>Fusarium sp.</u>	Doyer
	Bipolaris	<u>Bipolaris sorokiniana</u>	Doyer
	Havrebrunplet	<u>Pyrenophora avenae</u>	OSMO
	Nøgen brand	<u>Ustilago avenae</u>	Washing
Ærter	<u>Ærtesyge</u>	<u>Ascochyta pisi</u>	Jord test
		<u>Mycosphaella pinodes (I ISTA Ascochyta pinodes)</u>	Jord test
		<u>Phoma</u>	Jord test
	Gråskimmel	<u>Botrytis cinerea</u>	Agar
	Fusarium		Agar
Hestebønne	Hestebønnebladplet	<u>Ascochyta fabae</u>	Agar
	Gråskimmel	<u>Botrytis fabae</u>	Agar
	Fusarium	<u>Fusarium sp.</u>	Agar
Lupin	<u>Antracnose</u>	<u>Colletotricum</u>	Agar
	Fusarium		Agar
	Gråskimmel	<u>Botrytis</u>	Agar



WE NEED HEALTHY SEED, NOW AND IN THE FUTURE

- **Our strategy:**
- Take samples from all row seed lots on farms and analyze for seed carried diseases.
- Divide in:
 - * Healthy seed – need no treatment
 - * Seed need treatment, new method
 - * Seed need dressing or no use.
- Keep our maintenance breeding and multiplication free of ustilago.
- Get ustilago resistance into our Barley breeding (5-10 years)



THANKS FOR LISTENING



WHEAT COMPETITION 2025

PACMAN 17.194 TON
BOHR 16.931 TON

