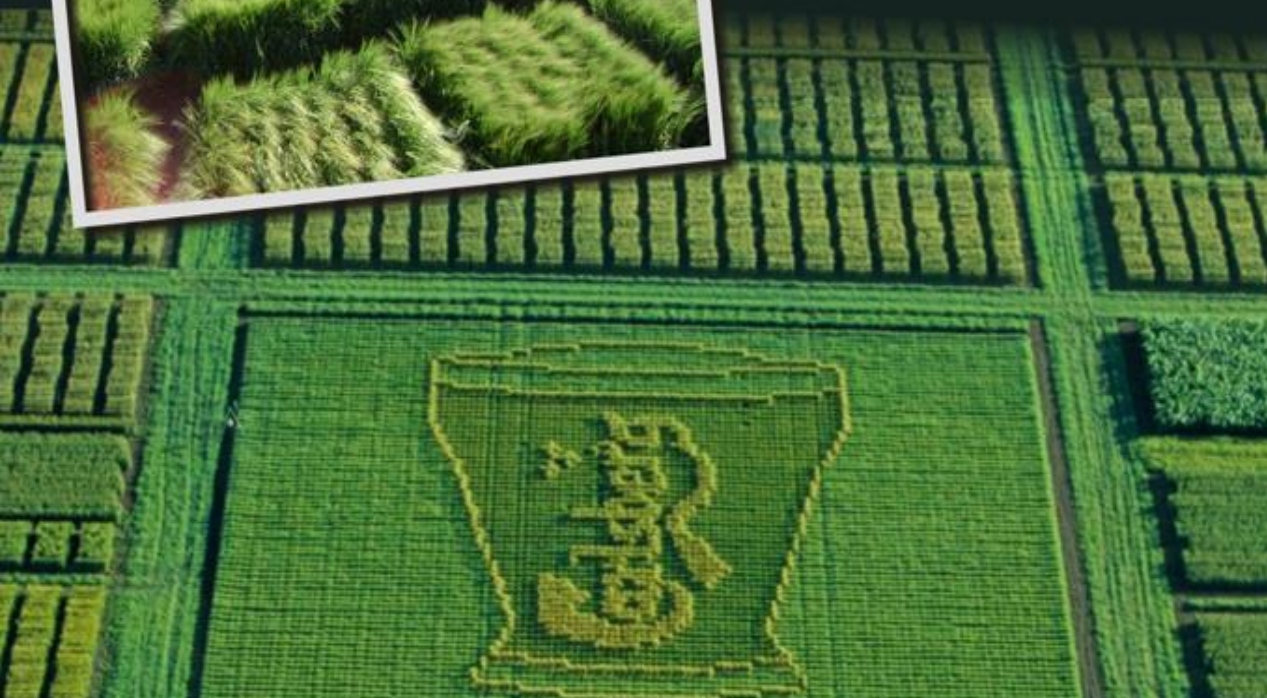




# Malting barley varieties from Carlsberg

**Contact: Pai rosager Pedas and Kim Gubbi Jørgensen – CRL**  
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# New standard for malting barley

## **Null-LOX1G barley**

Fresh for longer  
Higher drinkability  
Improved flavour  
and foam stability

## **Null-LOX 3G barley**

Same as for  
Null-LOX1G + energy  
savings, sustainability,  
higher productivity and  
quality

## **Null-LOX4G barley**

Same as for  
Null-LOX3G  
+ beer clarity

# 3G FACT BOX

## Null Lox

Reduced lipoxygenase activity in malt gives beer with

- ✓ Better taste fresh for longer
- ✓ Improved flavor stability with no staling and papery off-flavor
- ✓ Better foam stability

## O-DMS

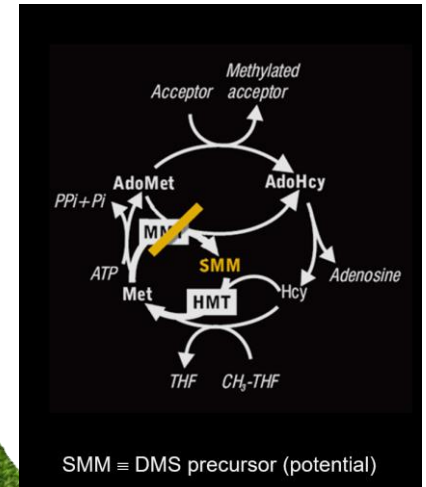
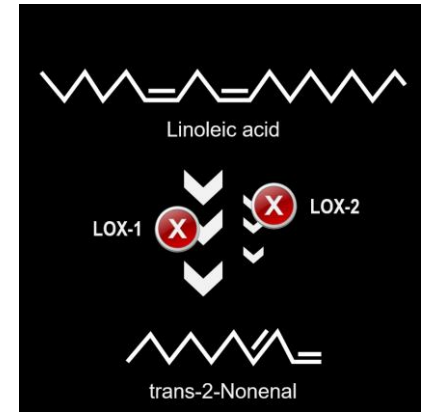
Knock out of the enzyme MMT (Methionine-S-Methyltransferase)

- ✓ No DMS formation during malting
- ✓ No DMS formation during brewing



Maltsters may reduce kilning temperature and time  
Brewers can reduce evaporation during wort boiling  
Energy saving and long-term support for CSR agenda

**3G traits covered by a patent jointly owned by Heineken & Carlsberg**

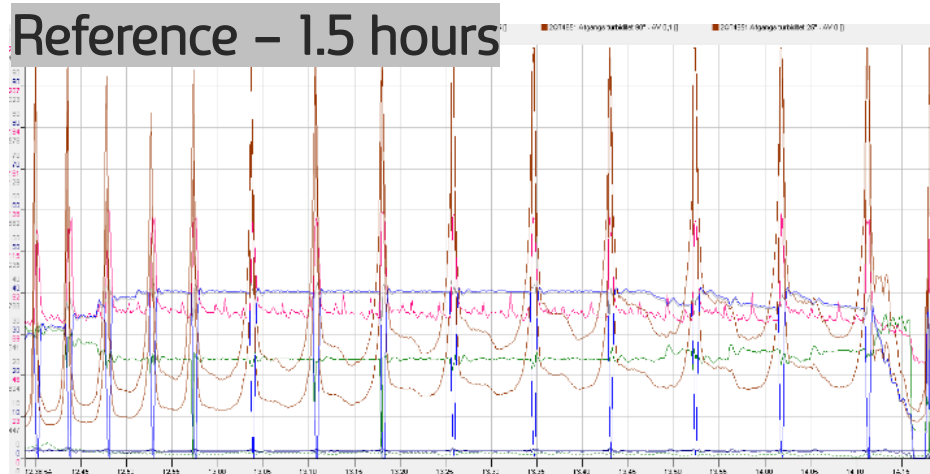
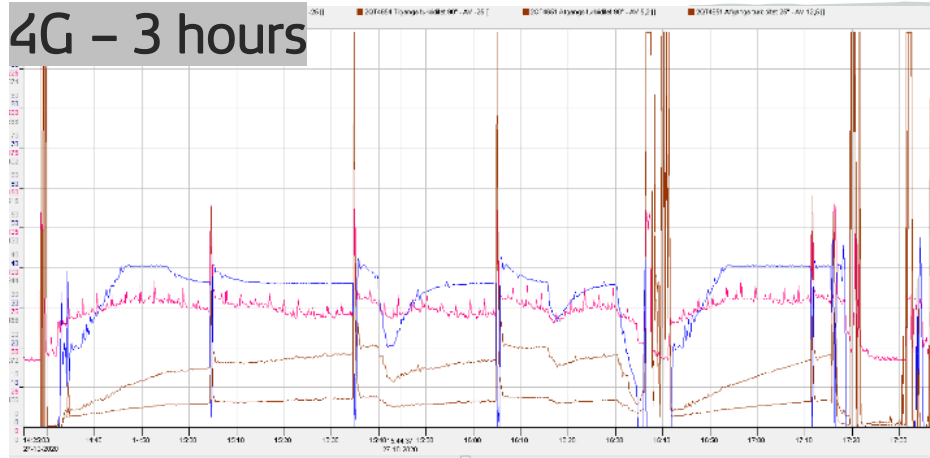




# Null-LOX4G – Pro-anthocyanin free barley

## Significantly improved beer stabilization

Better filtration and better performance of centrifuge due to clearer beer before filtration process



Trials with CB CLOUD	4G Trial 1	4G Trial 2	Reference
Alc. % vol.	4,49	4,45	4,6
AE % P	1,23	1,16	1,14
ADF % P	87,5	88,0	88,5
Colour	6,3	7,3	4,2
BU	19,6	20,1	18,9
FAN mg/l	134	133	113,5
Coag. N mg/100ml	2,7	1,5	1,3
Free DMS mg/l	4	5	33
Tot. Diacetyl µl	33	14	12
Haze 8° EBC	0,56	0,48	0,44
Haze 20° EBC	0,54	0,46	0,43
Forced aging 5D/60°, EBC	0,50 ✓	0,44 ✓	0,78
Foam NIBEM, s	274	272	269
Total N mg/100ml	90,6	91,7	75,4
Total Polyphenols mg/l	40,3 ✓	46,7 ✓	110,3
Total Flavanoids mg/l	5,0 ✓	5,9 ✓	13,2
pH	4,45	4,44	4,43

# CB COURAGE – 3G variety

AGRONOMY	CB COURAGE	RGT Planet	CB COURAGE	RGT Planet
	Yield (%)			
	Crop 2019		Crop 2020	
Performance				
DK	99	100	99	102
UK	98	100	102	102
DE	101	100	105	101
Disease (DK)				
Mildew	-	-	-	-
Rust	4	14	0	8
Scald	2.1	5.0	10.0	7.0
Net blotch	4	15	17	26
Agronomy (DK)				
Screenings > 2.5 mm	97	96	97	97
Resistance to lodging	1.6	2.0	1.6	0.9
Maturity	04-Aug	03-Aug	29-Jul	29-Jul
Height (cm)	72	77	72	76
Sp.Wt (kg/hl)	66.1	66.4	68.9	69.1
Resistance to straw brake	6.0	8.0	6.0	4.5

Data source: [www.tystofte.dk](http://www.tystofte.dk) – 2019/2020 for DK. UK and DE from Carlsberg trials

CB Courage is a shorter Planet type barley with improved disease resistance

	KWS Irina_45	KWS Irina_43	KWS Irina_41	RGT Planet_45	RGT Planet_43	RGT Planet_41	CB Courage_45	CB Courage_43	CB Courage_41
Extract	3	5	4	3	3	5	4	5	5
Friability	1	4	5	1	2	5	1	3	4
Beta-Glucan	2	4	5	1	2	4	1	3	4
Viscosity	2	3	5	1	2	4	1	2	3
FAN	2	3	4	1	3	4	3	4	5
Soluble N	3	4	5	1	3	4	3	4	5
Kolback	3	3	4	1	3	4	3	4	5
FAN afv.*	4%	9%	12%	2%	-3%	0%	-5%	-9%	-9%
Soluble N afv.*	-3%	2%	1%	6%	0%	3%	-4%	-6%	-5%
Kolback afv.*	-2%	3%	3%	5%	-1%	2%	-7%	-6%	-8%
Proteolyse ifht. modifikation	3% højere			2% højere			6% lavere		
Alpha-Amylase	5	5	5	3	4	3	4	4	4
Beta-Amylase	1	2	3	2	2	1	3	2	3
Limit Dextrinase	2	3	2	2	3	2	2	4	2
Attenuation	2	5	4	1	2	5	1	1	3
Turbidity	5	3	1	5	3	4	3	3	4
Index **	15	24	22	13	15	24	18	22	25
Index mean ***	38			32			42		



# CB COURAGE – 3G variety

AGRONOMY	CB COURAGE	RGT Planet	CB COURAGE	RGT Planet
	Yield (%)			
	Crop 2019		Crop 2020	
Performance				
DK	99	100	99	102
UK	98	100	102	102
DE	101	100	105	101
Disease (DK)				
Mildew	-	-	-	-
Rust	4	14	0	8
Scald	2.1	5.0	10.0	7.0
Net blotch	4	15	17	26
Agronomy (DK)				
Screenings > 2.5 mm	97	96	97	97
Resistance to lodging	1.6	2.0	1.6	0.9
Maturity	04-Aug	03-Aug	29-Jul	29-Jul
Height (cm)	72	77	72	76
Sp.Wt (kg/hl)	66.1	66.4	68.9	69.1
Resistance to straw brake	6.0	8.0	6.0	4.5

Data source: [www.tystofte.dk](http://www.tystofte.dk) – 2019/2020 for DK. UK and DE from Carlsberg trials

BARLEY						
Variety	PLANET	Planet	Planet	CB Courage	CB Courage	CB Courage
Crop	2020	2020	2020	2020	2020	2020
Location	DK-DLG	DK-CB	DK-CB	DK-DLG	DK-DLG	UK-ADM
MICROMALT ANALYSIS						
Moisture, %	4.1	4.2	4.5	4.3	4.2	4.3
Protein, % dm	9.9	10.2	10.2	9.9	10.3	10.2
Extract, % dm	84.1	84.2	84.2	83.6	83.4	84.0
N Soluble, %	0.76	0.78	0.78	0.77	0.78	0.73
Colour	5.0	4.8	4.8	4.5	4.7	5.0
β-glucan, mg/l	100	188	167	120	96	164
α-amylase, U/g	246	272	276	261	273	298
β-amylase U/g	14.4	14.0	14.1	14.1	15.0	14.5
Limit dextrinase mU/g	53.1	44	56	74	66	60

CB Courage is a shorter Planet type barley with improved disease resistance

# CB CONCORD – 3G variety

AGRONOMY	CB CONCORD	RGT Planet	CB CONCORD	RGT Planet
Performance	Yield (%)			
	Crop 2019		Crop 2020	
DK	101	100	99	102
UK	98	99	97	98
DE	98	100	98	101
Disease (DK)				
Mildew	-	-	-	-
Rust	6	14	3	8
Scald	1.0	5.0	10.0	7.0
Net blotch	-	15	0.3	26
Agronomy (DK)				
Screenings > 2.5 mm	97	96	97	97
Resistance to lodging	2.3	2.0	-	0.9
Maturity	03-Aug	03-Aug	28-Jul	29-Jul
Height (cm)	71	77	70	76
Sp.Wt (kg/hl)	66.6	66.4	69.2	69.1
Resistance to straw brake	6.5	8.0	4.5	4.5

Data source: [www.tystofte.dk](http://www.tystofte.dk) – 2019/2020 for DK, UK and DE from Carlsberg trials

CB CONCORD is a short type barley with superior disease resistance

	KWS Irina_45	KWS Irina_43	KWS Irina_41	RGT Planet_45	RGT Planet_43	RGT Planet_41	CB Concord_45	CB Concord_43	CB Concord_41
Extract	3	5	4	3	3	5	2	3	4
Friability	1	4	5	1	2	5	1	1	2
Beta-Glucan	2	4	5	1	2	4	1	1	2
Viscosity	2	3	5	1	2	4	1	1	1
FAN	2	3	4	1	3	4	1	2	4
Soluble N	3	4	5	1	3	4	1	2	3
Kolback	3	3	4	1	3	4	2	2	3
FAN afv.*	4%	9%	12%	2%	-3%	0%	-1%	-5%	10%
Soluble N afv.*	-3%	2%	1%	6%	0%	3%	1%	-1%	-2%
Kolback afv.*	-2%	3%	3%	5%	-1%	2%	-3%	-4%	-5%
Proteolyse ifht. modifikation	3% højere			2% højere			3% lavere		
Alpha-Amylase	1			1			1		
Beta-Amylase	5	5	5	3	4	3	1	2	2
Limit Dextrinase	1	2	3	2	2	1	1	3	3
Attenuation	2	3	2	2	3	2	3	4	5
	2	5	4	1	2	5	1	1	1
Turbidity	5	3	1	5	3	4	4	4	2
Index **	15	24	22	13	15	24	10	13	16
Index mean ***	38			32			25		



# CB CONCORD – 3G variety

AGRONOMY	CB	RGT Planet	CB	RGT Planet
	CONCORD		CONCORD	
Performance	Yield (%)			
	Crop 2019		Crop 2020	
DK	101	100	99	102
UK	98	99	97	98
DE	98	100	98	101
<b>Disease (DK)</b>				
Mildew	-	-	-	-
Rust	6	14	3	8
Scald	1.0	5.0	10.0	7.0
Net blotch	-	15	0.3	26
<b>Agronomy (DK)</b>				
Screenings > 2.5 mm	97	96	97	97
Resistance to lodging	2.3	2.0	-	0.9
Maturity	03-Aug	03-Aug	28-Jul	29-Jul
Height (cm)	71	77	70	76
Sp.Wt (kg/hl)	66.6	66.4	69.2	69.1
Resistance to straw brake	6.5	8.0	4.5	4.5

Data source: [www.tystofte.dk](http://www.tystofte.dk) – 2019/2020 for DK. UK and DE from Carlsberg trials

## BARLEY

Variety	PLANET	Planet	Planet	CB Concord	CB Concord	CB Concord
Crop	2020	2020	2020	2019	2019	2019
Location	DK-DLG	DK-CB	DK-CB	DK-CB	DK-CB	UK-CB

## MICROMALT ANALYSIS

Extract, % dm	84.1	84.2	84.2	84.6	84.9	84.2
N Soluble, %	0.76	0.78	0.78	0.86	0.80	0.72
β-glucan, mg/l	100	188	167	< 50	< 50	< 50
α-amylase, U/g	246	272	276	341	350	376
β-amylase U/g	14.4	14.0	14.1	15.9	14.6	15.5

CB CONCORD is a short type barley  
with superior disease resistance



# CB SCORE – 4G variety

AGRONOMY	CB SCORE	RGT Planet	CB SCORE	RGT Planet
	Yield (%)			
	Crop 2019		Crop 2020	
Performance				
DK	104	100	103	102
UK	102	101	98	98
DE	97	100	102	100
Disease				
Mildew	-	-	-	-
Rust	10	14	14	8
Scald	3.0	5.0	2.7	7.0
Net blotch	0.6	15	-	26
Agronomy				
Screenings > 2.5 mm	96	96	97	97
Resistance to lodging	1.2	2.0	-	-
Maturity	04-Aug	03-Aug	27-Jul	29-Jul
Height (cm)	75	77	70	76
Sp.Wt (kg/hl)	65.2	66.4	68.6	69.1
Resistance to straw brake	3.5	8	2.3	5

Data source: [www.tystofte.dk](http://www.tystofte.dk) – 2019/2020 for DK, UK and DE from Carlsberg trials

CB SCORE is a high performing variety, with superior net blotch resistance

	KWS Irina_45	KWS Irina_43	KWS Irina_41
Extract	3	5	4
Friability	1	4	5
Beta-Glucan	2	4	5
Viscosity	2	3	5
FAN	2	3	4
Soluble N	3	4	5
Kolback	3	3	4
FAN afv.*	4%	9%	12%
Soluble N afv.*	-3%	2%	1%
Kolback afv.*	-2%	3%	3%
Proteolyse ifht. modifikation	3% højere		
Alpha-Amylase	5	5	5
Beta-Amylase	1	2	3
Limit Dextrinase	2	3	2
Attenuation	2	5	4
Turbidity	5	3	1
Index **	15	24	22
Index mean ***	38		

RGT Planet_45	RGT Planet_43	RGT Planet_41
3	3	5
1	2	5
1	2	4
1	2	4
1	3	4
1	3	4
1	3	4
2%	-3%	0%
6%	0%	3%
5%	-1%	2%
2% højere		
3	1	3
3	4	3
2	2	1
2	3	2
1	2	5
5	3	4
13	15	24
32		

CB Score_45	CB Score_43	CB Score_41
2	1	2
2	4	5
2	4	5
2	3	4
2	3	4
1	2	3
1	2	3
7%	8%	19%
7%	10%	16%
7%	12%	17%
11% højere		
3	1	3
2	2	1
4	4	4
2	3	4
2	4	3
1	1	1
14	16	18
31		



# CB SCORE IFBM – material from official CPTS trials

020 : ORGES DE PRINTEMPS

RÉSULTATS DE L'IQ ET DE L'IF POUR LES VARIÉTÉS OP

➤ Moyennes de chacune des variétés en étude

iFBM

	KWS IRINA série 1	RGT PLANET série 1	KWS IRINA série 2	RGT PLANET série 2	CB SCORE inscrite sous dérogation
					CB 17-2021 1048013
Rendement éco (brut ou $(\%(\text{PLANET} + \text{IRI})/2)$ )	67,7	75,2	66,1	75,7	100,6
Humidité (%)	4,3	4,4	4,3	4,3	4,1
Extrait fine mouture (% m.s.)	82,9	83,6	83,1	83,6	83,5
Extrait - protéines solubles (% m.s.)	78,5	79,1	78,7	79,2	78,6
Couleur (EBC)	3,2	3,6	3,3	3,7	4,0
pH	5,9	6,0	5,91	5,97	5,99
Protéines totales (% m.s.)	10,5	10,1	10,3	9,9	10,4
Protéines solubles (% m.s.)	4,38	4,50	4,41	4,47	4,88
Indice Kolbach	42	44	43	45	47
Pouvoir diastasique (WK m.s.)	346	336	348	335	339
Viscosité du moût (mPa.s)	1,54	1,55	1,52	1,53	1,51
Friabilité (%)	88	86	89	88	82
Grains entiers (%)	0,3	0,2	0,4	0,2	0,6
Grains Insuffisamment Désagrégés (%)	1,8	2,9	1,7	2,1	4,1
Béta-glucanes du moût (mg/l)	242	223	214	184	206
<b>INDICE QUALITE (RGT PLANET + KWS IRINA)</b>					<b>B (99)</b>
Atténuation limite (%)	82,4	82,3	83,1	82,9	81,0
Désagrégation calcofluor (%)	98	97	98	98	98
Homogénéité calcofluor (%)	91	91	92	91	89
Alpha-amylase (U.D. m.s.)	54	66	52	63	72
Azote aminé libre (mg/l)	174	170	177	173	185
Turbidité (UF EBC)	3,5	5,3	3,6	6,4	1,6
Polyphénols (mg/l)	65	63	66	66	19
Brassin TEPRAL : vitesse "b" (g/min)	39	38	36	36	27
Brassin TEPRAL : Temps pour filter 350 g (min)	0:12:51	0:14:00	0:14:18	0:14:57	0:15:23
Brassin TEPRAL : rendement (%)	79,5	79,9	80,5	80,9	79,9
Saccharification EBC (min)	5	5	6	6	5
Indice Hartong 45°C (V.P.)	41,3	45,5	40,6	44,1	49,3
Couleur KZ (EBC)	6,4	6,4	6,4	6,5	6,7
pDMS (mg/kg)	9,6	7,1	8,7	7,2	<0,3
<b>INDICE FONCTIONNEL (RGT PLANET + KWS IRINA)</b>					<b>B (101)</b>

\* En application du règlement CPTS concernant la nouvelle classification technologique entérinée à la section du 19. juillet 2011

# Compiled data from IFBM – material from official CPTS trials (crop 2019 and 2020)

	KWS IRINA	RGT PLANET	CB SCORE	Classification
Moisture (%)	4.3	4.4	4.1	
Extract (% dm)	82.9	83.6	83.5	100
Color (EBC)	3.2	3.6	4.0	
pH	5.93	5.99	5.99	
Protein (% dm)	10.5	10.1	10.4	105
Soluble N (% dm)	4.38	4.50	4.88	
KI	42	44	47	
DP (WK, dm)	346	336	339	100
Viscosity (mPa s)	1.54	1.55	1.51	103
Friability (%)	88	86	82	90
Glassy grains (%)	0.3	0.2	0.6	
PUG (%)	1.8	2.9	4.1	
Beta glucan (mg/l)	242	223	206	100
				<b>INDEX: 99</b>

IFBM micro-malting data from France CPTS plots (4 reps per year) – mean values across 2019 and 2020 official trials.

CB SCORE – Malt class B

# Reduced kilning – impact on pDMS

## Data from IFBM

	Material from 2019				Material from 2020				pDMS - Mean (mg/kg)	
	REP1	REP2	REP3	Mean 2019	REP1	REP2	REP3	Mean 2020		
<b>Classic kilning at IFBM</b>										
KWS IRINA	7.5	8.4	6.7	7.5	8.8	10.1	7.9	8.9	8.2	
RGT PLANET	5.7	6.8	4.4	5.6	5.0	6.8	7.6	6.5	6.1	
CB SCORE	<0,3	<0,3		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	No pDMS
<b>Reduced kilning at IFBM</b>										
KWS IRINA	11.9	18.2	14.3	14.8	12.9	13.6	10.5	12.3	13.6	
RGT PLANET	10.7	13.0	9.3	11.0	8.3	11.2	7.6	9.0	10.0	
CB SCORE	<0,3	<0,3		<0,3	<0,3	<0,3	<0,3	<0,3	<0,3	No pDMS

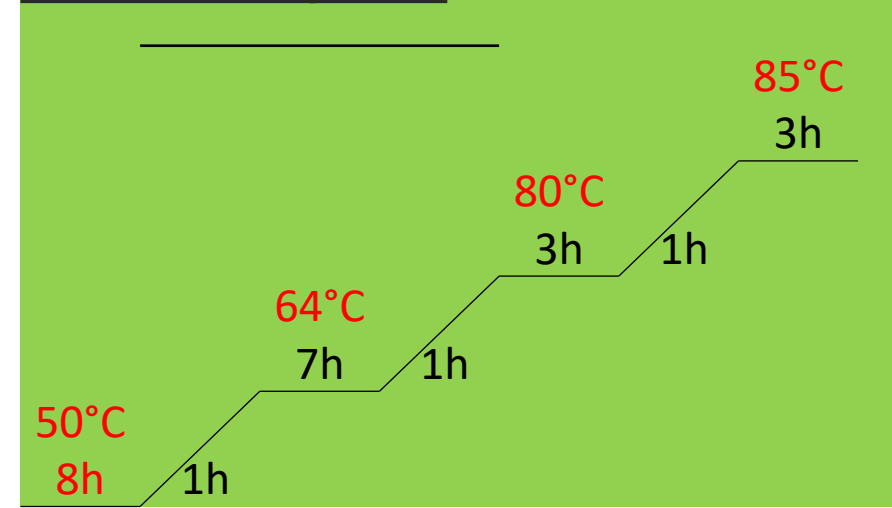
Detection limit : 0,1 mg/kg

Quantification limit : 0,3 mg/kg

### Reduced temperature and time for kilning : 20h



### Classic kilning : 24h



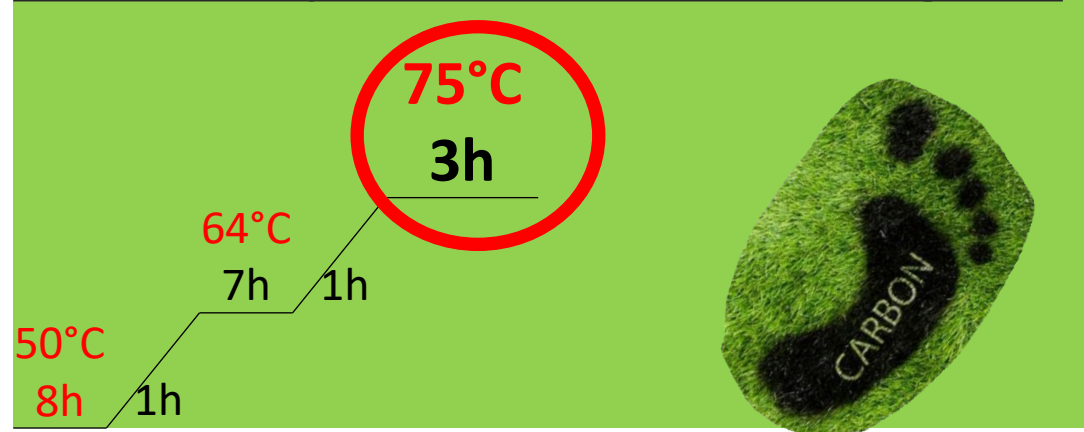


# Reduced kilning – impact on DP

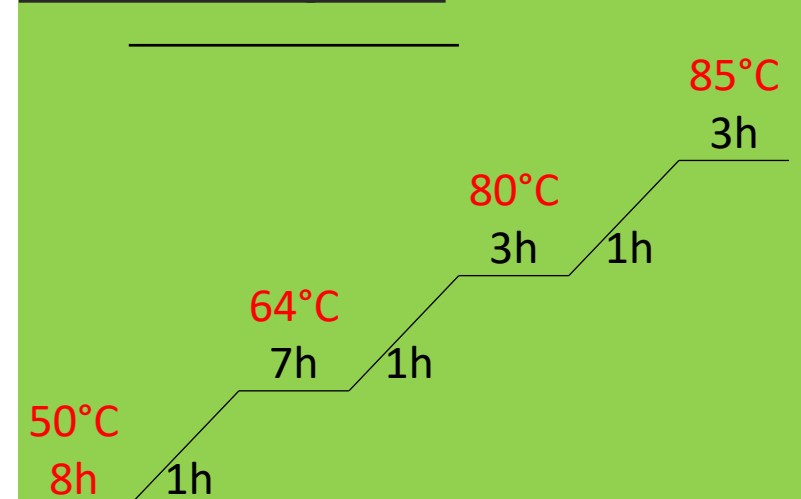
## Data from IFBM

	Material from 2019				Material from 2020				DP Mean (W, K)	
	REP1	REP2	REP3	Mean 2019	REP1	REP2	REP3	Mean 2020		
<b>Classic kilning at CTPS/IBFM</b>										
KWS IRINA	260	350	260	290	470	410	360	413	352	
RGT PLANET	280	350	260	297	420	410	430	420	358	
CB SCORE	250	340		295	410	430	290	377	344	
<b>Reduced kilning at CPTS/IBFM</b>										
KWS IRINA	320	440	320	360	490	480	390	453	407	<b>Improved DP</b>
RGT PLANET	330	430	340	367	470	500	380	450	408	<b>Improved DP</b>
CB SCORE	300	430		365	480	500	360	447	414	<b>Improved DP</b>

### Reduced temperature and time for kilning : 20h



### Classic kilning : 24h



**THANK**

**YOU**

