Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Department of Animal Nutrition
and Management

Evaluation of moist crimped barley preserved with a biocontrol yeast and starter culture fed to growing pigs

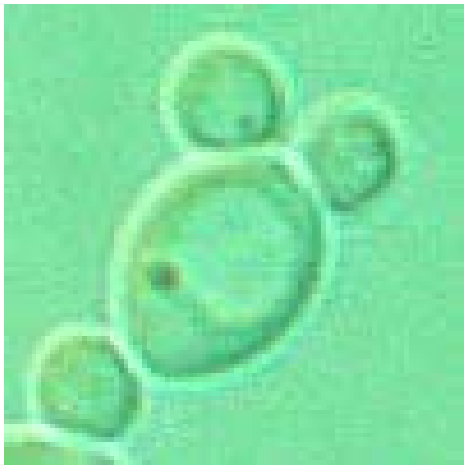
J.Borling and K. Lyberg

Energy efficient storage

- Moist cereal grain
- No drying
- Optimal water content

Biopreservation

- *Wickerhamomyces anomalus* (*Pichia anomala*)
- Biocontrol
- Suppress mould growth
- Reduce *Enterobacteriaceae*
- Phytase activity
- Beneficial aa profile



Moist grain treatments

D- Dried crimped grain

C- non inoculated moist grain

W- *W. anomalus* inoculated moist grain

WS- *W. anomalus* and Starter culture inoculated

Microorganisms

- Yeast, lactic acid bacteria (LAB), enterobacteria & mould
- Cultivation on selective media
- Fingerprinting of Yeast and LAB (GTG' microsatellite)
- Sequencing of yeast (D1/D2 region, 26sRNA gene, primer NL4)
- Sequencing of LAB (16sRNA gene, primer 16S)

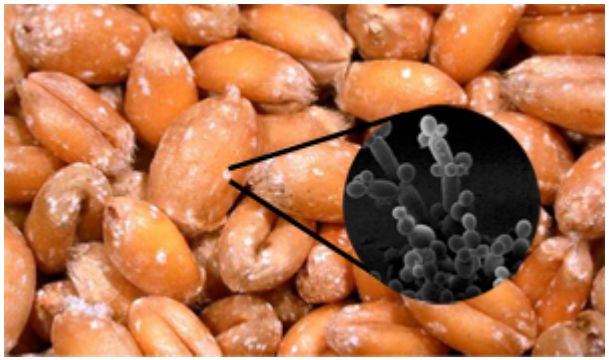
	Species	Day	0	43	50	60	74	88	102	116	134
D	*Enterobacteria*			6	4	4	4	4	4	4	4
	LAB			6		3	4				
	Yeast			6	6		4	5	5	5	6
	Mould			3		4	4	2	4	3	4
C	*Enterobacteria*		8	4							
	LAB		7	8	8	8	7	7	7	7	7
	Yeast		4	4	6	7	5	5	5	5	
	Mould		4	3		6					
W	*Enterobacteria*		7	5							
	LAB		6	8	9	7	8	6	6	6	6
	Yeast		4	5	7	8	8	7	7	6	3
	Mould		3					2			
WS	*Enterobacteria*		8	8							
	LAB		6	8	8	7	8	6	6	5	6
	Yeast		4	4	7	9	8	7		5	
	Mould		3								

Log Cfu/g grain

W. Anomalus

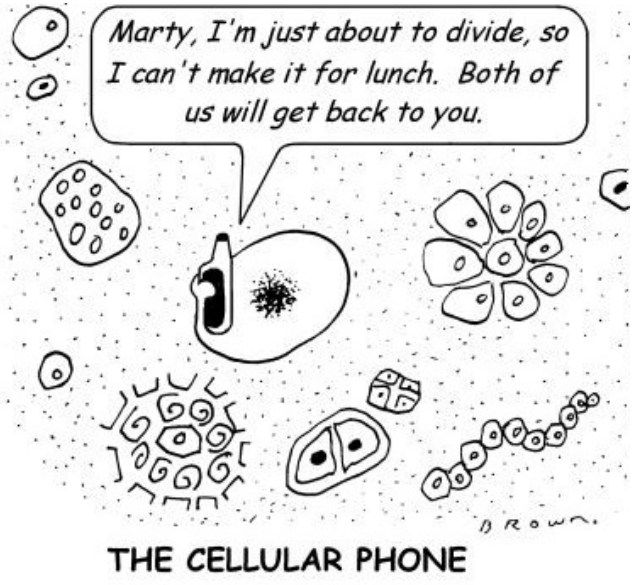
+

LAB Starter culture



H2O

Fermented liquid feed



Fermented liquid feed treatment

FD- Dried crimped grain

FC- non inoculated moist grain

FW- *W. anomalus* inoculated moist grain

FWS- *W. anomalus* and Starter culture inoculated

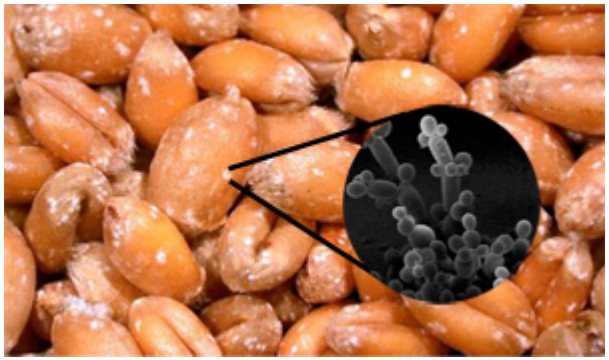
	Species	Day	0	43	50	60	74	88	102	116	134
FD	*Enterobacteria*				2						
	LAB				9	9	9	9	9	9	10
	Yeast				7	7	8	7	8	7	8
	Mould				5		3	2	2	2	2
FC	*Enterobacteria*				6						
	LAB				9	9	9	9	9	9	9
	Yeast				7	8	7	7	7	7	8
	Mould										
FW	*Enterobacteria*										
	LAB				9	9	9	9	9	9	9
	Yeast				8	8	7	7	8	7	8
	Mould							4	5		
FWS	*Enterobacteria*										
	LAB				10	8	8	9	9	9	9
	Yeast				9	8	7	8	8	7	8
	Mould							5	3	3	

Log Cfu/g grain

	Day 0 43	50	60	74	88	102	116	134
FD		*P. membranifaciens*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*
FC		*P. kudriavzevii*	*W. anomalus*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*
FW		*P. kudriavzevii*	*W. anomalus*	*W. anomalus*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*
FWS		*P. kudriavzevii*	*W. anomalus*	*W. anomalus*	*K. exigua*	*K. exigua*	*K. exigua*	*K. exigua*

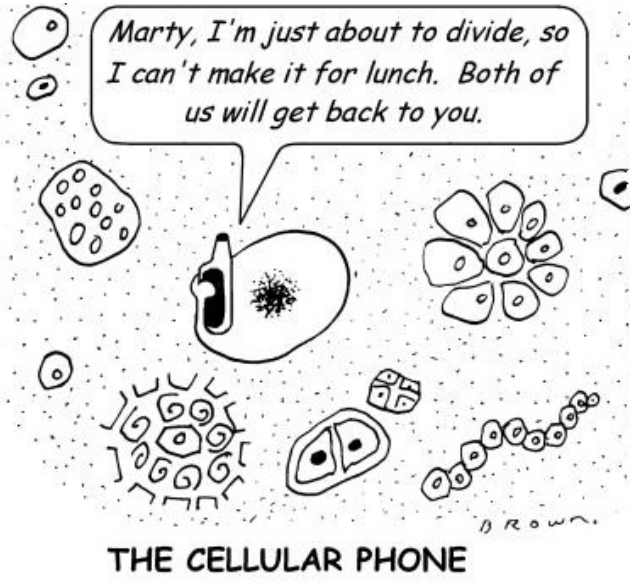
Dominating species of 10 randomly selected.

Moist crimped grain



H2O

Fermented liquid feed



Conclusion

Wickerhamomyces anomalus and a Lactic acid bacteria starter culture, inoculated at harvest will ensure a good hygiene during storage and in fermented liquid feed.

Thank you.