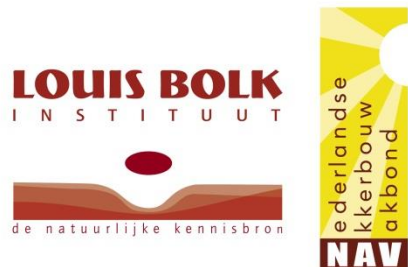


# Lupines

A healthy alternative for farmer and consumer

Project 'Lupine in de Veenkoloniën'

Uitvoering:



Financiering:





# Lupines

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## Lupines for meat substitutes

- Local manufacturers: Meatless, Ojah and Encko Foodgroup (Vivera)
- Regional production of lupins
- Alkaloid levels < 0,02%
- Healthy crop in crop-rotation





# Lupines

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## A good EU replacement for soya

- **Healthy grain legume for humans**  
(High protein -35%-, high fibre)
- **Good functional properties**
- **In line with dietary health trends**  
(less carbo-hydrates, more proteins and fibres)



# Lupines

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## Lupine in food

- **Functional ingredient**



- **Main-ingredient**



# Lupines

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## Lupine in a crop-rotation

- **N-fixation** (150-200 kg N/ha)
- **Mobilisation of phosphorus**
- **More crop-diversity**
- **Enhances other biodiversity**



# Lupines

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## Lupine projects 2007-'13

- **Variety trials** (mono- and mixed cropping)
- **Crop-optimisation** (fertilisation, weed control)
- **Breeding for calcareous soils**
- **Joined marketing** (lupine-cooperative)
- **Developing the market** (bread, meat substitutes)







# Lupines

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## Mixed cropping

	2011			2012		
	Total	Lupine	Cereal	Total	Lupine	Cereal
Haags Blaue	1,9	1,9		3,1	3,1	
Haags Blaue-Barley	3,3	0,7	2,6	4,1	1,2	2,8
Haags Blaue-Wheat				4,3	1,5	2,8
Barley	4,6		4,6			
Wheat				6,6		6,6



# Lupines

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## Mixed cropping dilemma's

- Haags Blaue is too late for barley in ripening
- Haags Blaue is too small for wheat (poor growth of lupines and diseases)
- Boruta seems good match with wheat, but is unreliable (unevenness in ripening)
- Iris is good match with wheat in crop height but too late in ripening

**Breeding for compatibility:**

**Boruta 2.0, small wheat or late wheat**





# Lupines

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## Variety trials mono-cropping

### Blue lupines

#### Non-branching

Viol (BJ)  
Prima (BJ)  
Primadonna (STJ)  
Haags Blaue (SSt)  
Boruta (SSt)  
Regent (HRS)  
Sonet

#### Branching

Iris (BJ)  
Galant (BJ)  
Sanabor (SSt)  
Sonate (SSt)  
Haagena (SSt)  
Probor (SSt)  
Borlu (SSt)  
Boregine (SSt)  
Arabella (SwS)  
Bojar (HRS)  
Dalbor (HRS)

### White lupines

Feodora (SwS)  
Dieta (SU)  
Volos (SU)

BJ, Bjarne Jørnsgard (Dk)  
STJ, Søren Thorndal Jørgensen (Dk)  
SSt, Saatzucht Steinach (D)  
SwS, Südwest Saat (D)  
HRS, Hodowla Roślin Smolice (Pl)  
SU, Soya UK (UK)

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# Variety trials 2007-2013

Variety	# years	Yield Index	Canopy height	Resistance to		Ripening		Quality
				Lodging	Disease	Earliness	Evenness	Alkaloid
Primadonna	1	97	50-60	++	+	++	++	?
Haags Blaue	4	79	50-60	++	-	++	++	-+
Boruta	6	76	60-65	+	-	+	-	+
Regent	1	98	50-60	++	?	+	-	?
Sonet	1	105	50-60	++	?	++	-+	?
Iris	6	100	70-80	-+	++	-+	+	++
Sanabor	4	63	70-80	-	-+	-	+	-
Boregine	3	85	70-80	-+	++	--	+	--
Probor	2	69	60-65	-+		-	+	-+
Sonate	2	35	60-65	--	--	-	+	++
Bojar	2	79	60-65	-+	?	-+	+	+
Dalbor	1	77	60-65	-+	?	-+	+	?
Dieta	3	63	80-90	-	-	---	+	+
Volos	3	61	80-90	-+	-+	---	+	+



# Lupines

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## Influence of soil type

	2008			2009		
	Sand	Clay	Index	Sand	Clay	Index
Non-bran. Viol	2,9	3,6	122	1,8	2,9	162
Haags Blaue				3,0	4,0	134
Boruta	3,6	3,7	102	1,8	3,3	182
Branching Iris	4,3	4,8	113	2,7	3,4	126
Vitabor	1,8	2,6	143	1,4	3,2	225
Sanabor				2,0	4,0	201
Boregine	3,8	3,7	99	2,5	3,8	153
Probor				2,0	3,1	156
			116			167







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## Influence of sowing date

	End of March	Half April
	<i>t/ha</i>	
1Haags Blaue	3,3	2,2
2Boruta	3,3	2,6
3Sanabor	2,6	1,6
4Sonate	1,2	1,5
5Iris	3,1*	2,9
6Bojar	1,6	2,3
7Dieta	3,2	2,5
8Volos	2,9	2,8

\* Poor emergence (60%)

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## Influence of sowing date

	sowing till		1e emerg. till		1e emerg. till		1e emerg. till	
	1e emergence		90% emerg.		1e flower		ripening	
	26-mrt	16-apr	26-mrt	16-apr	26-mrt	16-apr	26-mrt	16-apr
<b>Haags Blaue</b>	14	10	3	3	54	47	126	123
<b>Boruta</b>	11	9	5	3	62	50	143	133
<b>Sanabor</b>	12	9	5	3	61	48	161	143
<b>Sonate</b>	11	9	5	3	62	48	162	143
<b>Iris</b>	14	9	10*	3	59	48	154	153
<b>Bojar</b>	14	10	3	3	54	47	159	152
<b>Dieta</b>	14	12	12	3	47	45	175	162
<b>Volos</b>	15	12	10	3	46	45	174	162

\* Poor seed quality



# Lupines

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## Fertilisation (K)

	Yield		Alkaloïde	
	Clay	Sand	Clay	Sand
<b>Boregine</b>	ppm		ppm	
0 kg K <sub>2</sub> O/ha	3,6	3,9	317	500
100 kg K <sub>2</sub> O/ha	3,5	3,5	267	450
200 kg K <sub>2</sub> O/ha	3,7	3,8	317	367
	Soil sample			
Potassium	167	35	mg K/kg soil	
K-number	37	11		
pH	6,4	5,2		
CaCO <sub>3</sub>	<0,2%			





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## Fertilisation (N,K)

Variety		Treatment			
		N+ K+	N- K+	N+ K-	
Iris	Yield (t/ha)	2,8	2,9	2,8	
	Alkaloid (ppm)	27	20	34	
Sanabor	Yield (t/ha)	1,0	1,8	1,6	
	Alkaloid (ppm)	127	147	313	



# Lupines

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## Diseases

Fungicide    No fung.  
t/ha

	Fungicide	No fung.	
1Haags Blaue	1,9	1,5	26%
2Boruta	2,2	2,0	10%
3Sanabor	1,7	1,6	6%
4Sonate	0,9	0,3	169%
5Iris	3,2	3,1	4%
6Dieta	1,9	1,6	18%
7Volos	2,2	1,8	24%

**Pleiochaeta Seitosa, Botrytis cinera, Fusarium spp., Sclerotinia sclerotiorum**



# Lupines

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## Crop residue

		t DM/ha	kg N/ha	kg P <sub>2</sub> O <sub>5</sub> /ha	kg K <sub>2</sub> O/ha
lupines	straw	1,8	16	10	46
	pods	1,2	10	2	13
	leafs	0,5	12	5	7
		<b>3,5</b>	<b>38</b>	<b>17</b>	<b>66</b>
wheat	straw	4,3	29	8	75





# Lupines

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## Residual effect soil fertility

	N	Pw	N	Pw
	kg/ha	mg P <sub>2</sub> O <sub>5</sub> /l	kg/ha	mg P <sub>2</sub> O <sub>5</sub> /l
Lupin	53	48	50	52
Lupin-cereal	32	34	25	60
Cereal	37	29	21	51



# Lupines

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## Breeding lupines for calcareous soils

- Young sea clays ( $\text{CaCO}_3$  5-12%, pH 7-8)
- Testing lupines albus and angustifolius
- Material from Bjarne Joernsgard and Globe Seeds
- Most Ca-tolerance in albus
- Breeding for earliness and sweetness



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**Thank you for your attention!**

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