

Improvement of pre-sowing treatments for dormant, European beech seeds

„International Conference of the European Seed kilns“

June 04-07, 2013, Bernkastel-Kues, Germany

Introduction

European beech (*Fagus sylvatica* L.)

6.7 % of forests (1/3 of optimum = 18%)

Full crops in long periods (6-10 years), weak local crops

Annual demand 56 tons of seeds

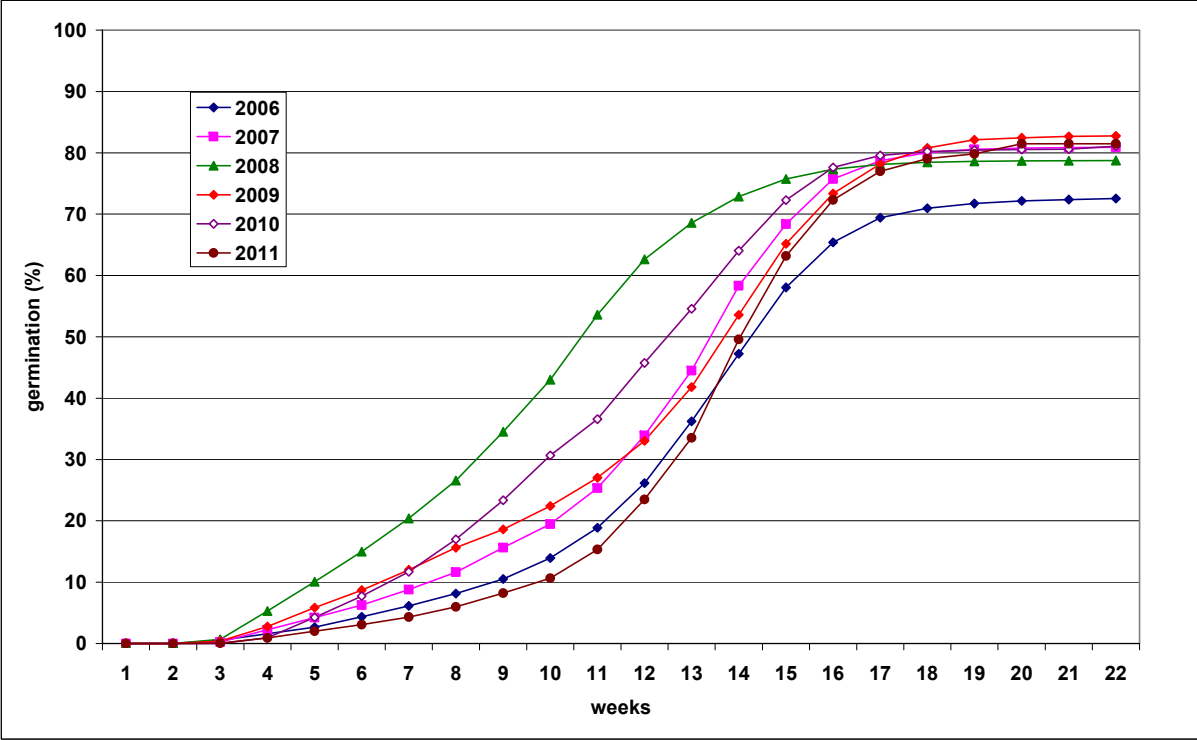
30 mil. seedlings

Seed price is growing (28 EUR / kg of seeds with 100 % purity + germination)

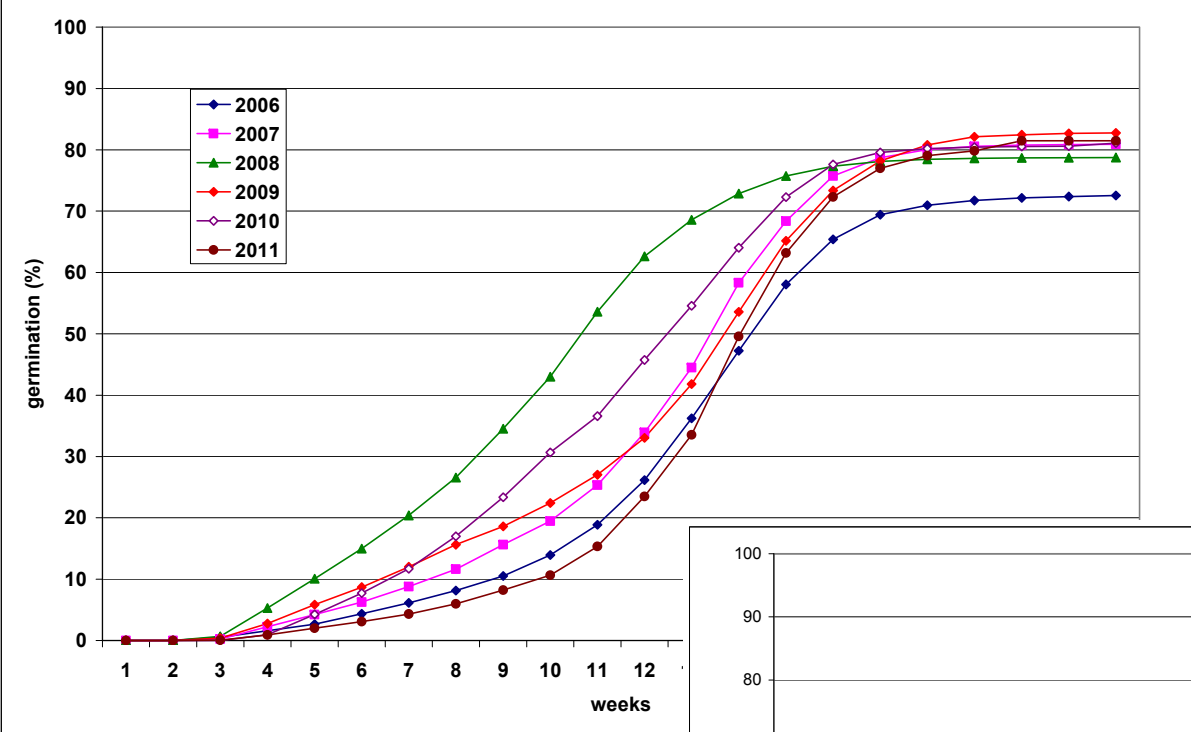
2 700 viable beechnuts / kg (ČSN 48 1211, 2006)

250 beech seedlings / kg of seed

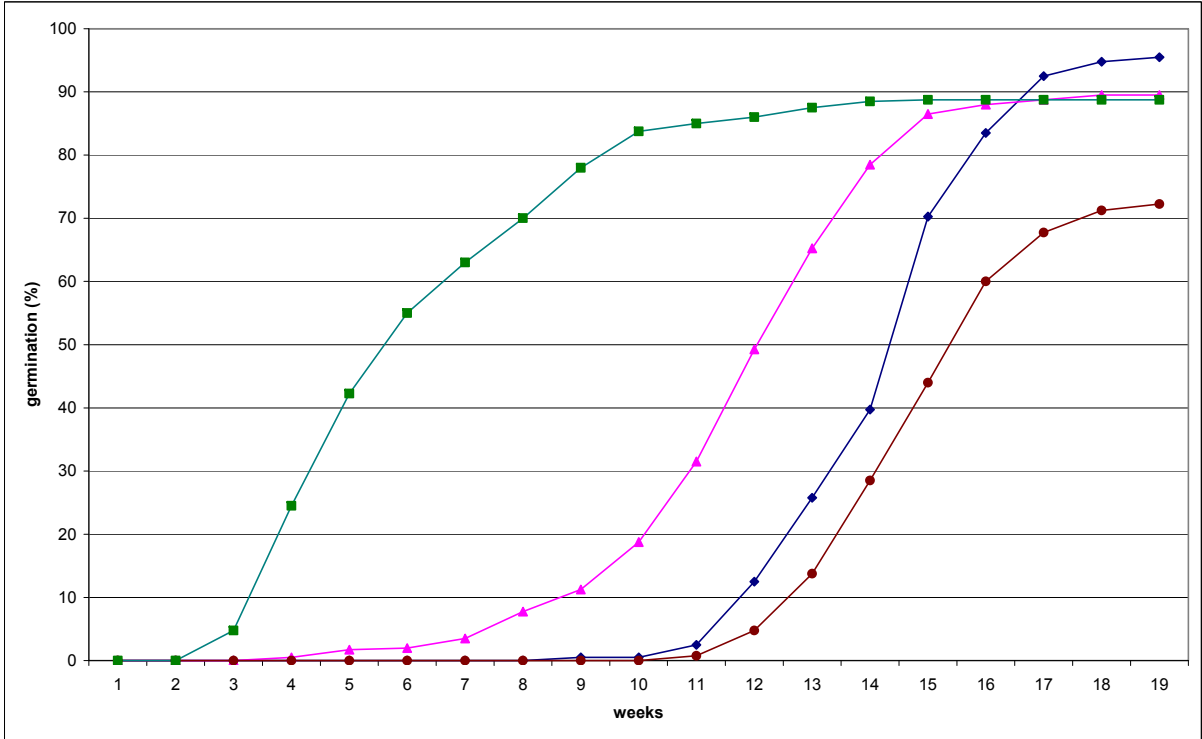
Germination of beechnuts harvested in different years



Germination of beechnuts harvested in different years



Harvest 2011



Project QI102A256

**Improvement of pre-sowing treatments
for dormant, European beech seeds**

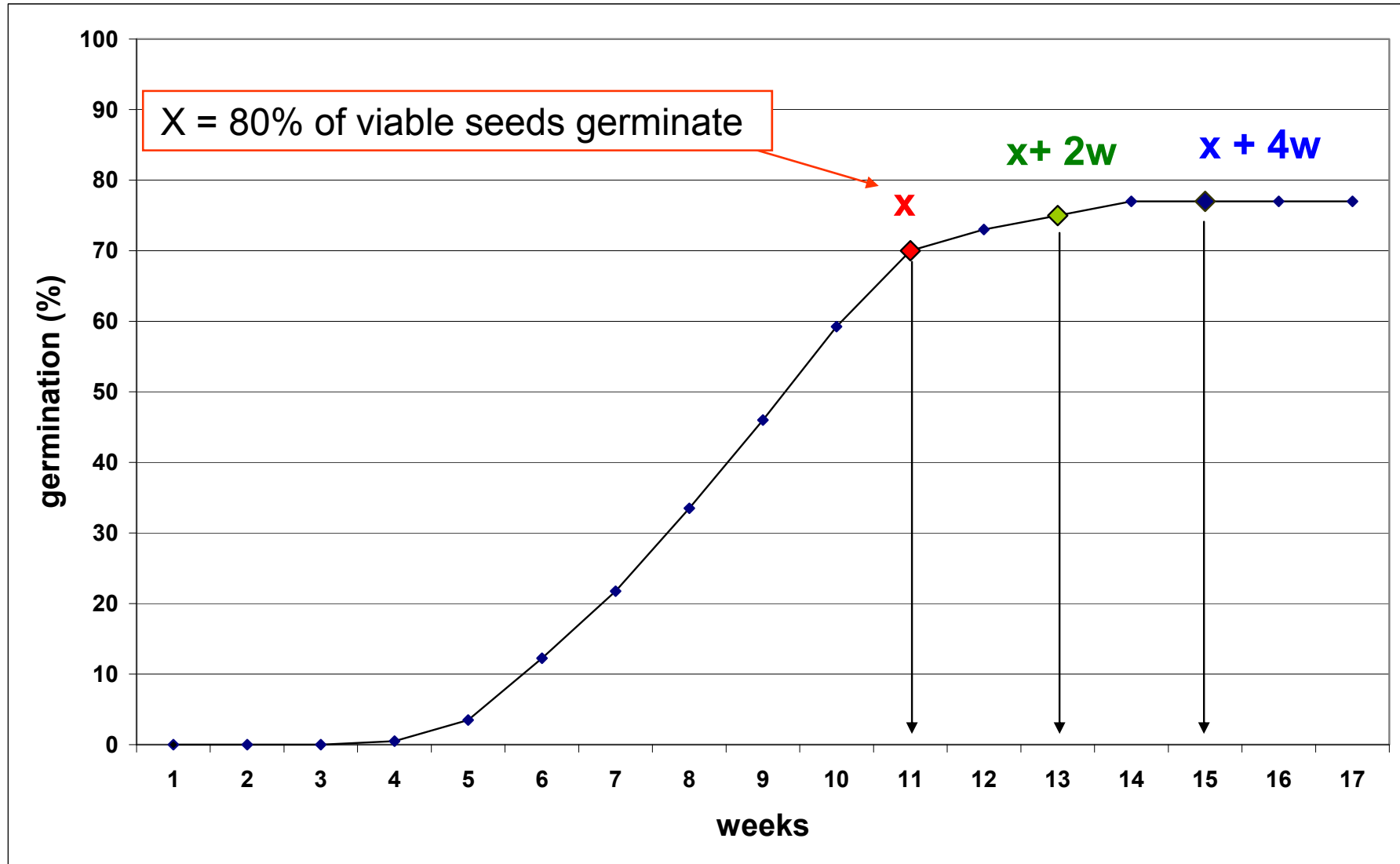
Objective

Determine factors causing low efficiency of pre-sowing treatment of European beech seeds (beechnuts) in the Czech republic

Determine

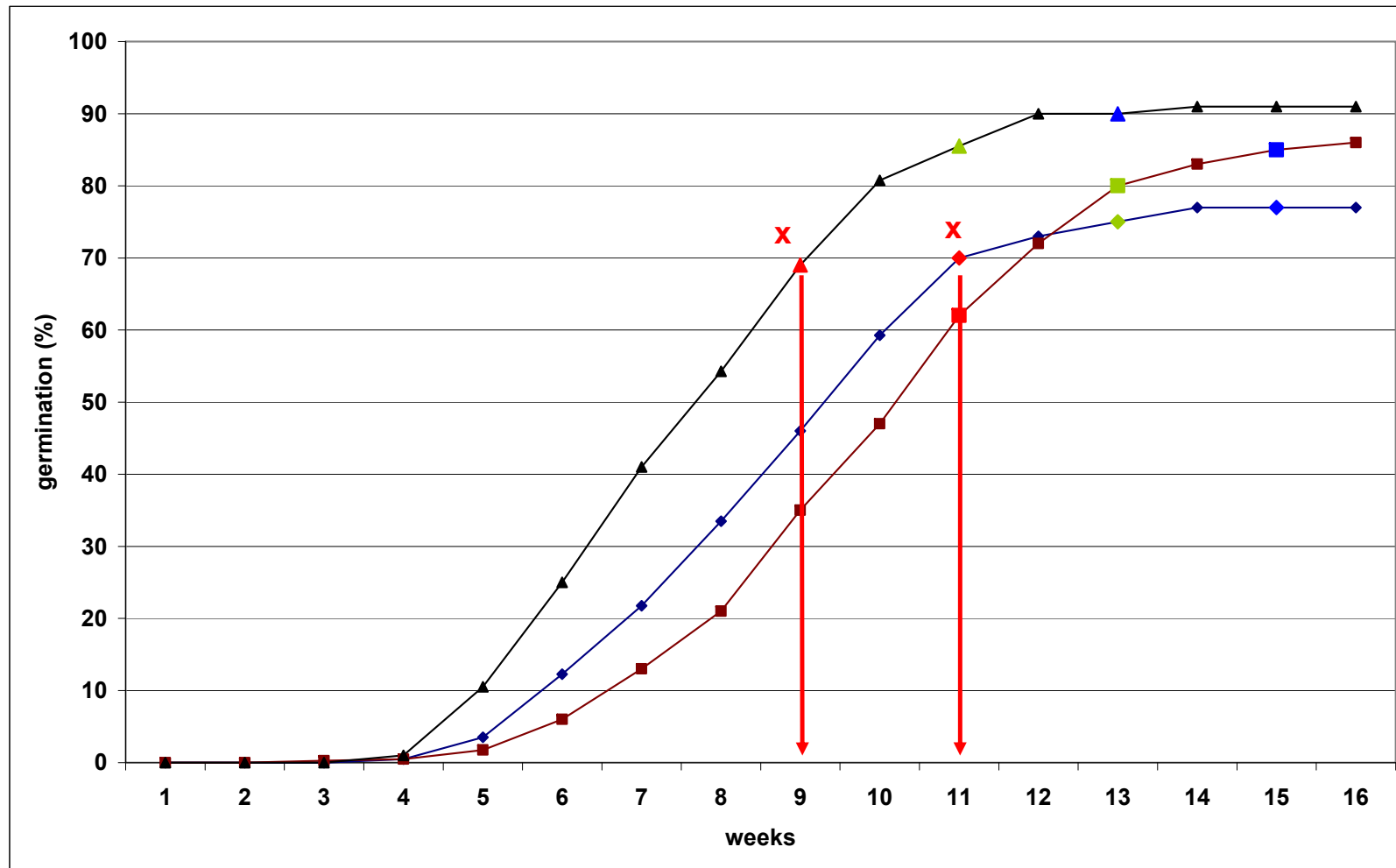
- 1) pre-chilling period of beechnuts (with various dormancy level) before storage**
- 2) effect of harvest area size on germination (capacity and rate) of beechnuts**
- 3) seasonal changes in viability, germination capacity and germination rate**
- 4) relation between ABA content, dormancy level and anatomical structure of beechnuts**

Pre-chilling of beechnuts (with various dormancy level) before storage



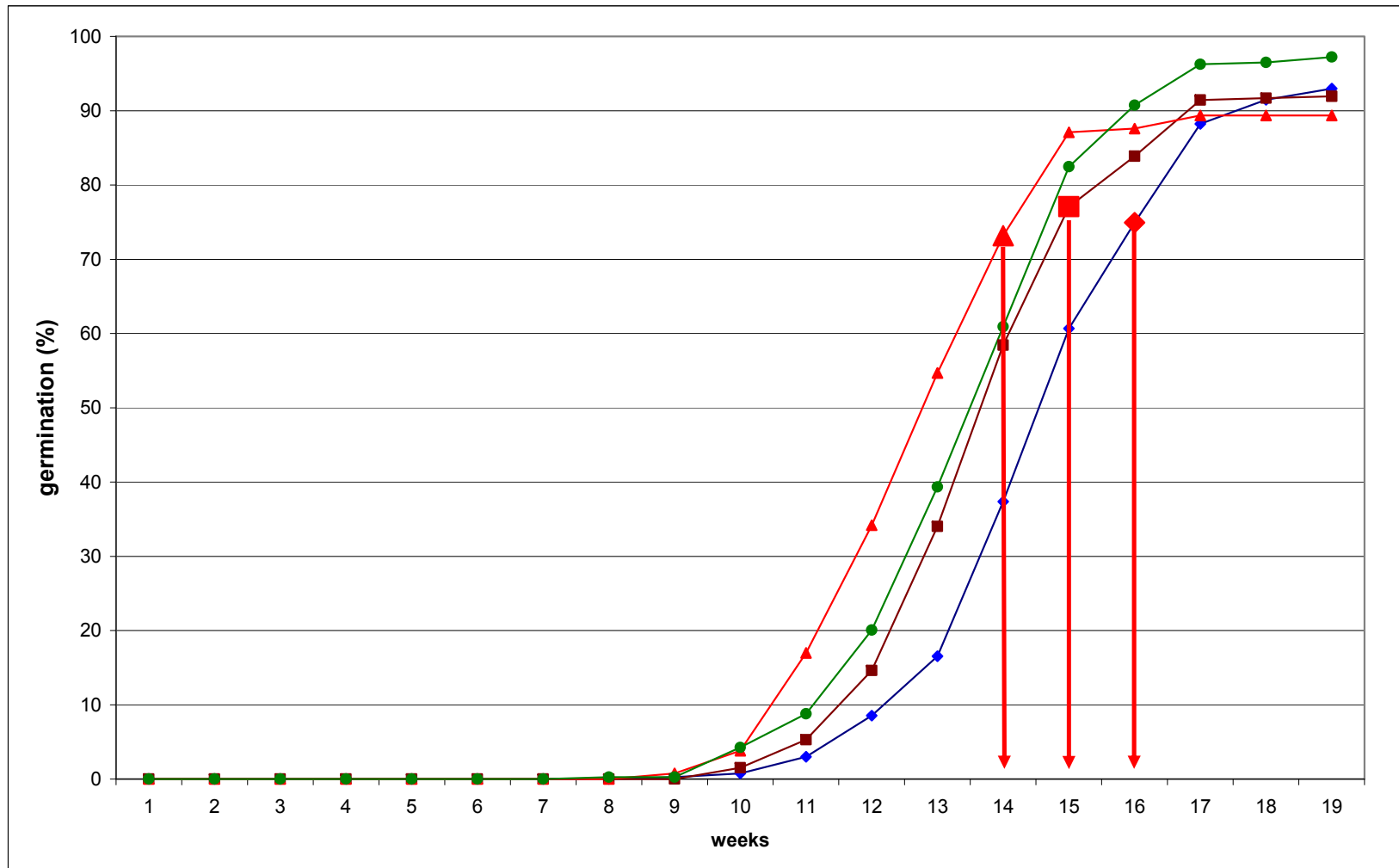
Different dormancy – harvest 2010

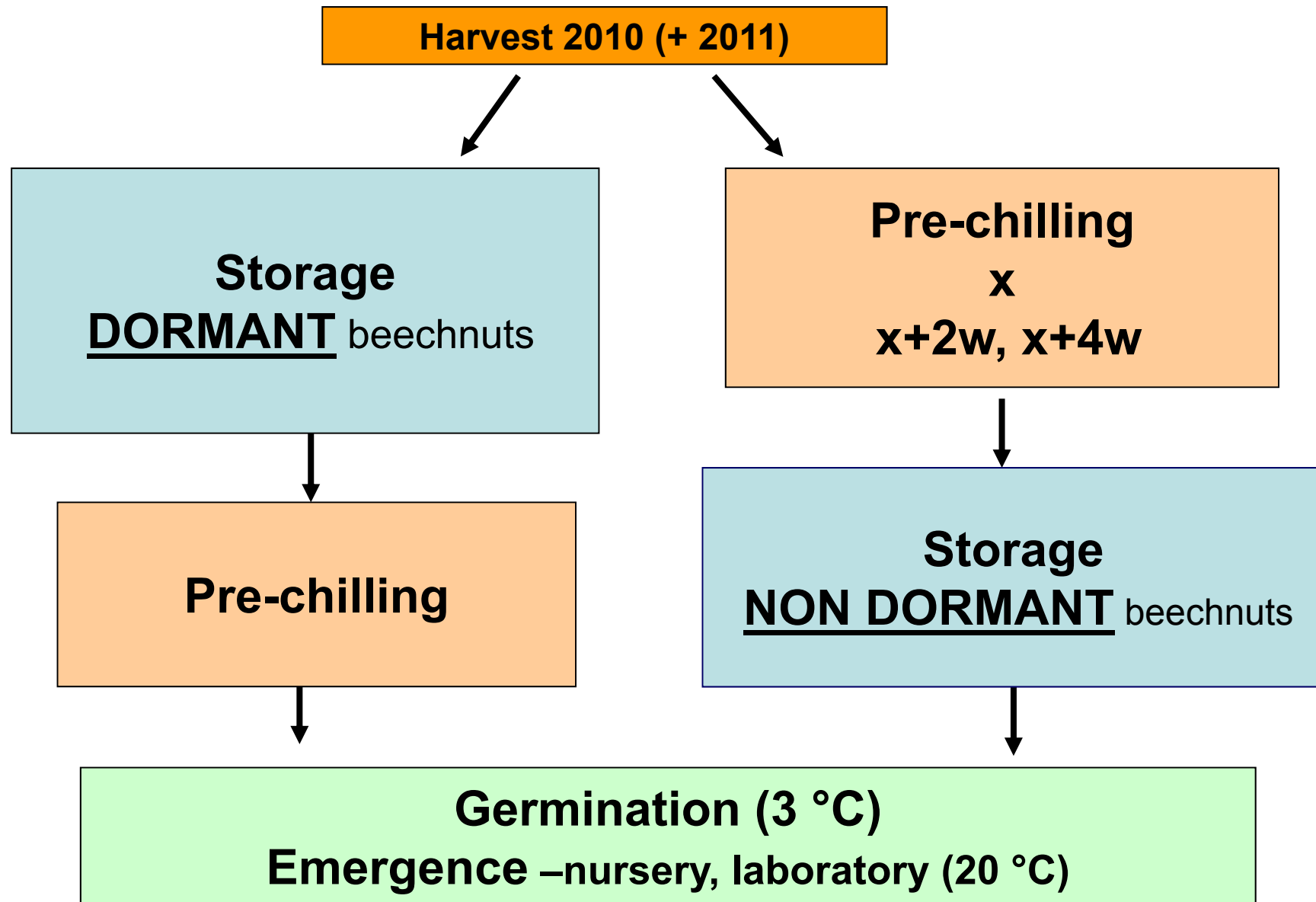
x = 9 / 11 weeks



Different dormancy – harvest 2011

x = 14 / 15 / 16 weeks („deeper“ dormancy)



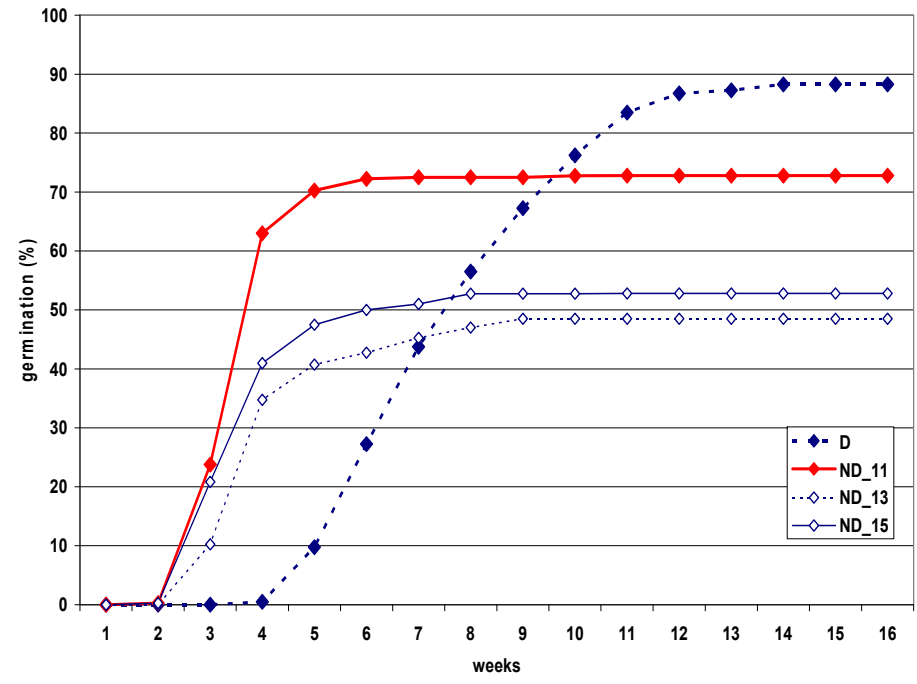
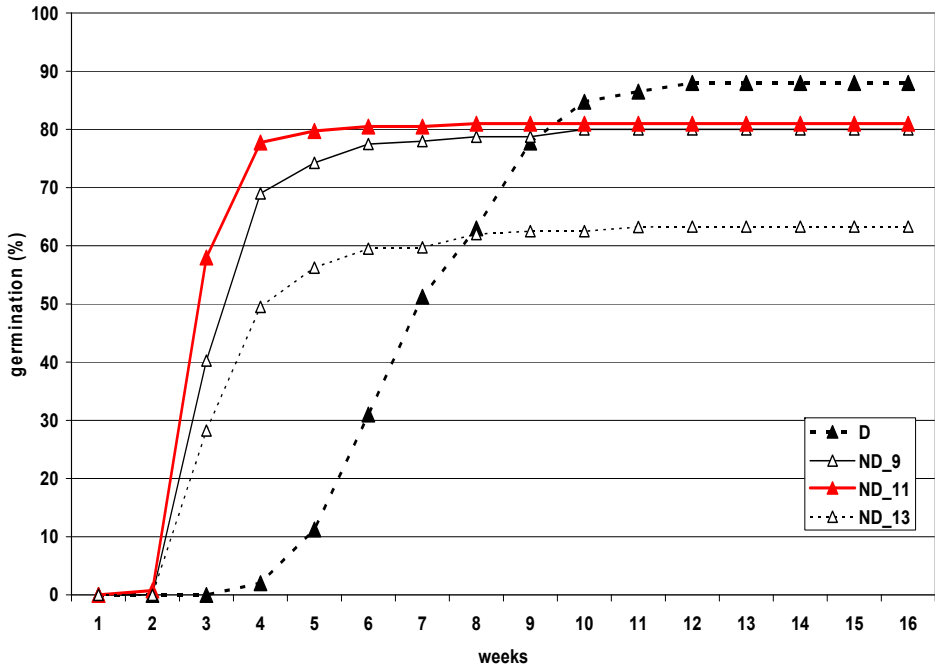
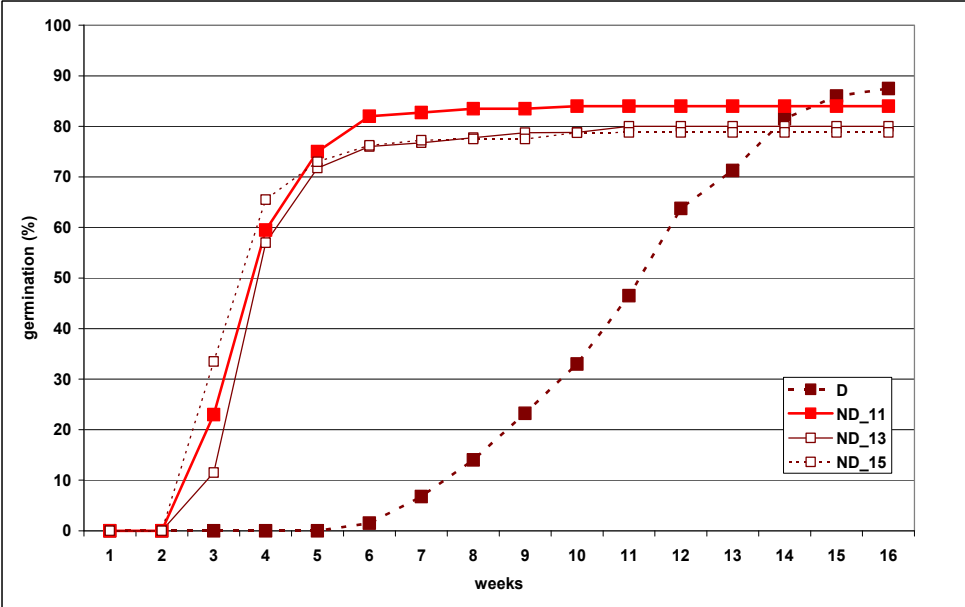


Germination at 3 °C

Harvest 2010

Dormant stored 7 m

Non dormant stored 3.5-5 m

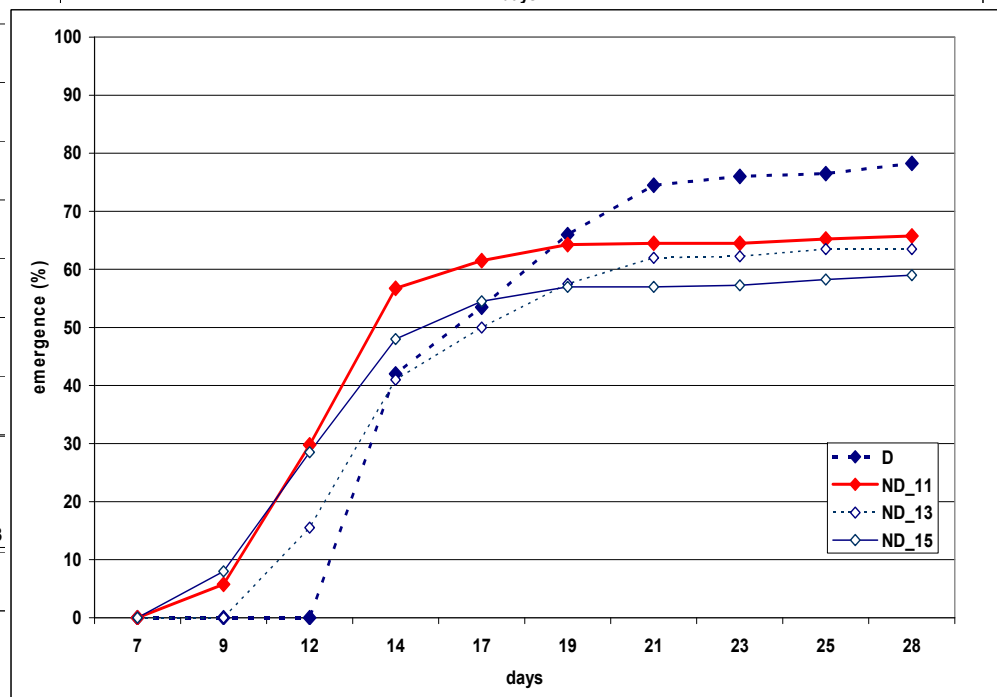
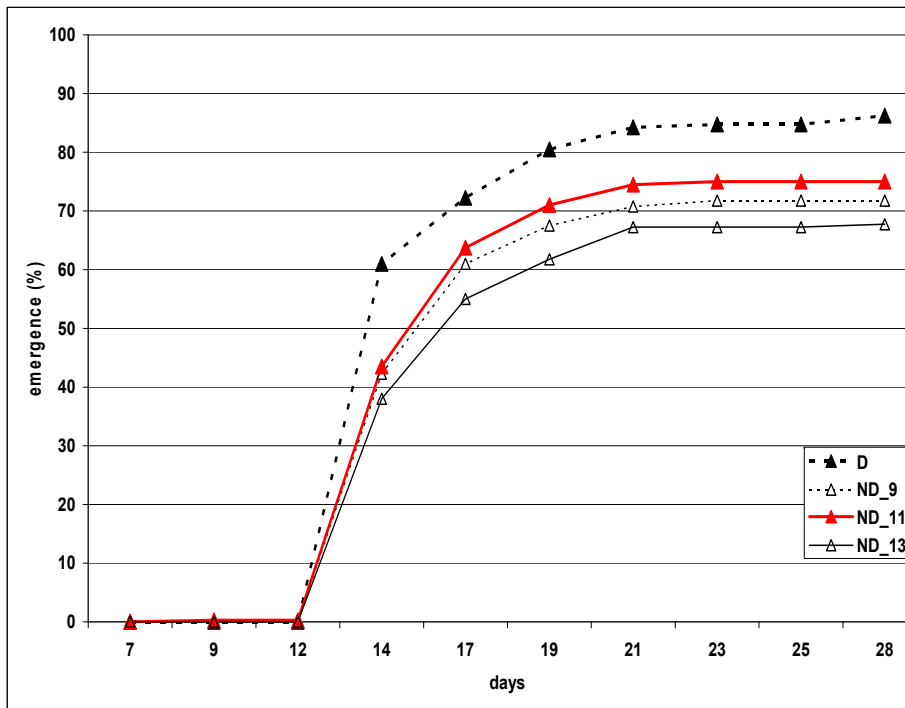
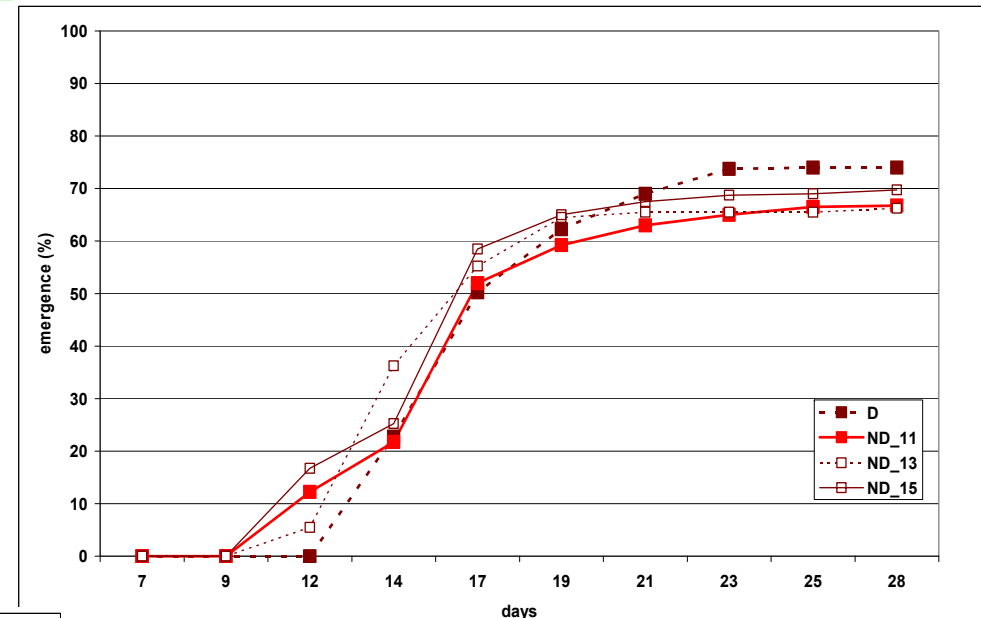


Emergence at 20 °C

Harvest 2010

Dormant stored 7 m

Non dormant stored 3.5-5 m

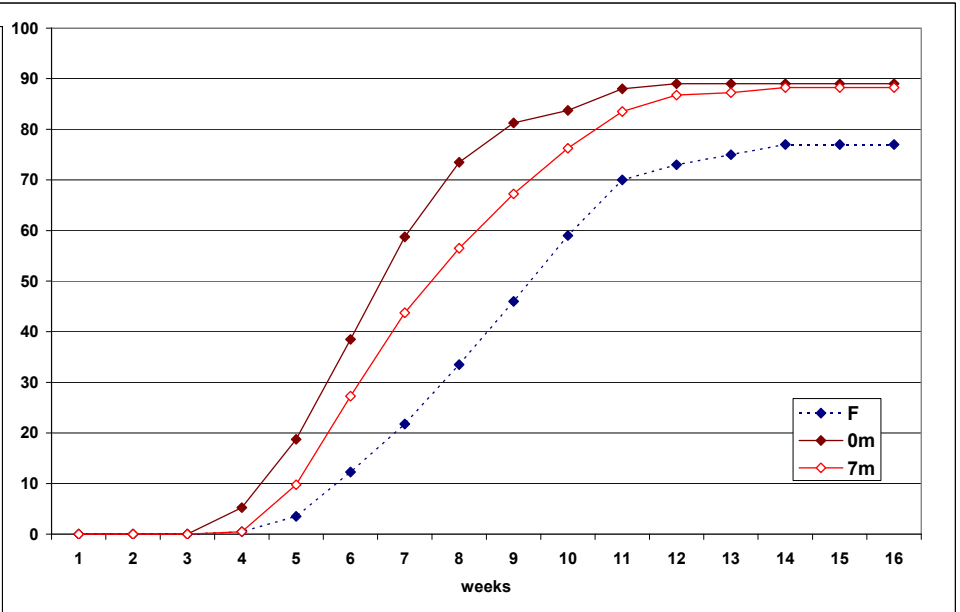
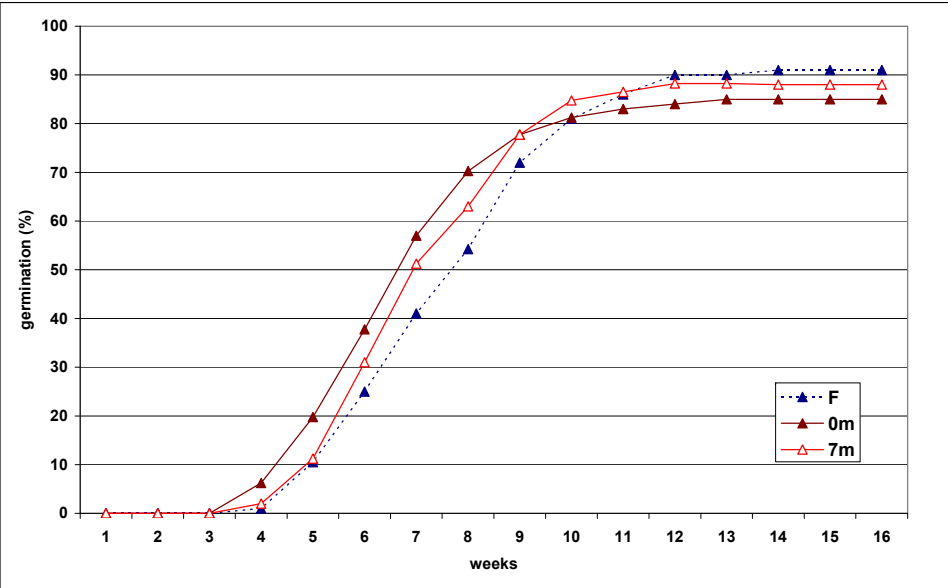
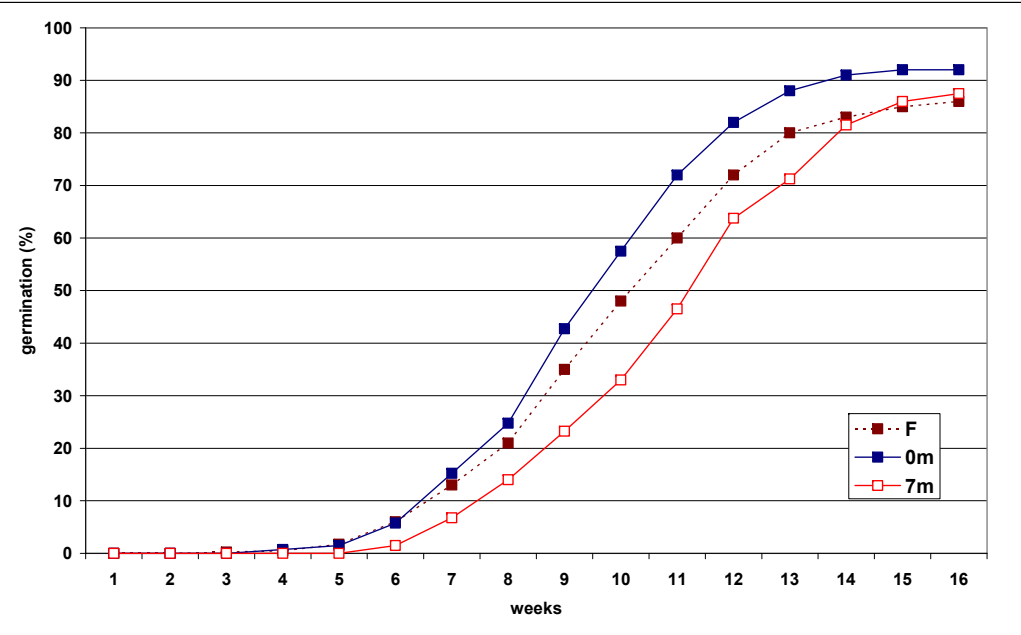


Germination at 3 °C

Harvest 2010

Dormant Fresh (no storage)

Dormant stored 0 m, 7 m
(10% MC)

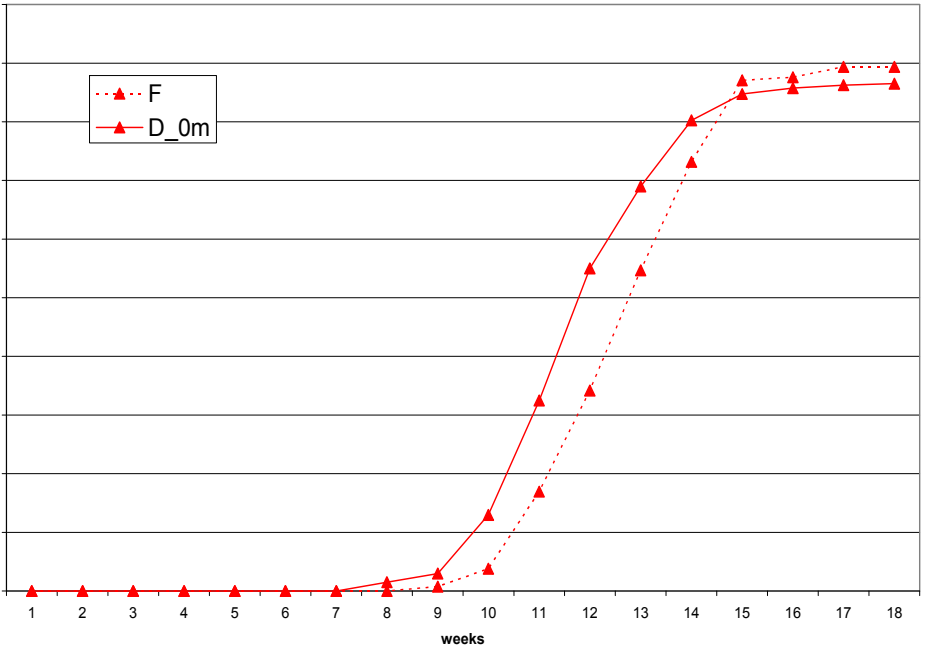
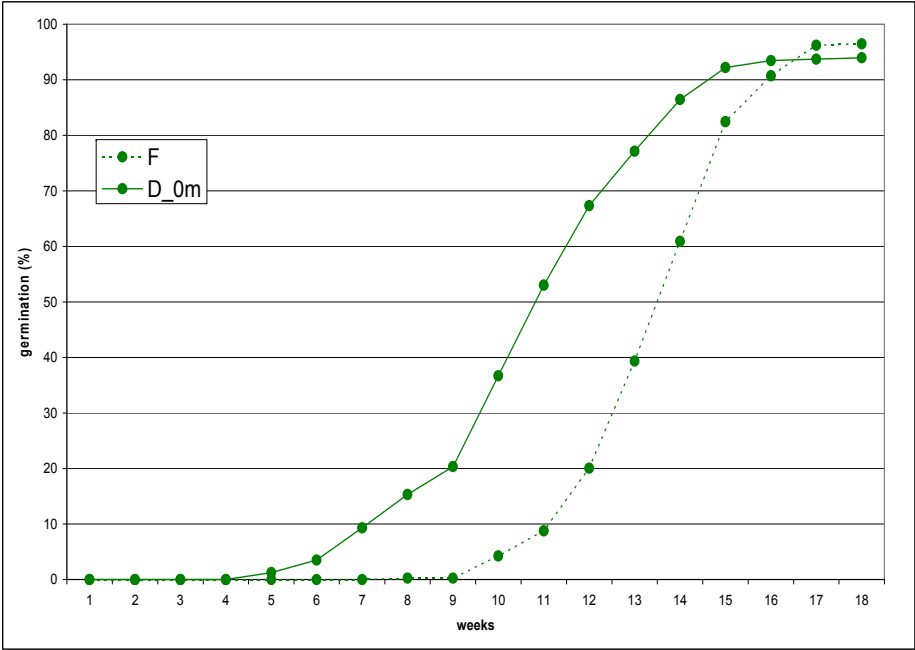
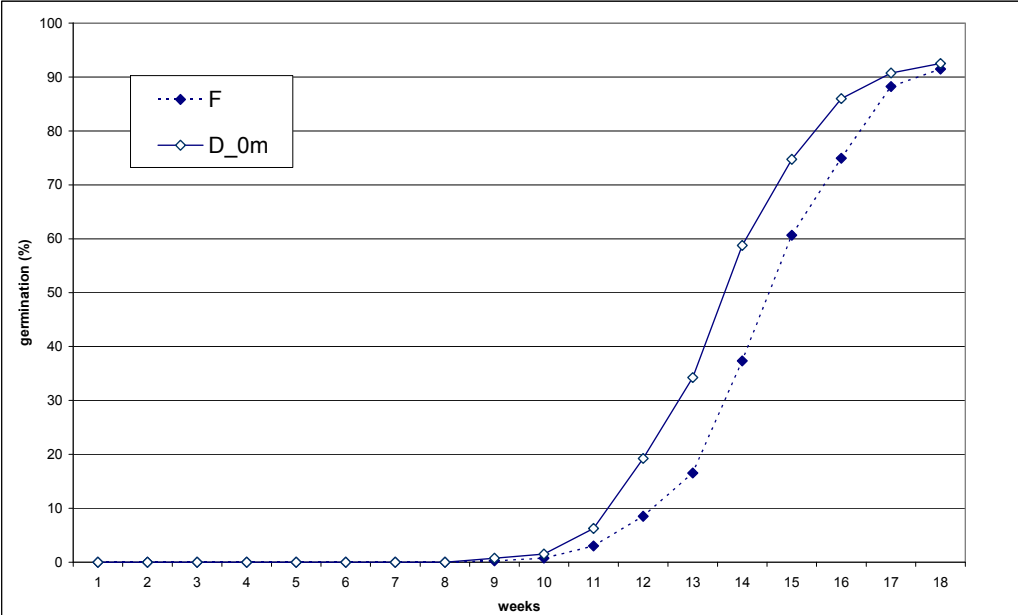


Germination at 3 °C

Harvest 2011

Dormant Fresh (no storage)

Dormant Dried stored 0 m



Conclusion

Pre-chilling after harvest varies by crop / seed lots

Drying speeds up germination by few weeks

Storage slows down germination

Seasonal changes in viability, germination capacity and germination rate

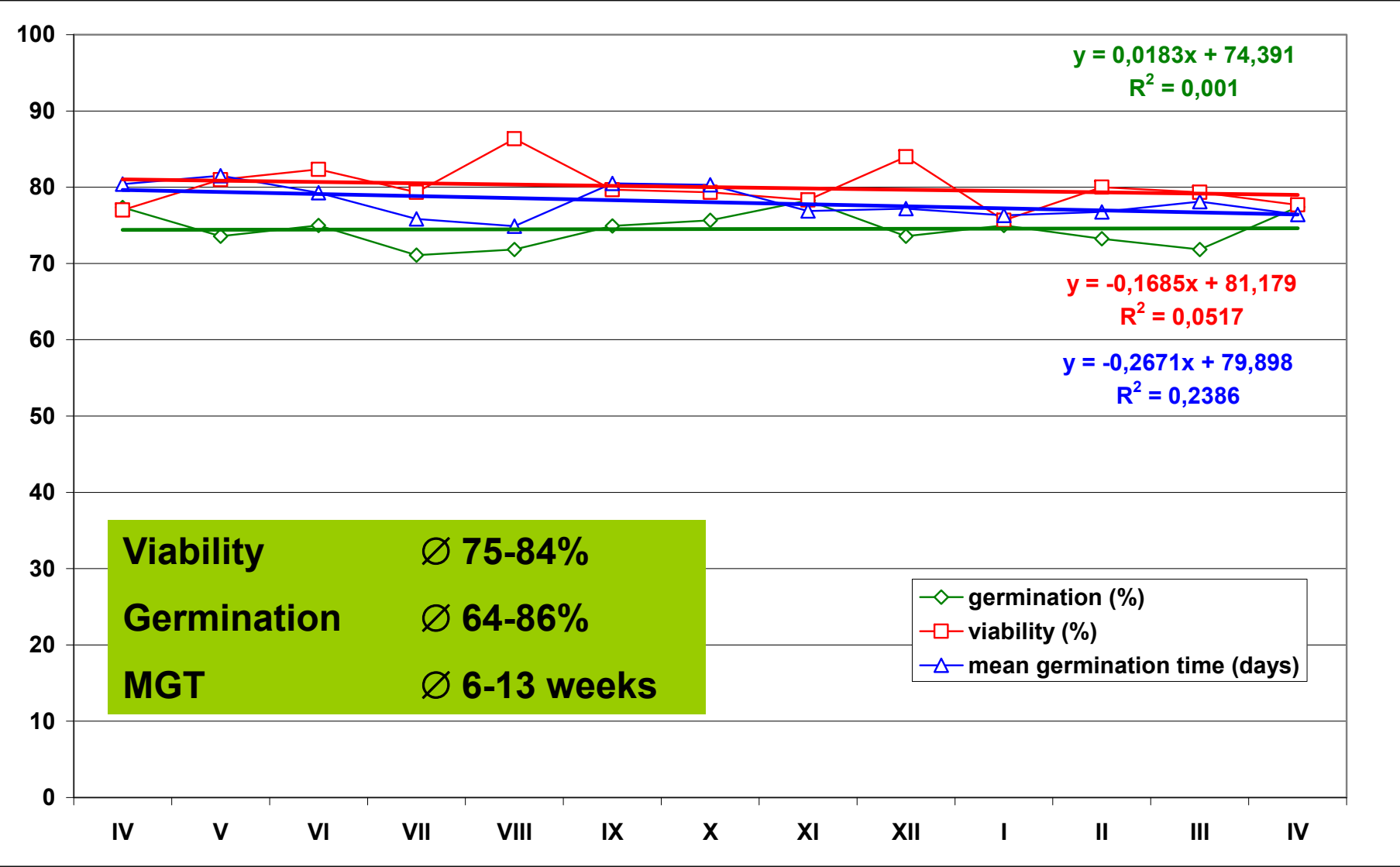
Material and methods

6 seed lots (crop 2009, 2010)

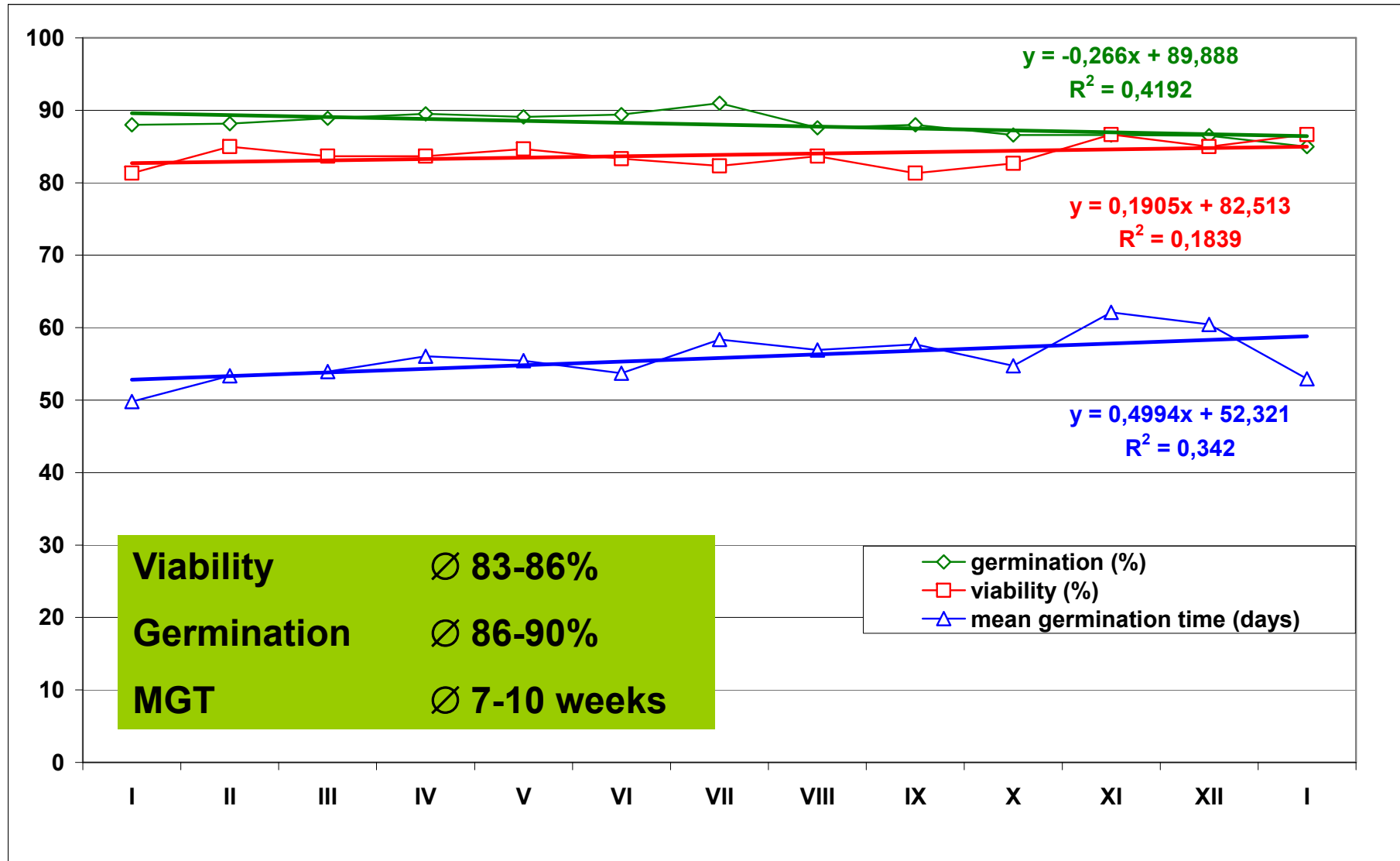
High, medium, low quality (viability + germination)

Viability and germination determined monthly

Seasonal changes in viability, germination capacity / rate harvest 2009



Seasonal changes in viability, germination capacity / rate harvest 2010



Conclusion

No consistent seasonal fluctuation in germination, germination rate and viability of the beechnuts was observed in the tests

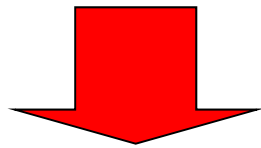
There were determined differences in germination, speed of germination and viability of stored dormant beech seeds done monthly

Among important factors that might influence the reliability of the repeated test seem to be initial seed quality (namely germination and dormancy)

Effect of harvest area size and locality on beechnut (*Fagus sylvatica*) germination: early results

Objective

Determine the effect of harvest area size and locality on germination (capacity and rate) of beechnuts

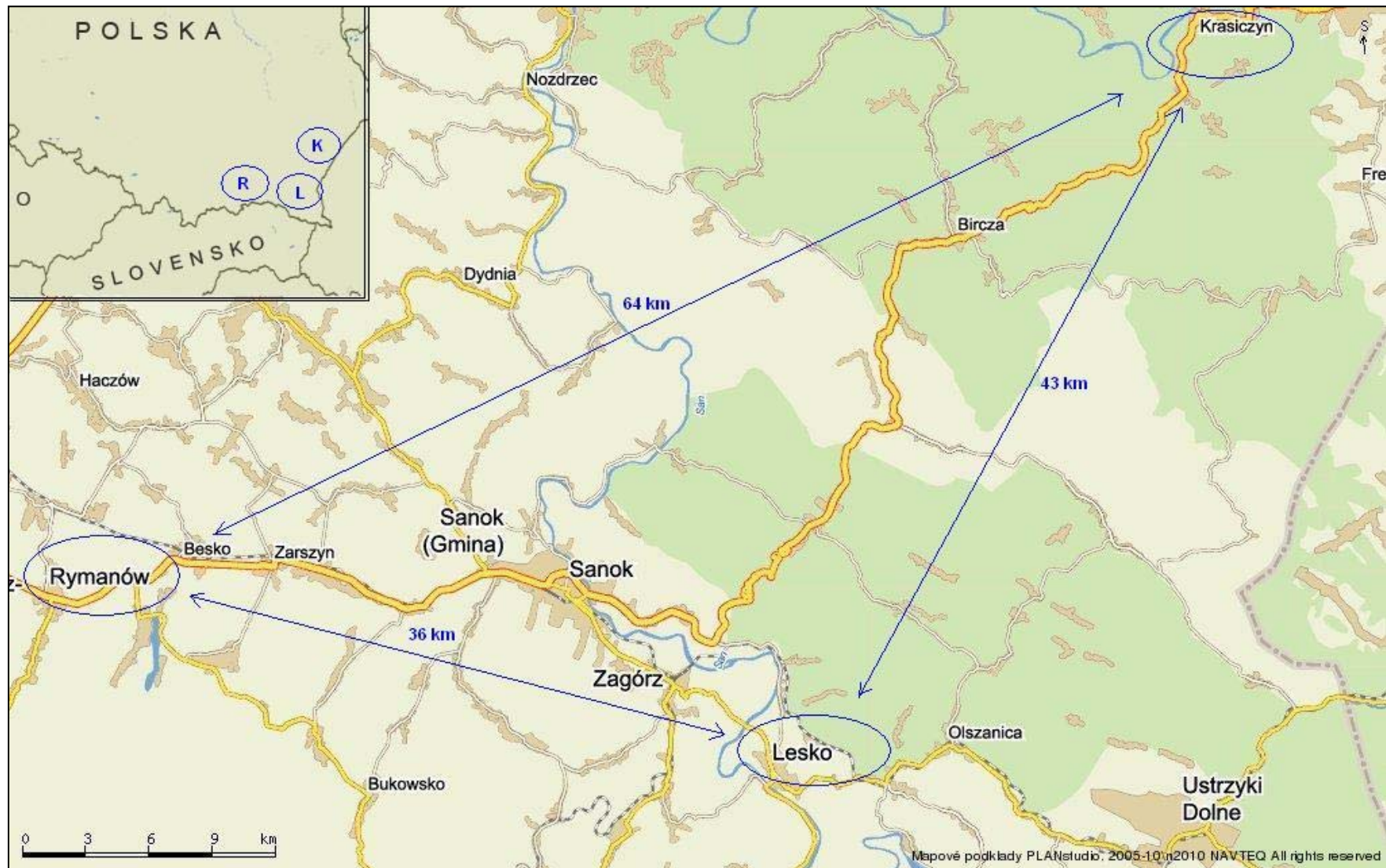


Evaluate the relation between dormancy and germination of beechnuts collected in stands with different climate conditions that are located within the same unit of approval (UA)

Material and methods

Collection 2010

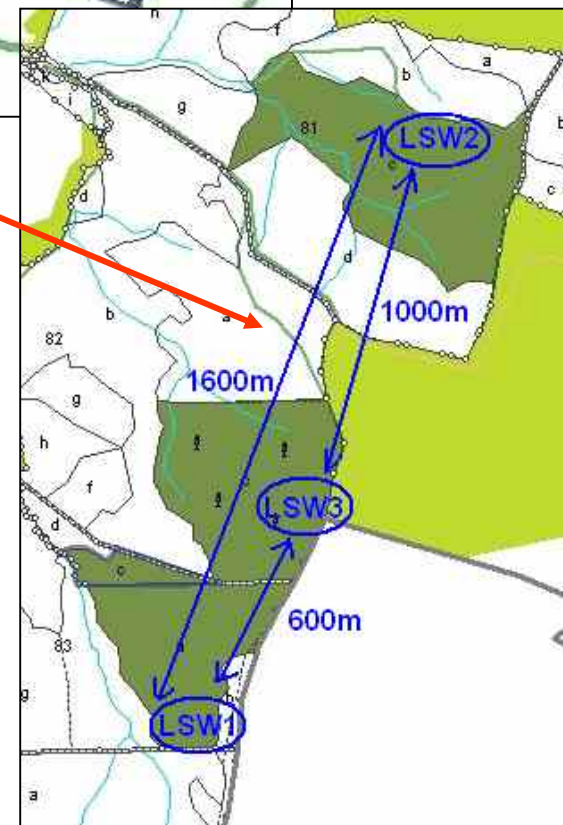
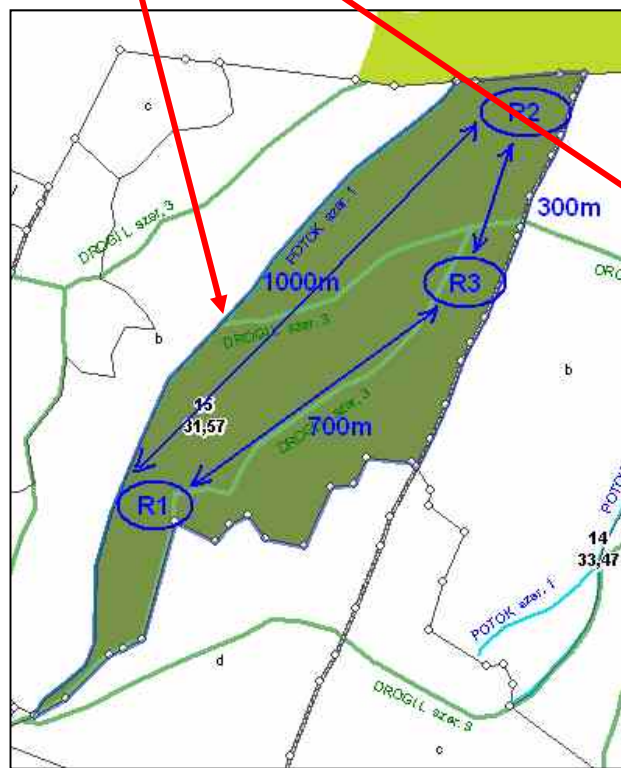
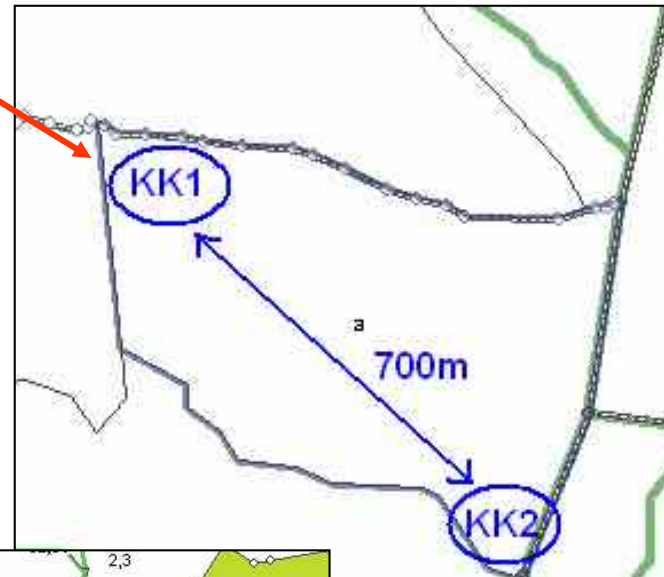
early October to early November

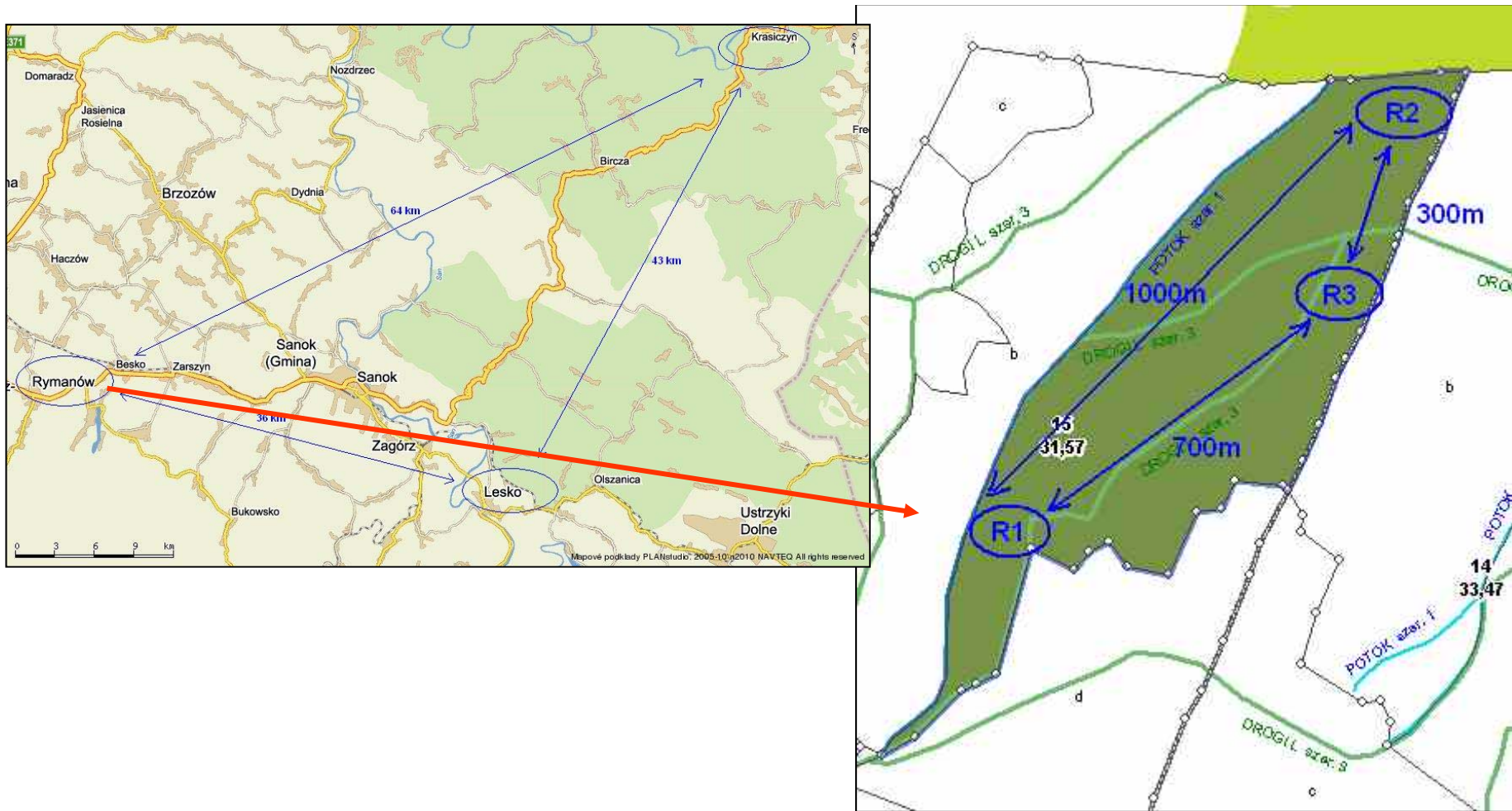




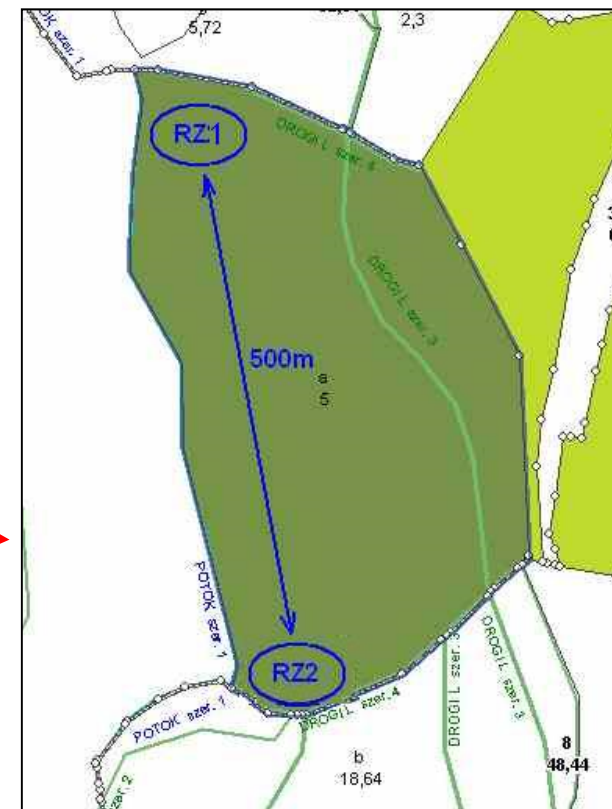
early September 2010



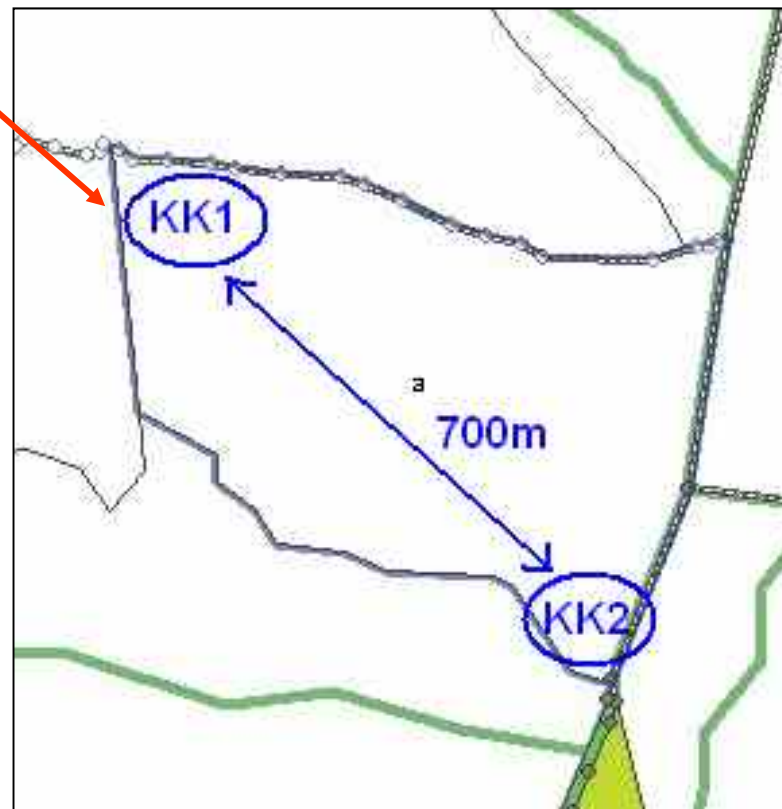




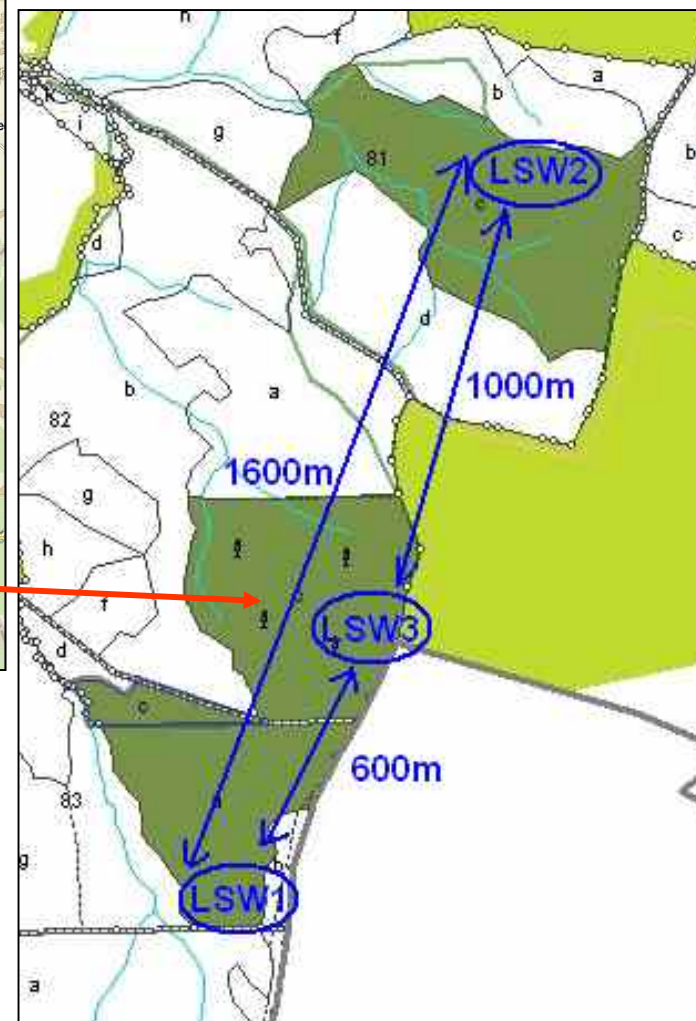
	Area (ha)	Exposition	Age (years)	Altitude (m a. s.)	Harvest		
					site	date	mast
Rymanow	11.00	NE	117/137	370	R1	3.-10. 11. 2010	medium
				330	R2		
				355	R3		



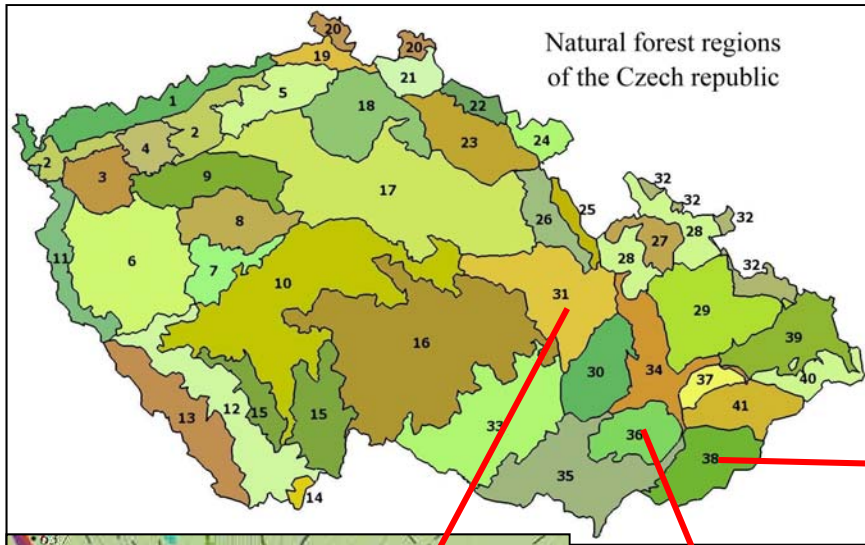
	Area (ha)	Exposition	Age (years)	Altitude (m a. s.)	Harvest		
					site	date	mast
Rymanow Zarszynska	5.00	W	117	360	RZ1	3.-10. 11. 2010	medium
					RZ2		



	Area (ha)	Exposition	Age (years)	Altitude (m a. s.)	Harvest		
					site	date	mast
Krasieczyn-Korytniki	10.48	NW	42/72/141	320	KK1	21.10.2010	good
				365	KK2		

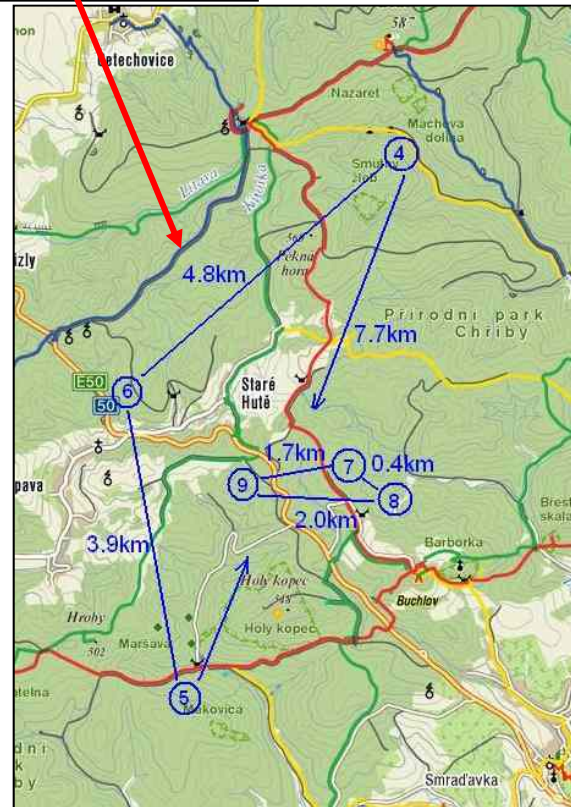
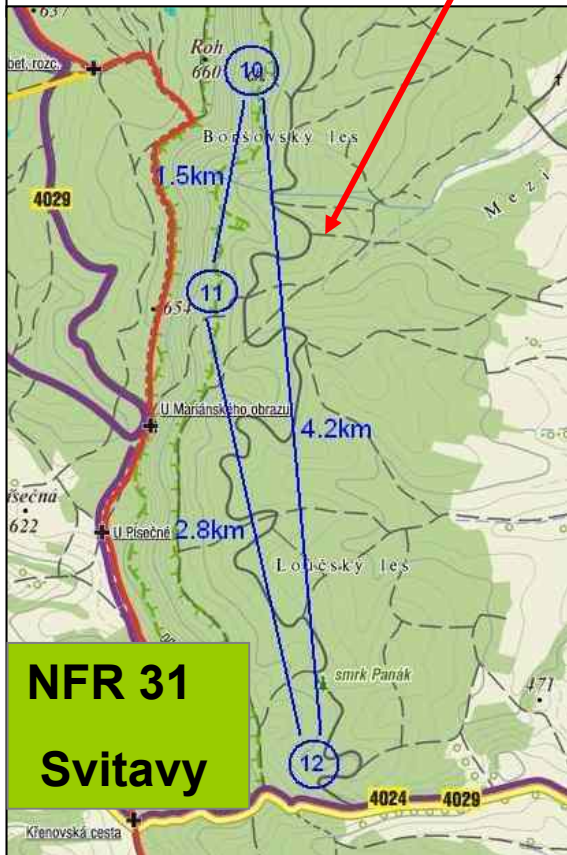


	Area (ha)	Exposition	Age (years)	Altitude (m a. s.)	Harvest		
					site	date	mast
Lesko-Srednie Wielkie	9.1	W	66/91/126	510	LSW1	11.10. 2010	good
	16.0		66/91/111	515	LSW2		
	12.7	NW		540	LSW3		



Collection 2011

mid October to mid November



NFR 38 Luhačovice

NFR 36 Buchlovice

Collection from mid October to mid November

Minimum 5 trees (50-100 m area around data loggers)



Samples from harvest sites within the UA
Mixed sample

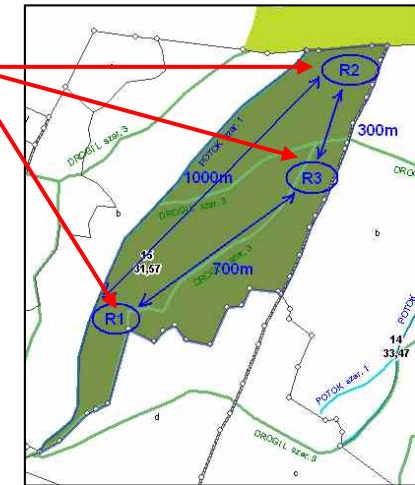
Air temperature and humidity

Moisture content

1,000 seed weight

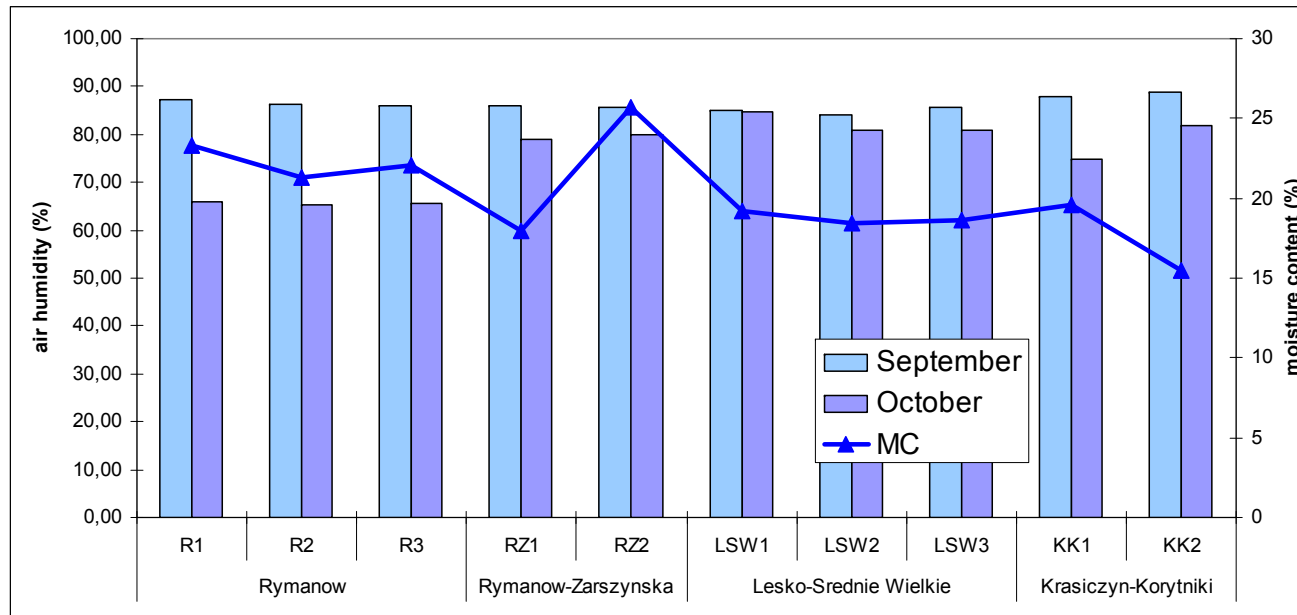
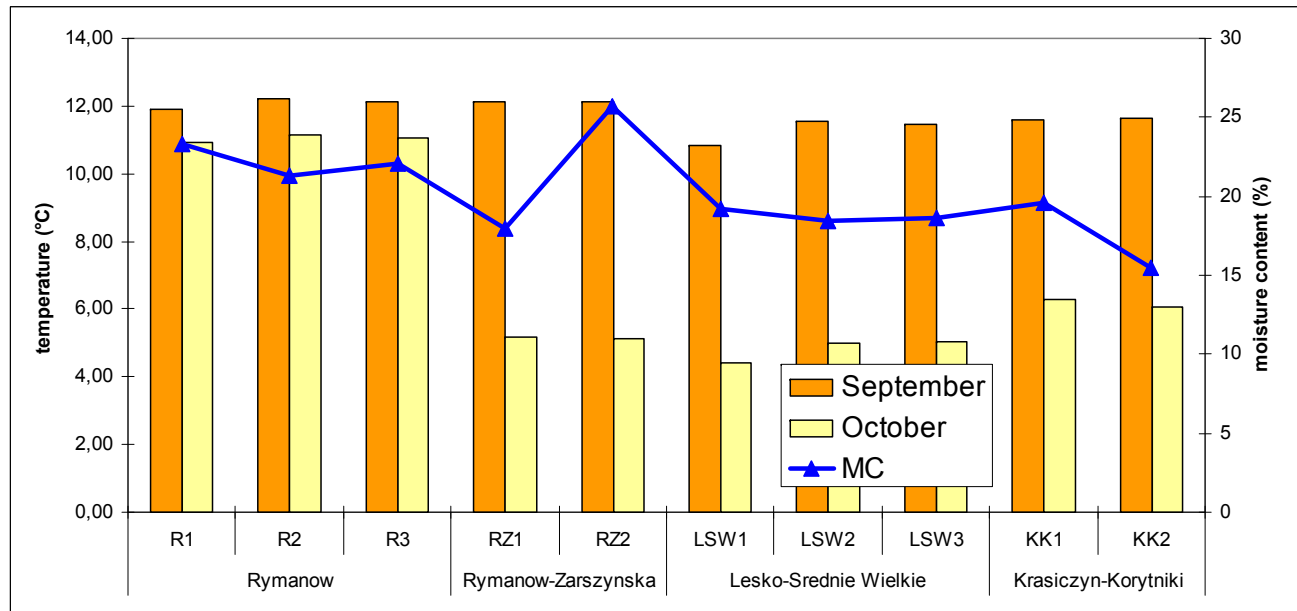
Viability

Germination



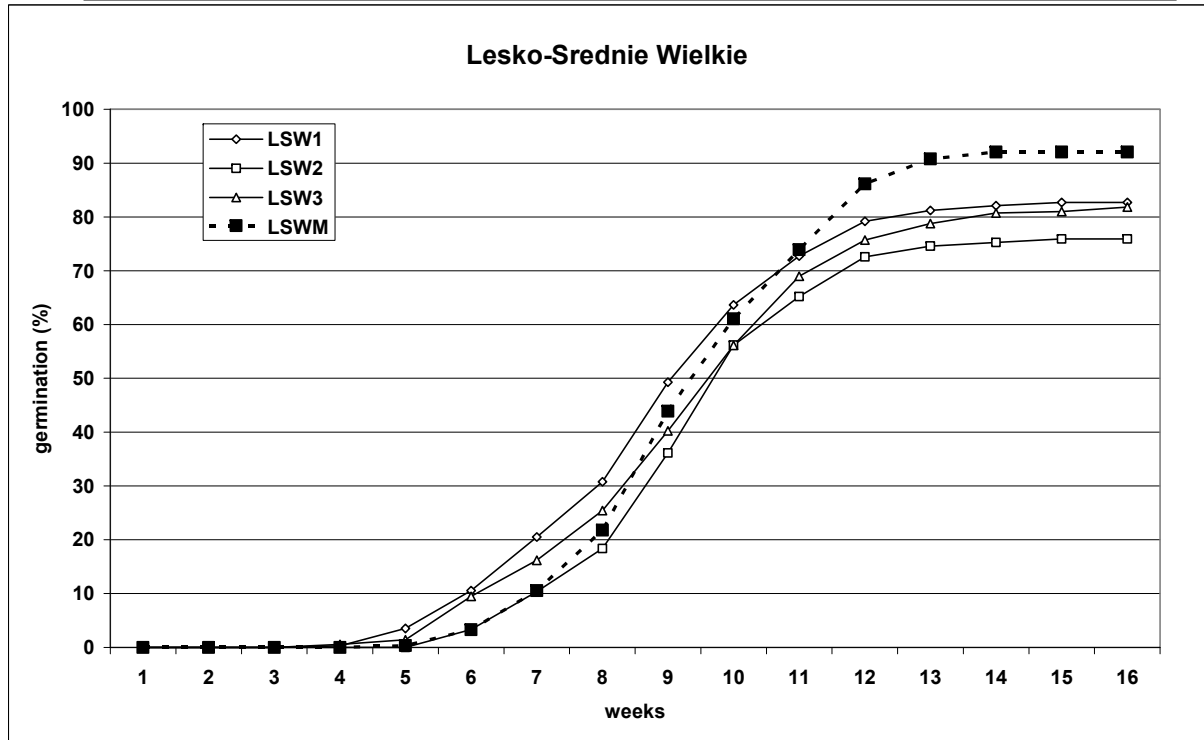
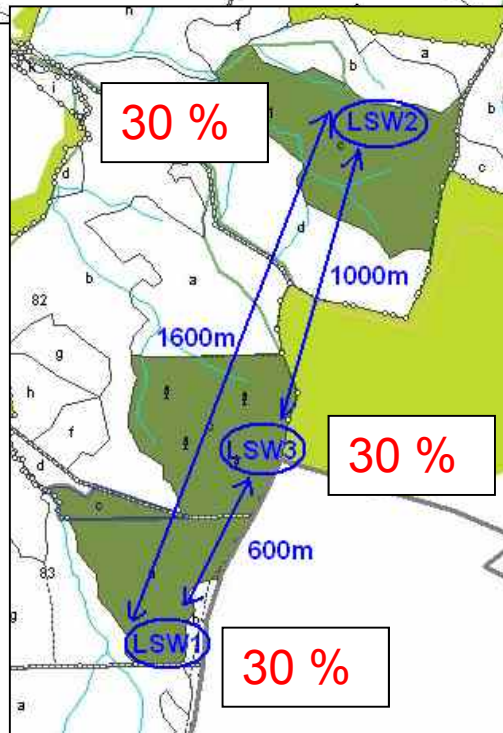
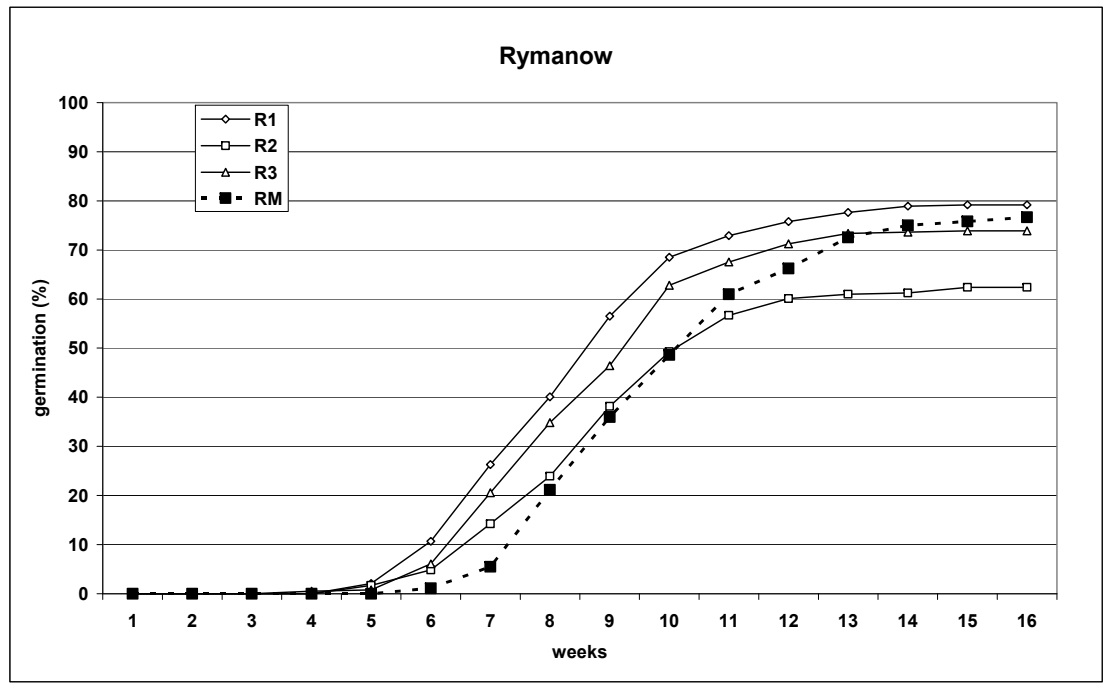
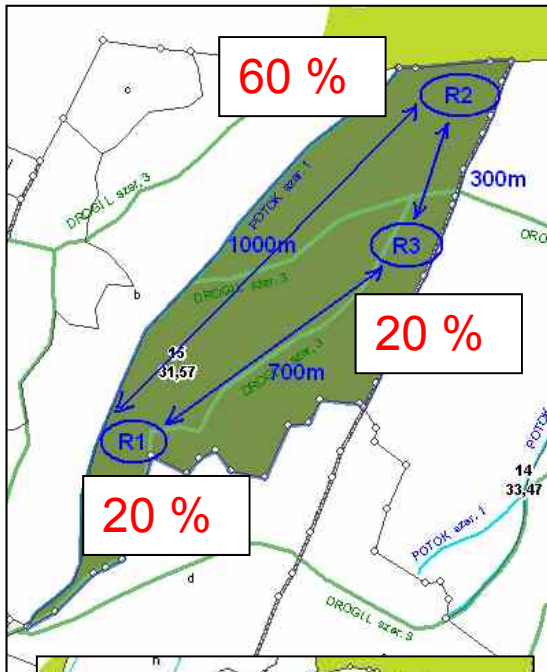
Results

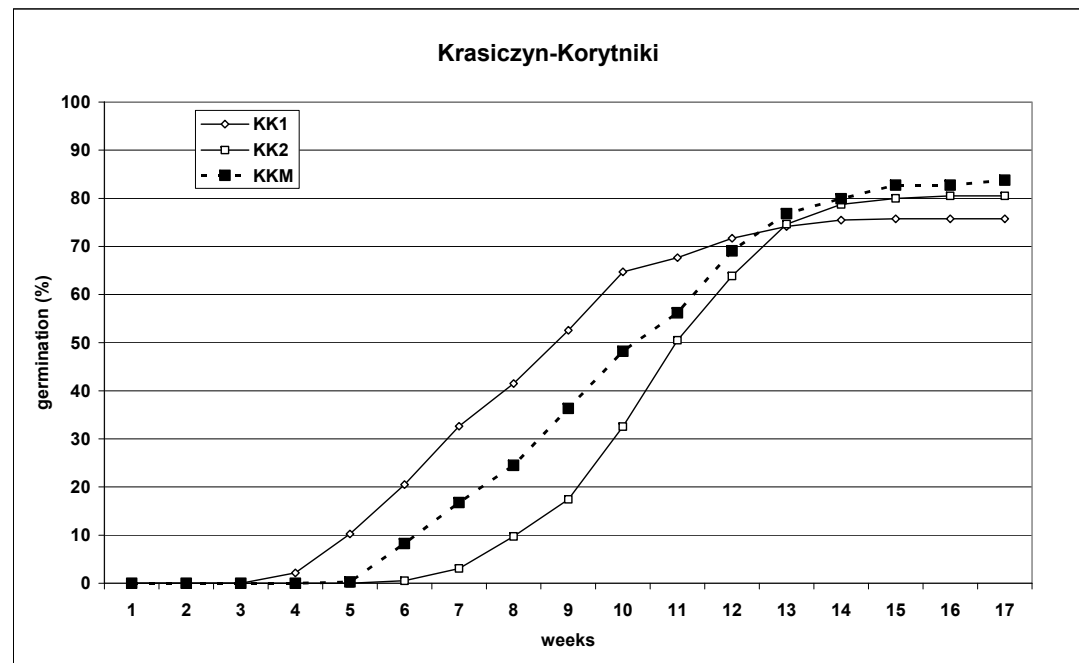
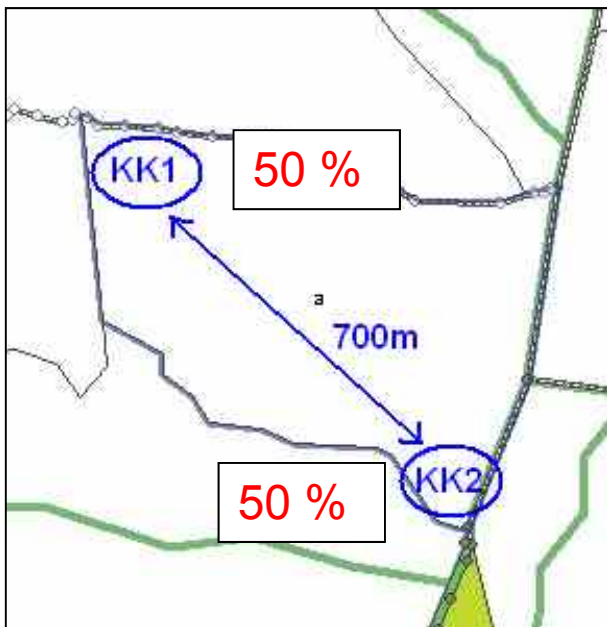
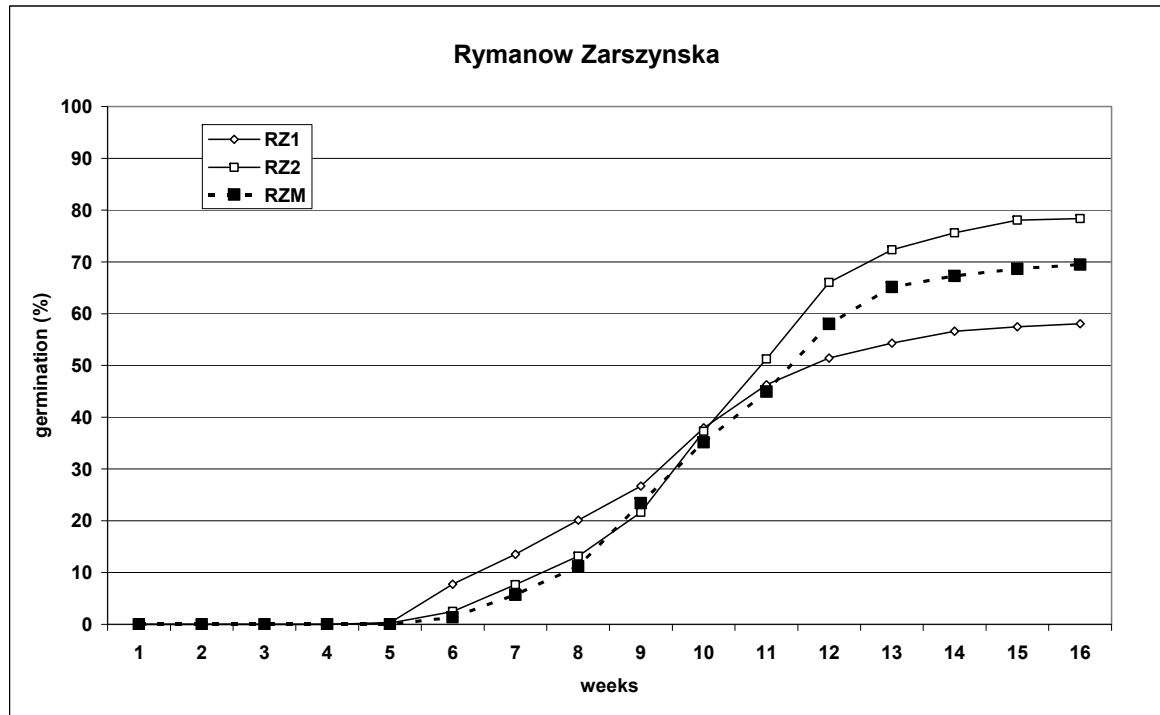
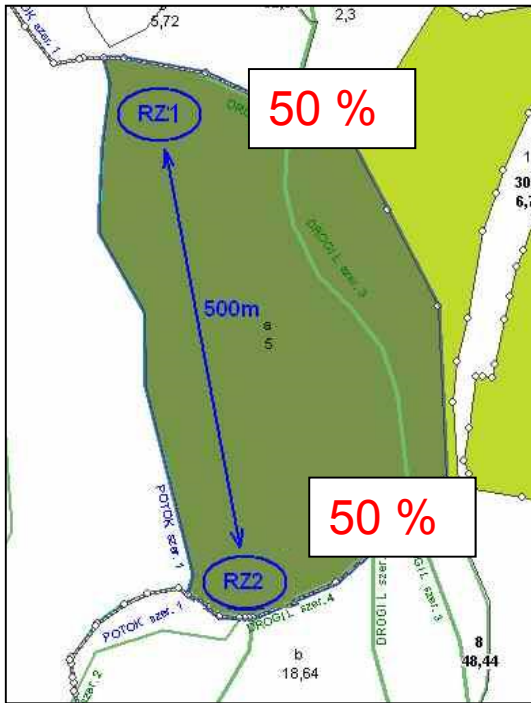
Harvest
2010



Results harvest 2010

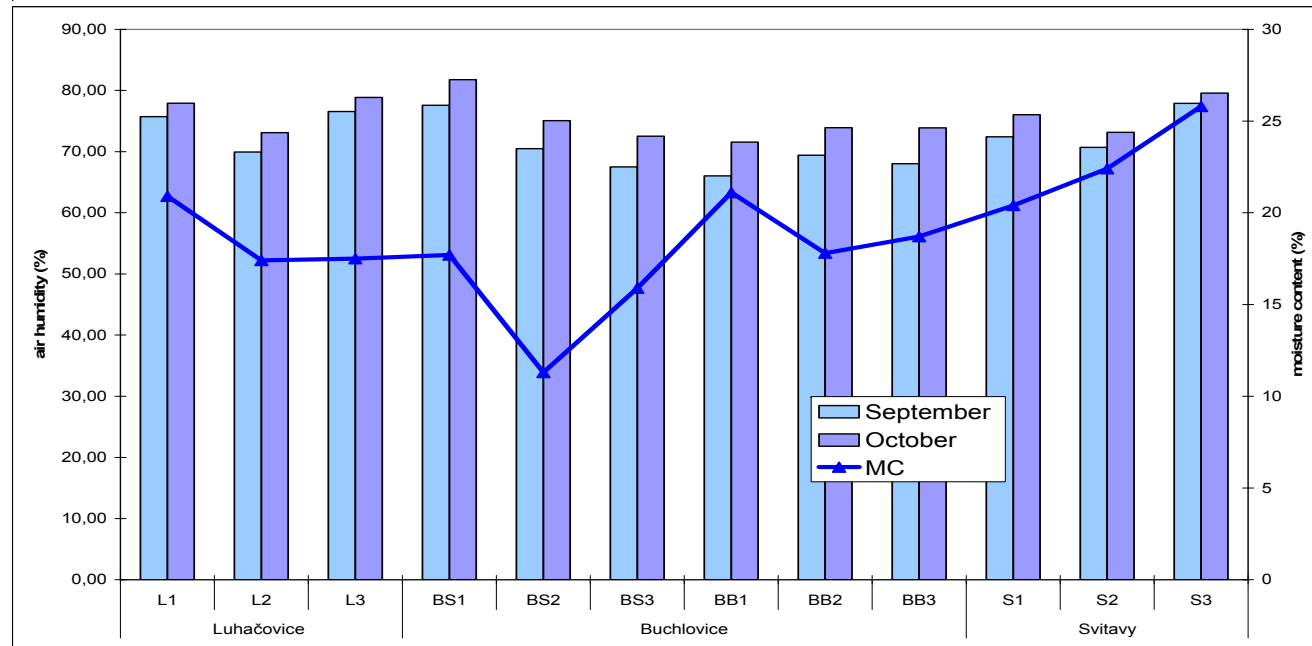
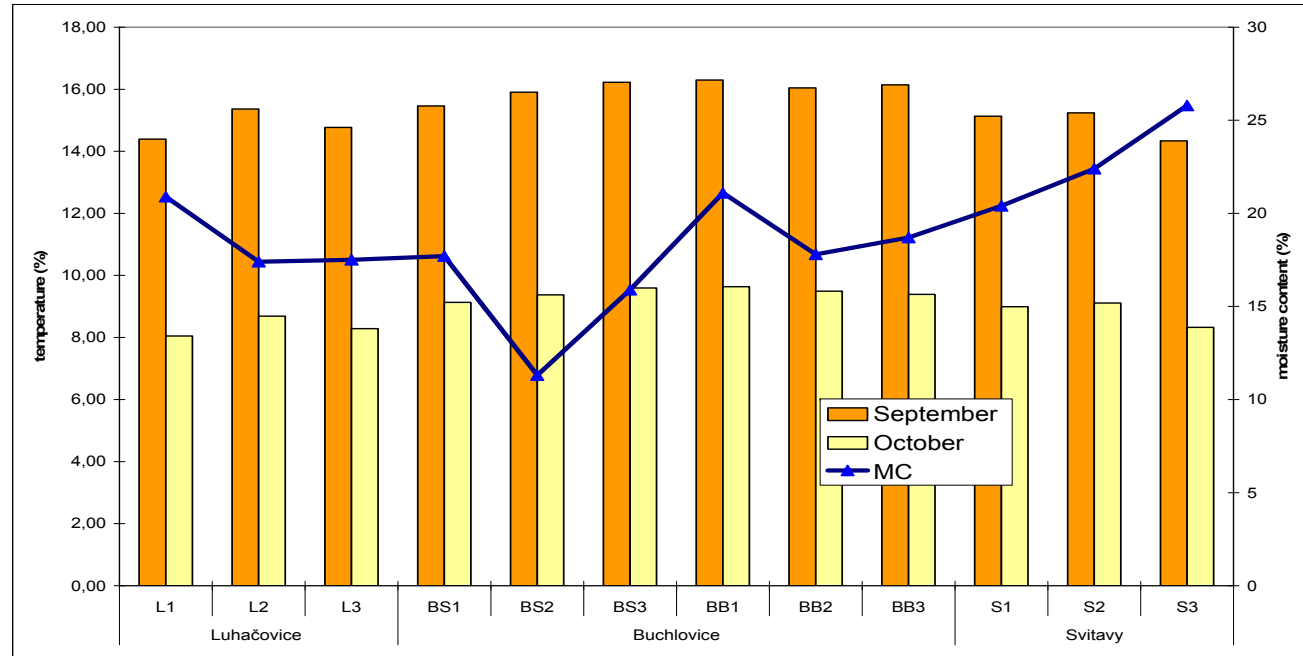
Locality	Harvest site (seed lot designation)	Moisture content (%)	1000 seeds weight (g)	Viability (%)	Germination (%)	Mean germination time (days)	Seed lot weight (g)	Proportion of seed lots (%)
Rymanow	R1	23,3	289.2b	71a	79b	58a	196.9	19
	R2	21,3	263.0ab	64a	62a	56a	630.6	61
	R3	22,1	283.8b	66a	77b	56a	209.5	20
	RM	n	225.7a	71a	76ab	65b	1037.0	100
Rymanow Zarszynska	RZ1	18,0	249.8b	76a	58a	58a	257.8	46
	RZ2	25,7	262.1b	76a	78b	67b	304.6	54
	RZM	n	232.9a	74a	70ab	65ab	562.4	100
Lesko- Srednie Wielkie	LSW1	19,2	224.4b	69ab	83ab	54a	674.9	33
	LSW2	18,4	205.6a	61a	76a	50a	687.2	34
	LSW3	18,6	227.2b	76b	82ab	59a	683.1	33
	LSWM	n	218.4ab	69ab	92b	52a	2045.0	100
Krasieczyn- Korytniki	KK1	19,6	276.7b	70a	79a	52a	766.2	50
	KK2	15,5	256.1a	81b	81a	73b	764.6	50
	KKM	n	268.3b	81b	84a	68b	1530.8	100



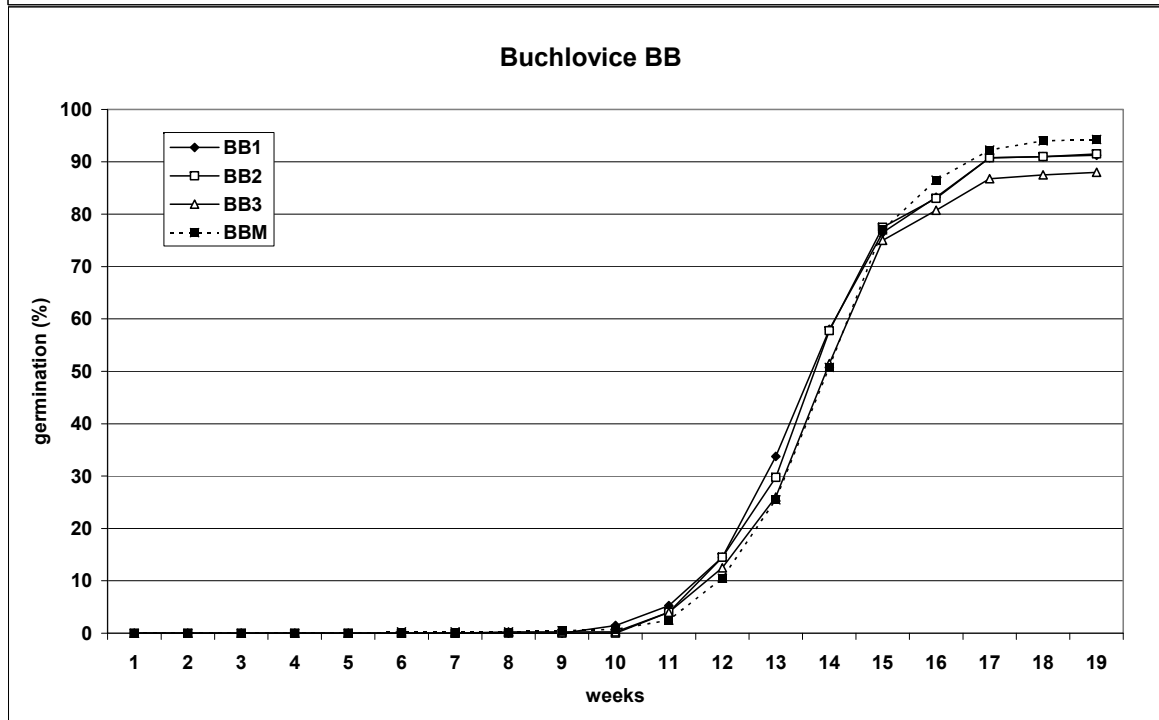
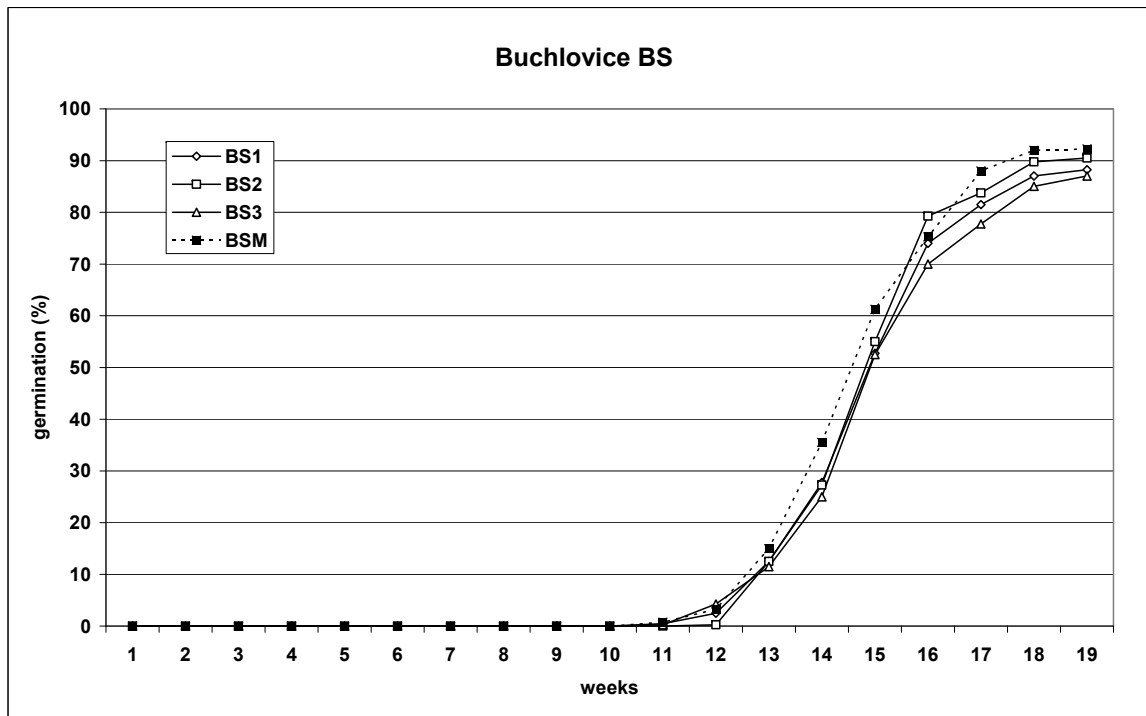


Results

Harvest
2011



Results harvest 2011



Germination

BS1-3 90 – 91%

BSM 93%

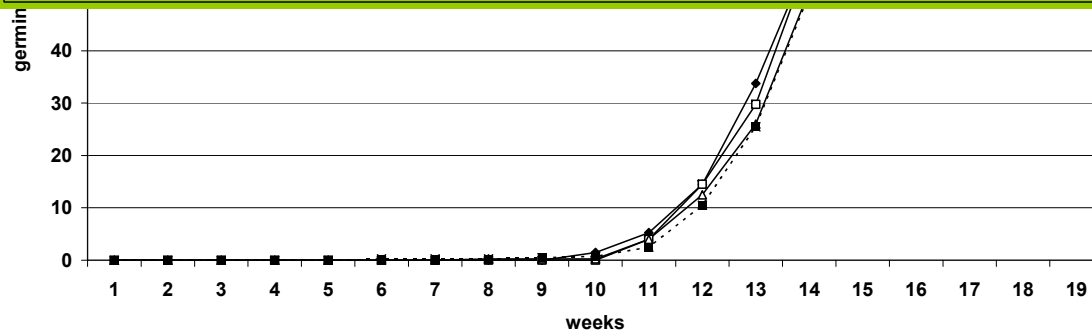
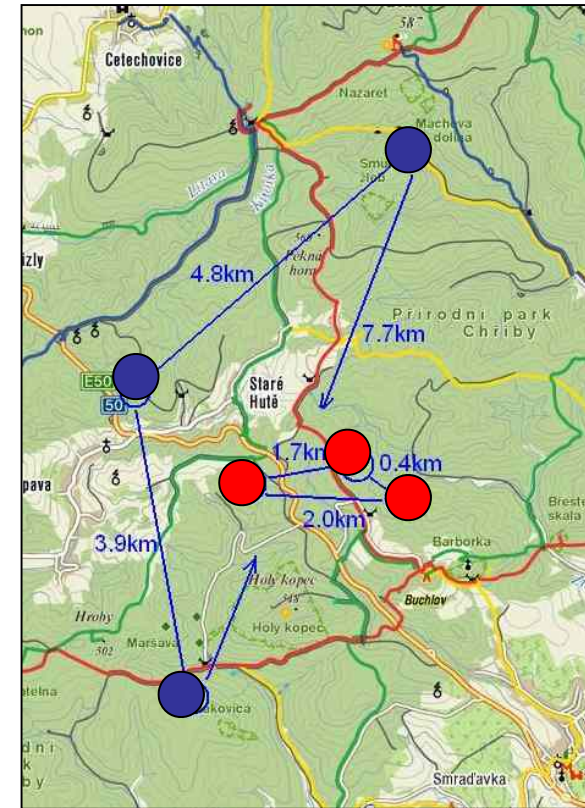
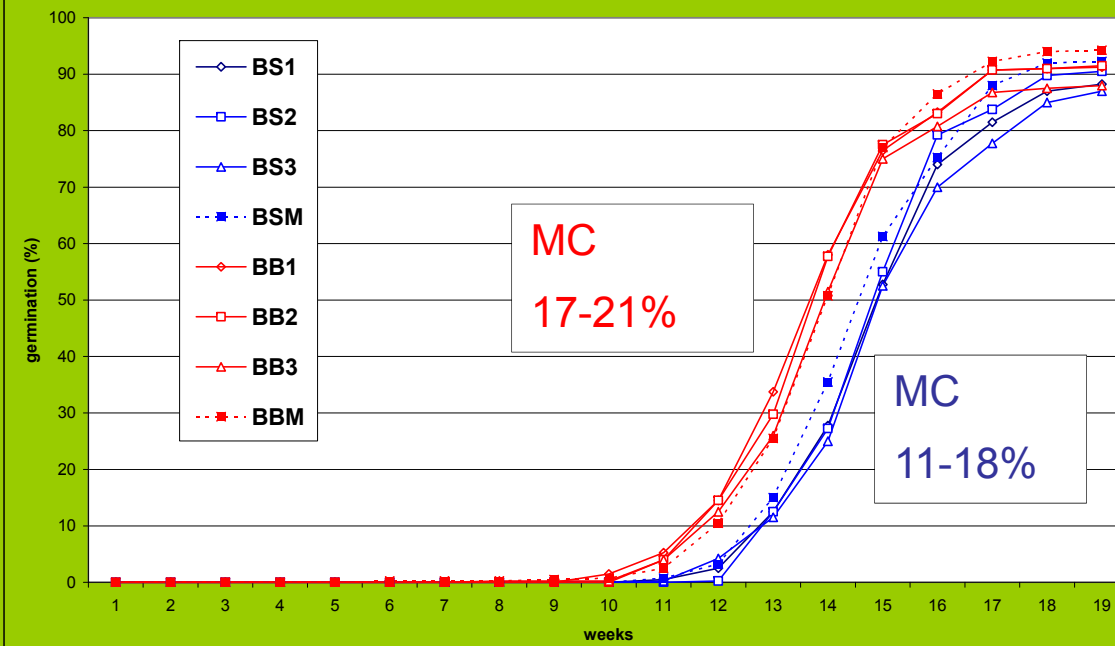
BB 1-3 90 – 92%

BBM 95%

Buchlovice BS

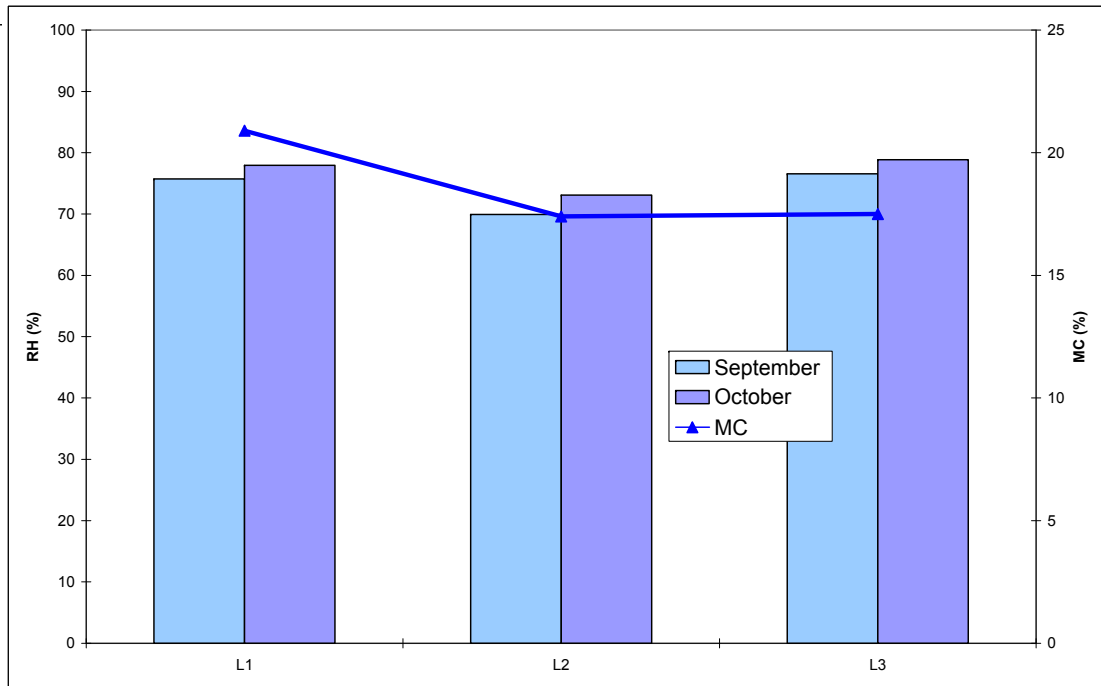
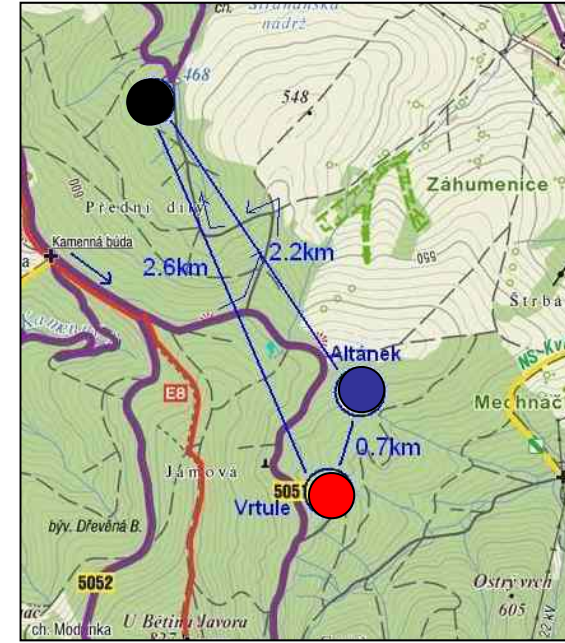
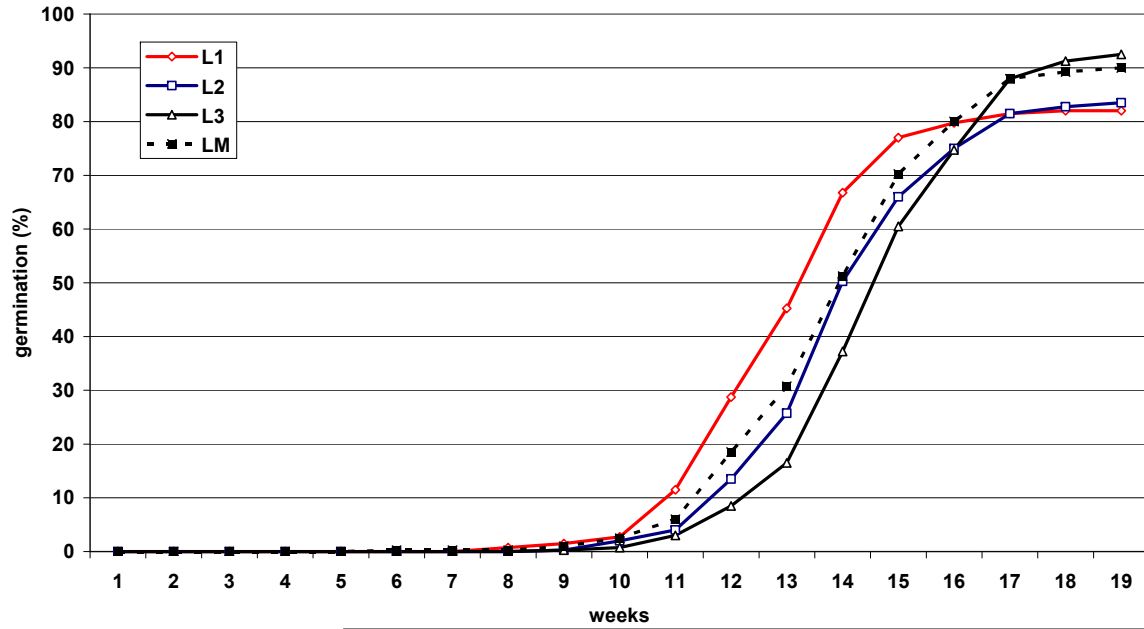


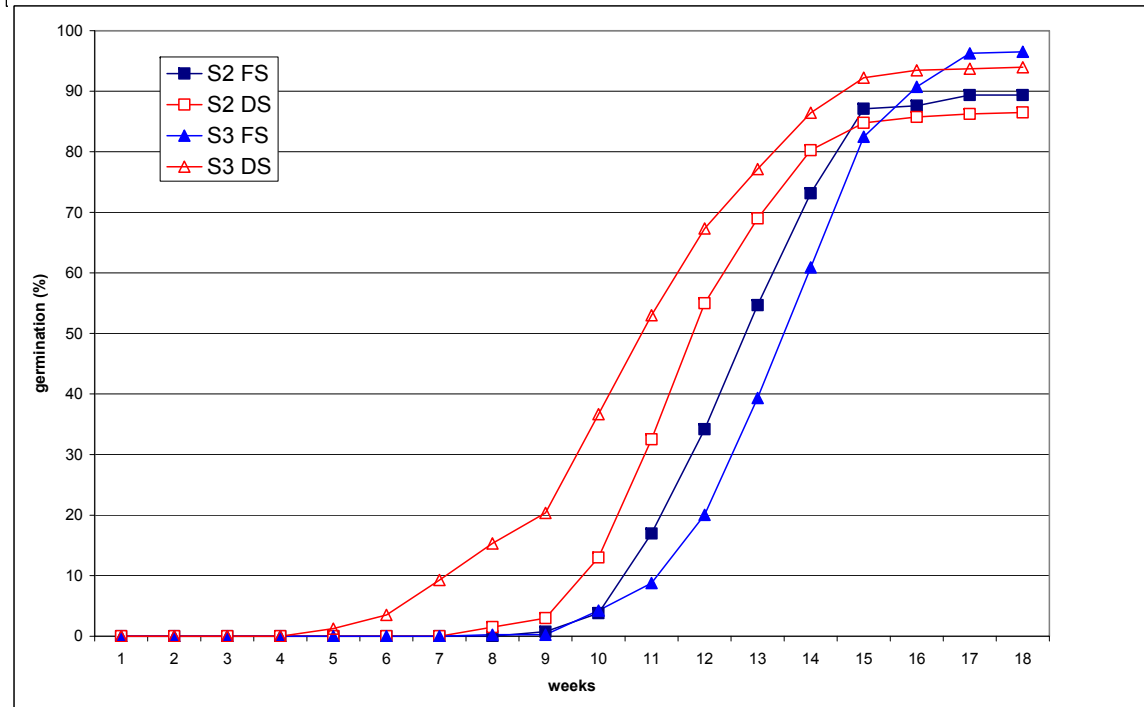
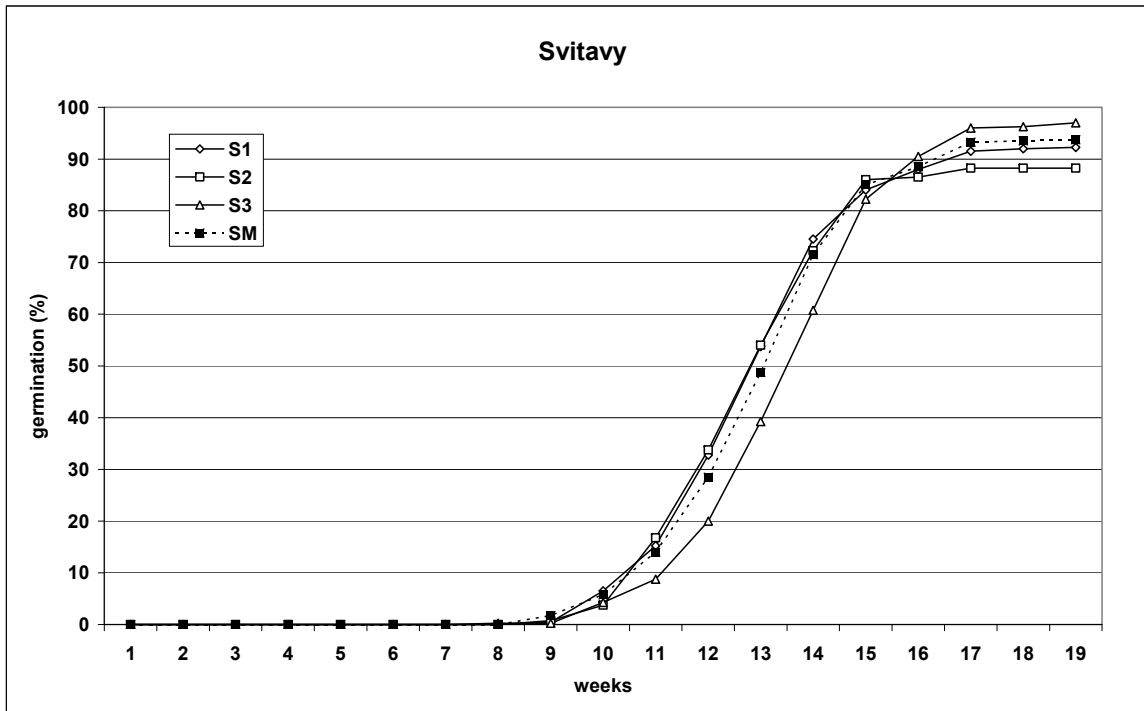
Buchlovice



Different speed of germination (dormancy release)

Luhačovice





Dried seeds germinate earlier than Fresh seeds

Conclusions

Beechnuts collected from different harvest sites within large areas (UA) can

- reached significantly different germination
- show different levels of dormancy expressed by different speed of germination

Germination capacity and germination speed of mixed samples can differ from the original sub-lots

Beechnut seed lots collected from a large area can show high heterogeneity in germination and dormancy, and this can significantly affect uniformity of pre-sowing treatment and emergence in nurseries

Acknowledgements



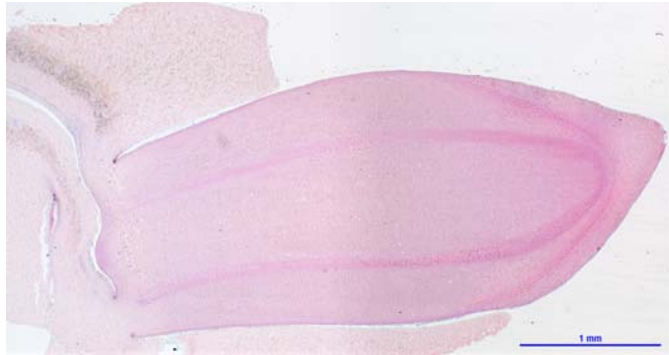
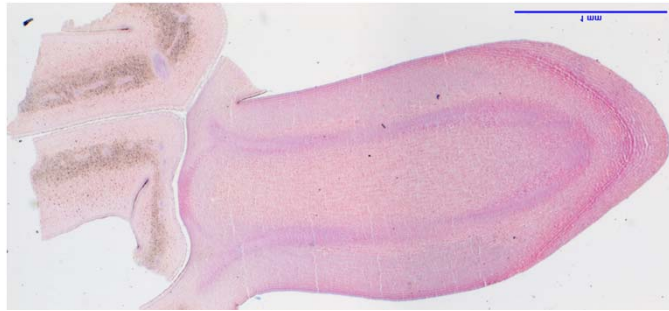
We are grateful to Polish foresters for their kind cooperation and assistance in beechnut harvest



ABA content, dormancy and anatomical structure of beechnuts

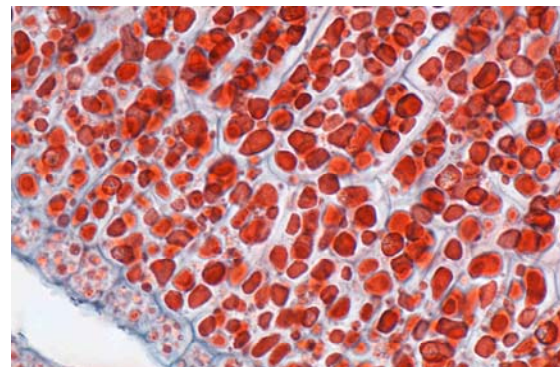
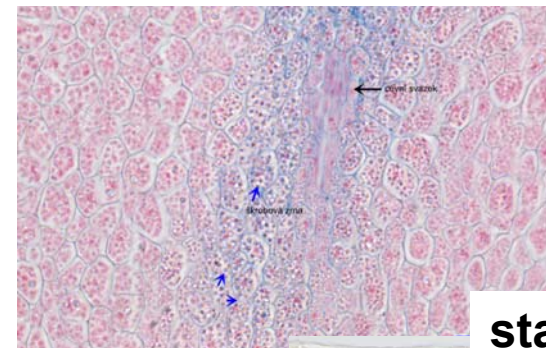
Institute of Experimental Botany, Academy of Science
Z. Vondráková, K. Eliášová, B. Pešek, M. Vágner, J.
Špačková

Anatomical structure of dormant beechnuts after harvest

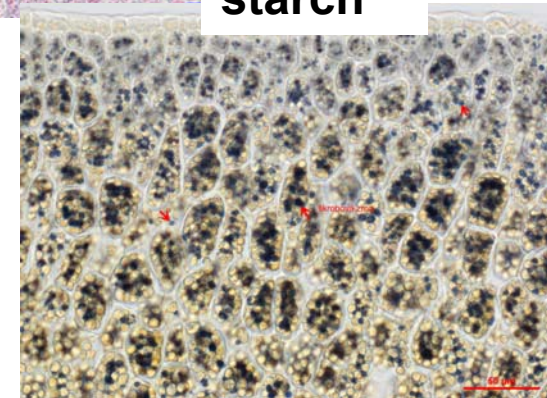


No significant difference in structure of dormant beechnuts from different seed lots

Cotyledons contain storage matters (starch, proteins, fat corpuscles, calcium oxalate crystals)



Vacuoles with storage proteins



ABA and IAA in dormant and non dormant beechnuts


3 seed lots

Dormant seeds

Non Dormant seeds

MC 10%

3 x 10 seeds

embryonic axis (EA)  2% of whole embryo (E)

cotyledons (C)  98% of whole embryo (E)

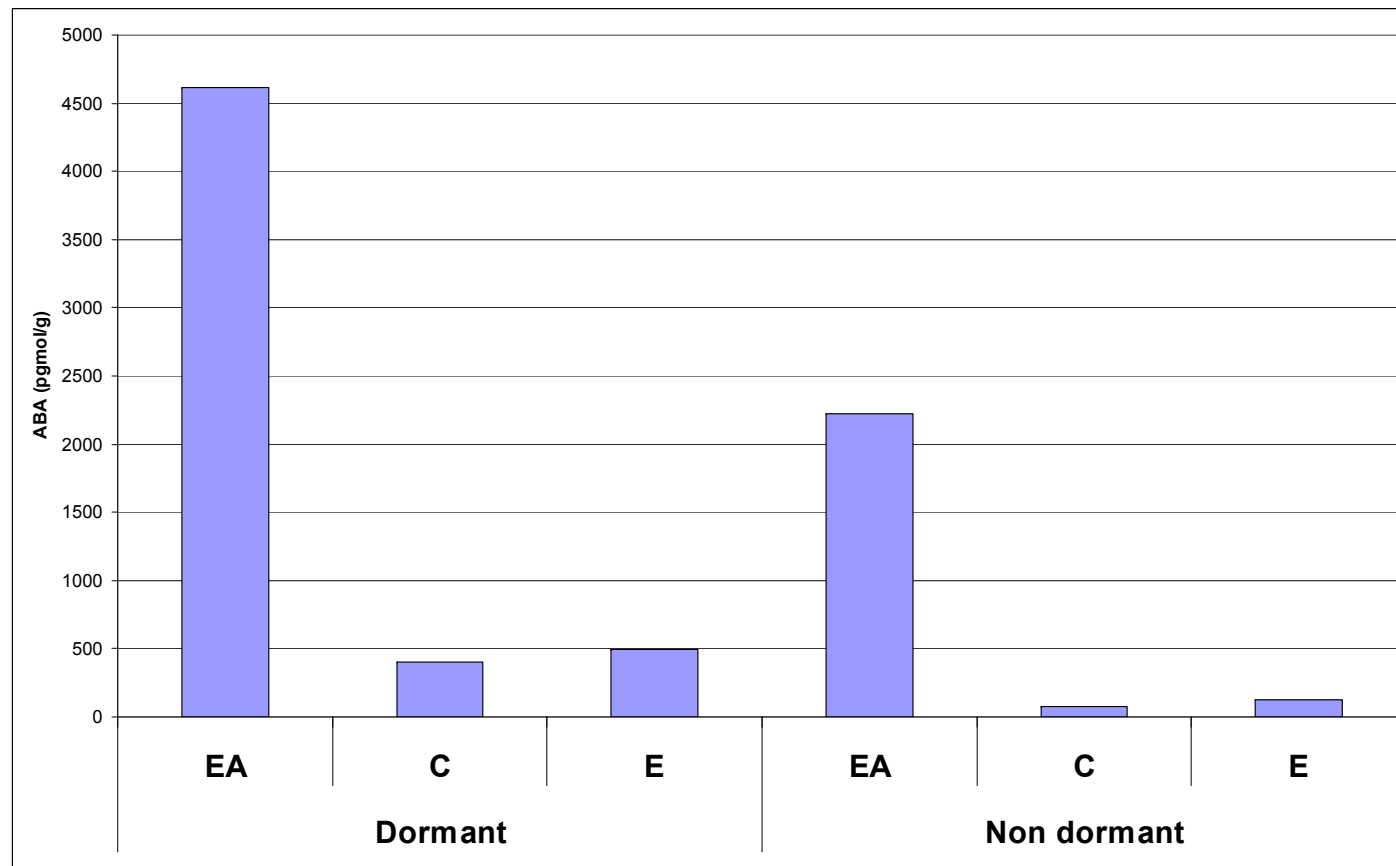
ABA in dormant and non dormant beechnuts

Significant differences between Dormant x Non Dormant seeds

embryonic axis (EA) 2,000 - 6,000 pmol.g⁻¹

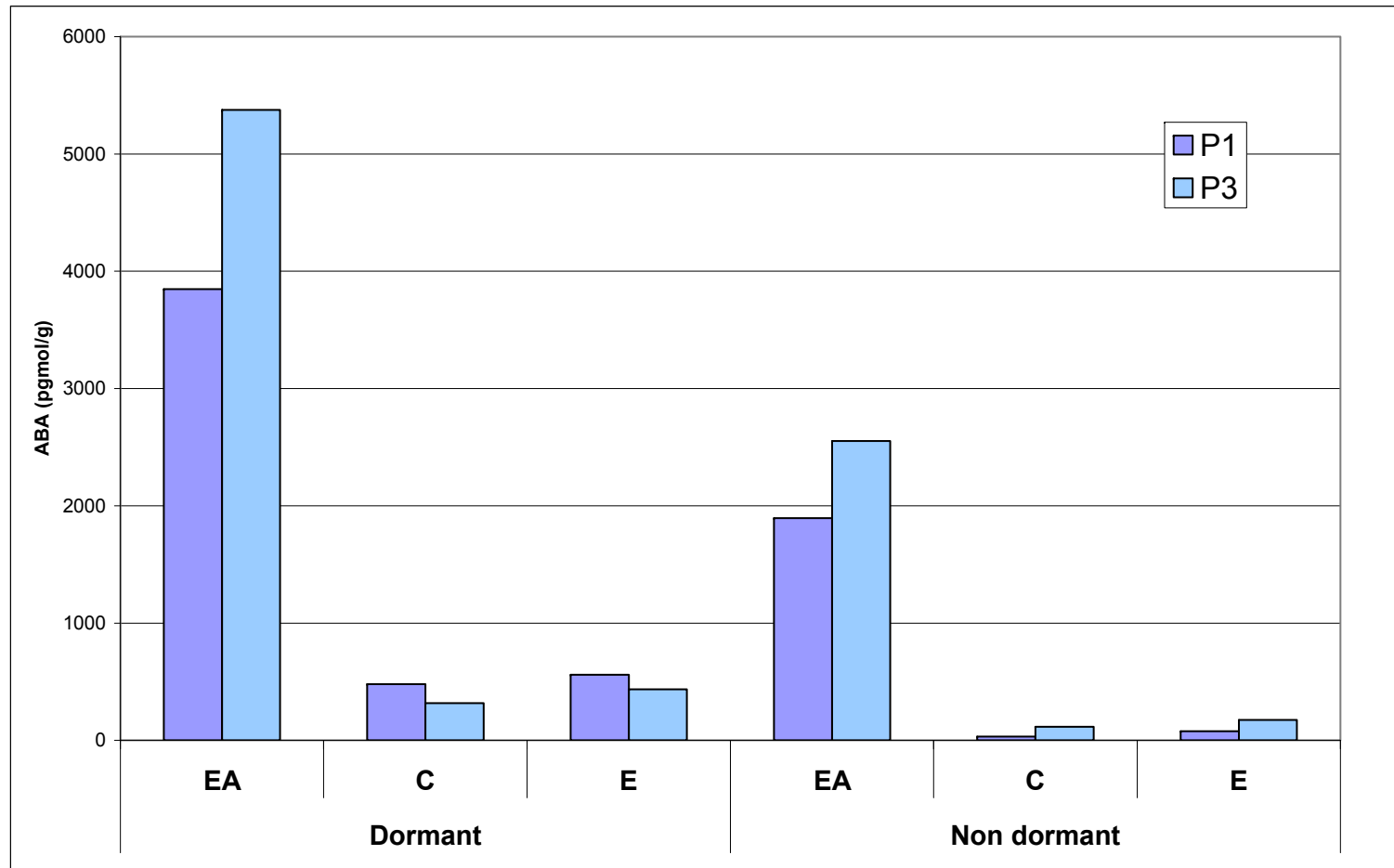
cotyledons (C) < 1,000 pmol.g⁻¹

whole embryo (E) < 1,000 pmol.g⁻¹



ABA in dormant and non dormant beechnuts

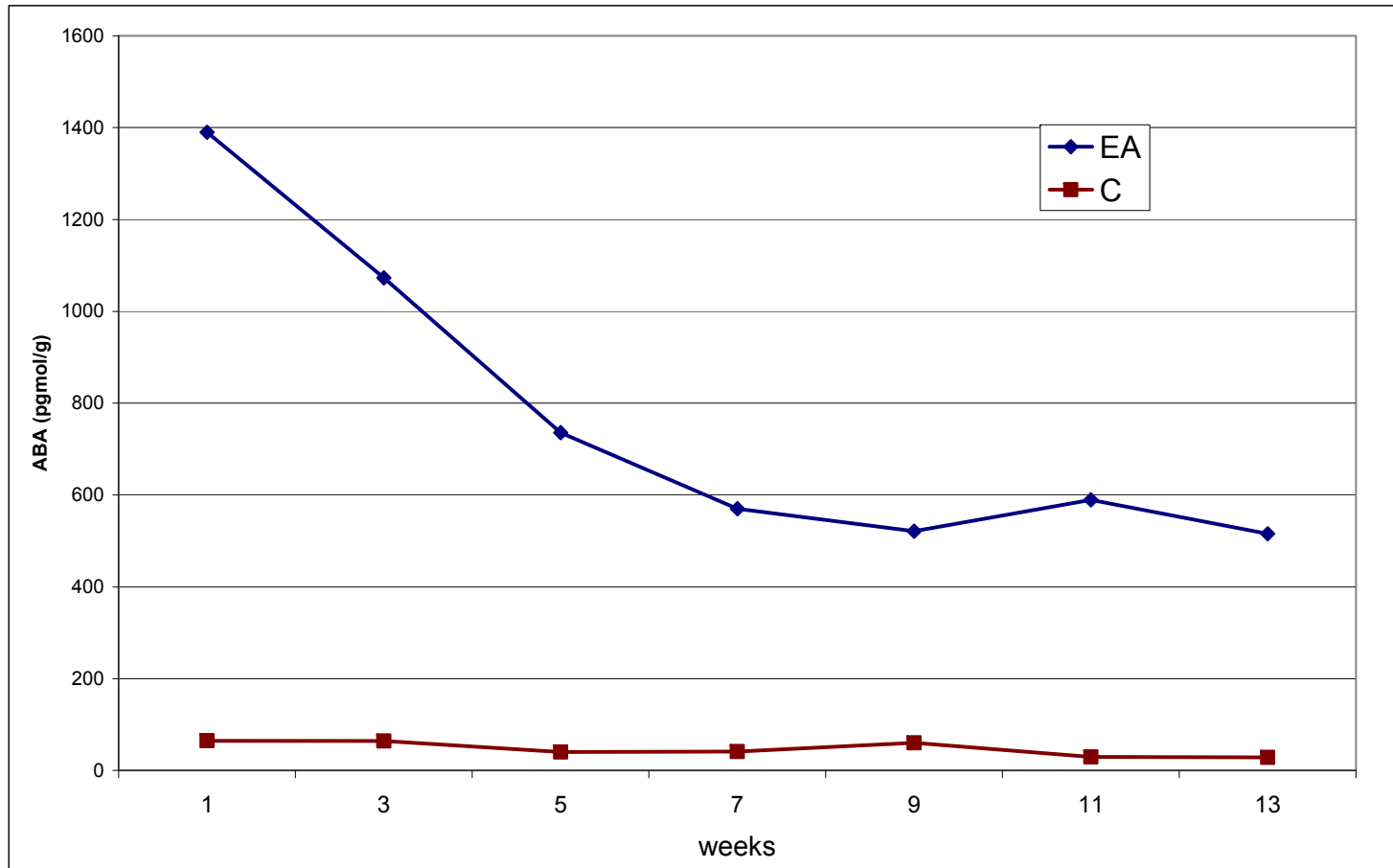
Differences between seed lots



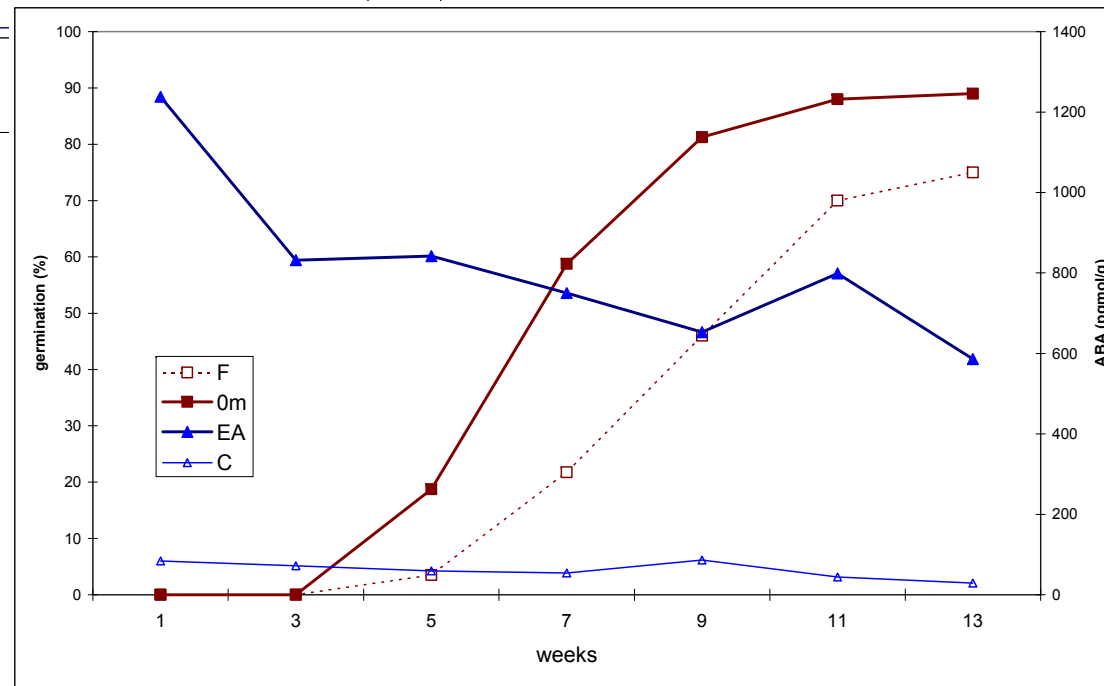
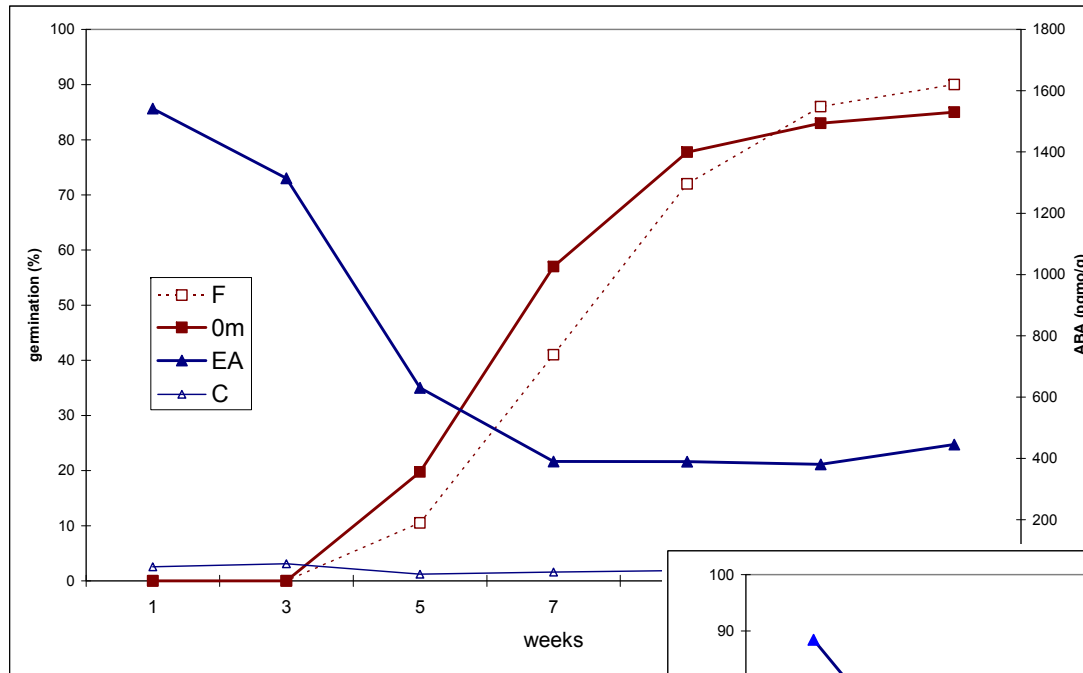
ABA in beechnuts during stratification

MC 28%

After 13 weeks ABA content declined to half of original content



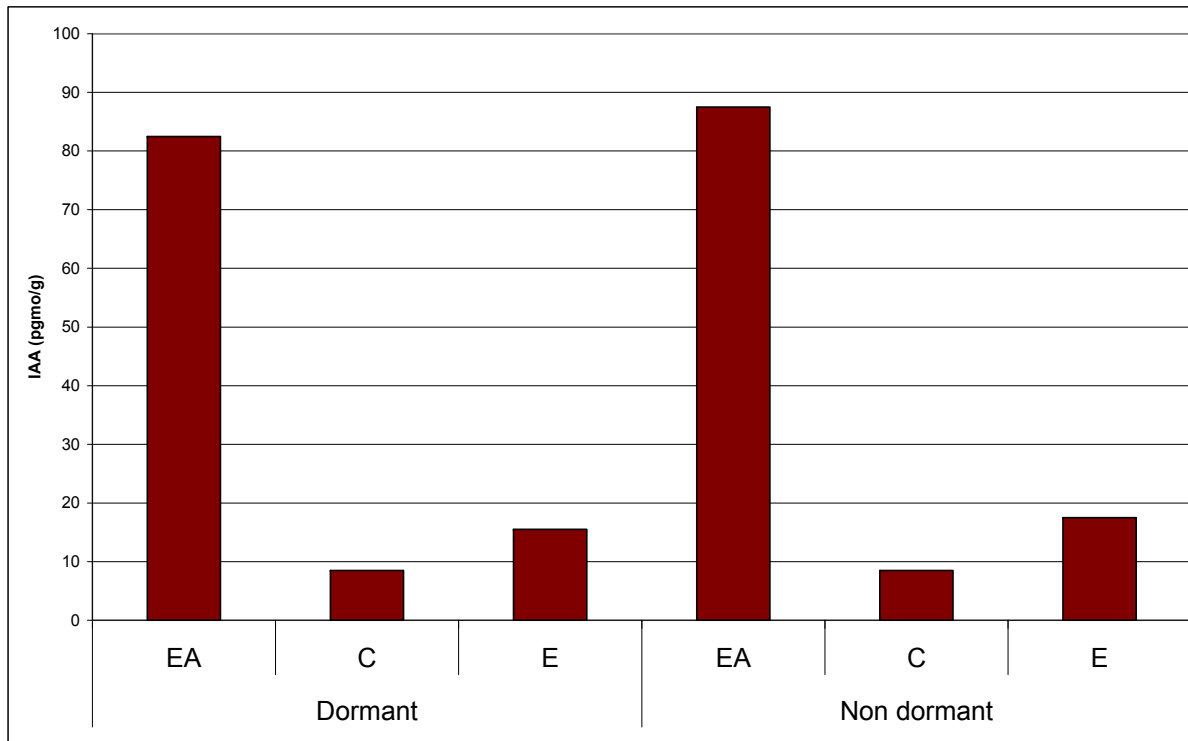
ABA in beechnuts during stratification. Endogenous ABA correlates with dormancy during stratification



IAA in dormant and non dormant beechnuts

No significant differences between Dormant and Non Dormant seeds

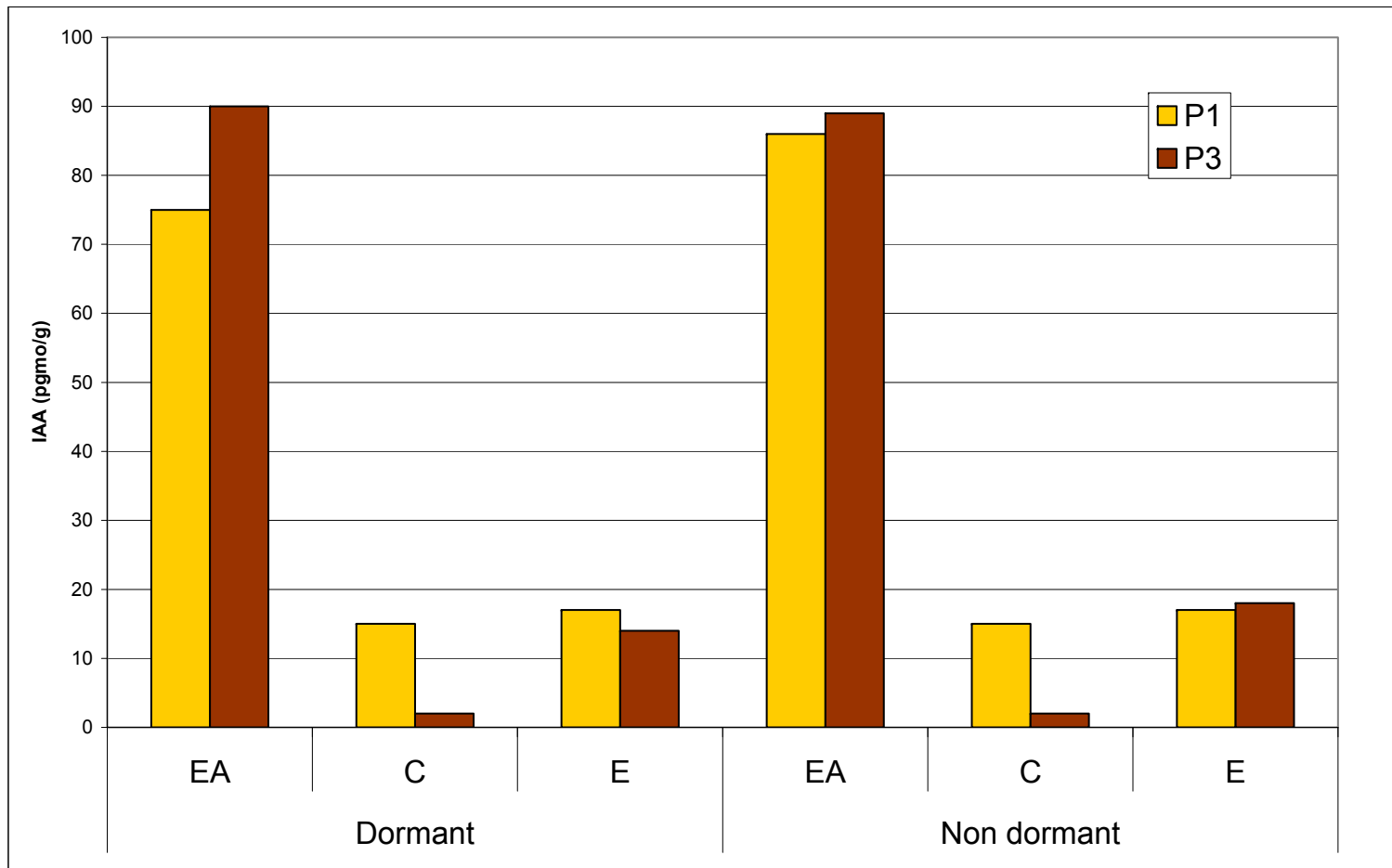
embryonic axis (EA)	about 100 pmol.g ⁻¹
cotyledons (C)	< 20 pmol.g ⁻¹
whole embryo (E)	< 20 pmol.g ⁻¹



IAA in dormant and non dormant beechnuts

No significant differences between seed lots

Endogenous IAA likely does not correlate with dormancy



Acknowledgements

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Thanks for your attention

