February 2023. Adieu, salut, good bye, auf Wiedersehen.
Quel dommage, ach wie schade. Alles Gute für Dich.

Typisch deutscher Spruch: „Wer nicht wagt, der nicht gewinnt“.
Typical German saying: “Nothing ventured, nothing gained”.

More than four years of Tim Beissinger‘s ‚Lehre und Forschung‘ brought novel knowledge and approaches to Göttingen, and novel checks of old attitudes. Danke!

All of us experienced how lively, cheerfull, optimistic, successful breeding science and research can be.

I never left your office, Tim, as grumpy and hesitant as I entered it; always I left it inspired and in improved mood ☺.

What will be the most important topic in plant breeding in 20 years [question mark] Tim asked us at Feb 1 2023 at Wed9AM

I should as well invite for brain storming,
more rely on community and crowd than ...

... to think up things by myself in a quiet corner of my study room ;-)

Parameters describing local and wide adaptation breeding. GL interactions (such as interactions of genotypes with soil type, terrain slope, access to ground water, position of crop in rotation, ...) are potentially exploitable by breeding locally adapted cultivars.

	Breeding for …	
	Local adaptation	**Wide adaptation**
Mean (t/ha)	μ	μ
Variance (t^2/ha^2)	$\sigma^2_G + \sigma^2_{GL}$	σ^2_G
Heritability h^2	$\frac{\sigma^2_G + \sigma^2_{GL}}{\sigma^2_G + \sigma^2_{GL} + \frac{\sigma^2_{GY}}{Y} + \frac{\sigma^2_{GYL}}{Y}}$	$\frac{\sigma^2_G}{\sigma^2_G + \frac{\sigma^2_{GL}}{L} + \frac{\sigma^2_{GY}}{Y} + \frac{\sigma^2_{GYL}}{LY}}$

cf. Atlin, Kleinknecht, Singh and Piepho, 2011. Managing genotype x environment interactions in plant breeding programs. A selection theory approach. JISAS 65, 237-247. https://repository.cimmyt.org/handle/10883/3150

From PhD thesis von Lamiae Ghaouti, 2007

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For each farm *et cetera* a ‚private', ‚specific' best-cultivar may be bred if breeding was much more easy-efficient-fast-cheap.

Improvements in Genomic Prediction (incl. GE) plus Single-Plant-based Selection may make this become true!

Faba bean trials.

Heritability (broad sense) was higher if
breeding was local and production was local

than if
breeding was supra-regional but production is local

Growing the locally best cultivar at each location is of course better than growing one, on-average-best-cultivar at each location.

From PhD thesis von Lamiae Ghaouti, 2007

How big is the drawback coming from: „Hey guy, the breeding company is not breeding just four your farm but instead you have to use seed of cultivars that perform best on average, across a large agro-eco-logical area".

'Correlated gain from selection' CR *vs.* 'Direct gain from selection', R;			*id est:* CR/R
‚Locale' heritability	‚Trans-local heritability	Genetic Correlation between local and trans-local	Gains from selection, ‚correlated' *vs.* ‚direct'
$h^2 = 0.803$	$h^2 = 0.765$	$r_G = 0.773$	CR/R=0.755

Atlin, Kleinknecht, Singh and Piepho, 2011. Managing genotype x environment interactions in plant breeding programs. A selection theory approach. JISAS 65, 237-247. https://repository.cimmyt.org/handle/10883/3150

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Most of GxE variance is unpredictable and connected to seasonal events and little is fied and predictable and attached to the choice of locations and the like

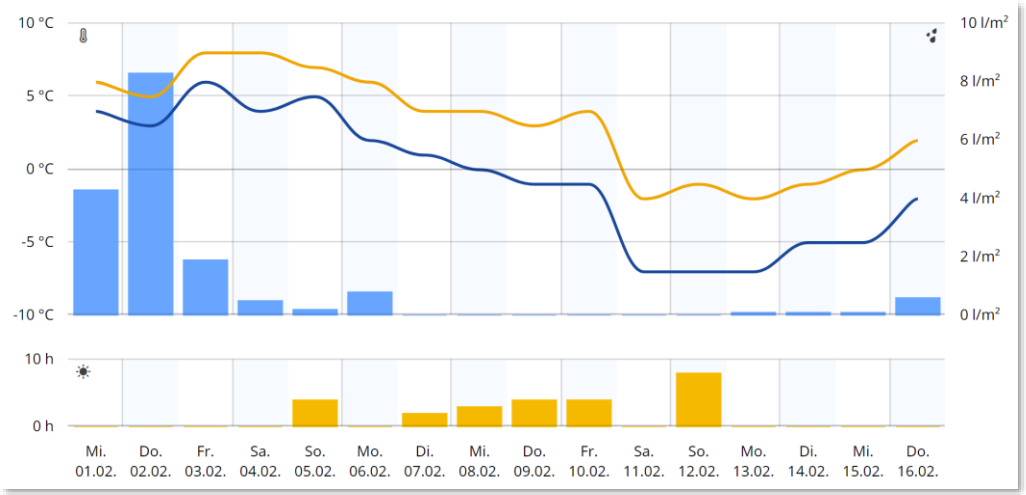
Crop	Region	Variance componens				Ratios of Var.cps.	
		σ^2_G	σ^2_{GL}	σ^2_{GY}	σ^2_{GLY}	$\sigma^2_{GL} / \sigma^2_G$	$(\sigma^2_{GY} + \sigma^2_{GLY})/\sigma^2_G$
Maize	South Africa	0,17	0,00	0,03	0,51	0,00	3,18
Rainfed rice	Thailand	0,07	0,04	0,06	0,32	0,57	5,43
Barley	East Canada	0,17	0,08	0,05	0,17	0,47	1,29
Spring wheat	East Canada	0,48	0,01	0,00	0,27	0,02	0,56
Winter wheat	East Canada	0,36	0,03	0,02	0,29	0,08	0,86
Spring wheat	East Canada	0,29	0,11	0,02	0,27	0,38	1,00
Barley	UK	0,10	0,06	0,12	0,27	0,60	3,90
Spring wheat	UK	0,13	0,12	0,14	0,28	0,92	3,23
Winter wheat	UK	0,27	0,02	0,06	0,31	0,07	1,37
Winter wheat	UK	0,18	0,07	0,04	0,29	0,39	1,83
Spring wheat	Italy	0,05	0,13	0,11	0,12	2,60	4,60
Average	Australia	0,21	0,06	0,06	0,28	0,56	2,48

	Breeding for …	
	Local and Now	**Wide adaptation**
Mean (t/ha)	μ	μ
Variance (t^2/ha^2)	$\sigma^2_G + \sigma^2_{GL} + \sigma^2_{GY} + \sigma^2_{GYL}$	σ^2_G
Heritability h^2	$\frac{\sigma^2_G + \sigma^2_{GL} + \sigma^2_{GY} + \sigma^2_{GYL}}{\sigma^2_G + \frac{\sigma^2_{GL}}{1} + \frac{\sigma^2_{GY}}{1} + \frac{\sigma^2_{GYL}}{1}}$	$\frac{\sigma^2_G}{\sigma^2_G + \frac{\sigma^2_{GL}}{L} + \frac{\sigma^2_{GY}}{Y} + \frac{\sigma^2_{GYL}}{LY}}$

From the point of view of a single farmer, production is always ‚local' and ‚now'.

Growing the cultivar best adapted to the current weather would as well be better than growing the one which is best-adapted to the average weather (or most stable across weathers).

Still, weather forecasts are a source of frustration and disappointment.



Still, weather forecasts are a source of frustration and disappointment. Nevertheless, look here ?!

Long-Term Weather Forecast | climate prediction center mo | Climate Prediction Center - S | Search Results for long term | Temporal convolutional neur

cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1

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Feb-Mar-Apr 2023

Click here for information about the three-month outlook

Text-Format Discussions

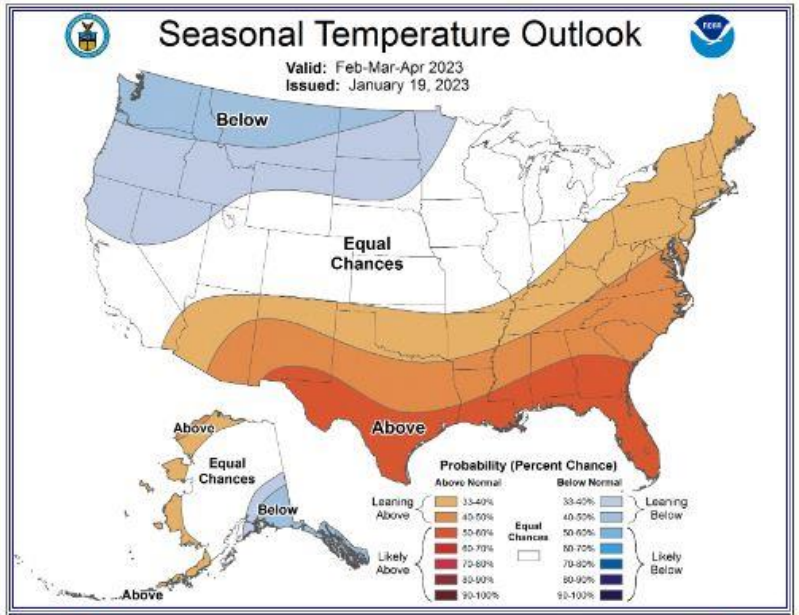
Monthly
Long Lead
30-& 90-Day Hawaiian

More Outlooks

0.5mn FMA 2023
1.5mn MAM 2023
2.5mn AMJ 2023
3.5mn MJJ 2023
4.5mn JJA 2023
5.5mn JAS 2023
6.5mn ASO 2023
7.5mn SON 2023
8.5mn OND 2023
9.5mn NDJ 2023 - 24
10.5mn DJF 2023 - 24
11.5mn JFM 2024
12.5mn FMA 2024
0.5mn Feb 2023

Climatological Values (1981-2010) for FMA

Tools Used (see Discussion for explanation)
Tools Discussion (updated as new tools are implemented)
Canonical Correlation Analysis
Ensemble Canonical Correlation Analysis
Optimal Climate Normals
Climate Forecast System
Screening Multiple Linear Regression Tool
Probability of Exceedence



DEU 16:00 08.02.2023

What if.

What if the weather forecasts were reliable for 3-5 months?

Then the farmer, as maize plants in June are still young, gets the forecast and learns that one should rather have sown sorghum instead of maize.

What about sowing both, sorghum and maize (mixture).

Then, in June, you ‘switch’ the maize plants off (tell them to vanish) and the field becomes a pure sorghum field (or *vice versa*; same with mixing two different cultivars instead of two species).

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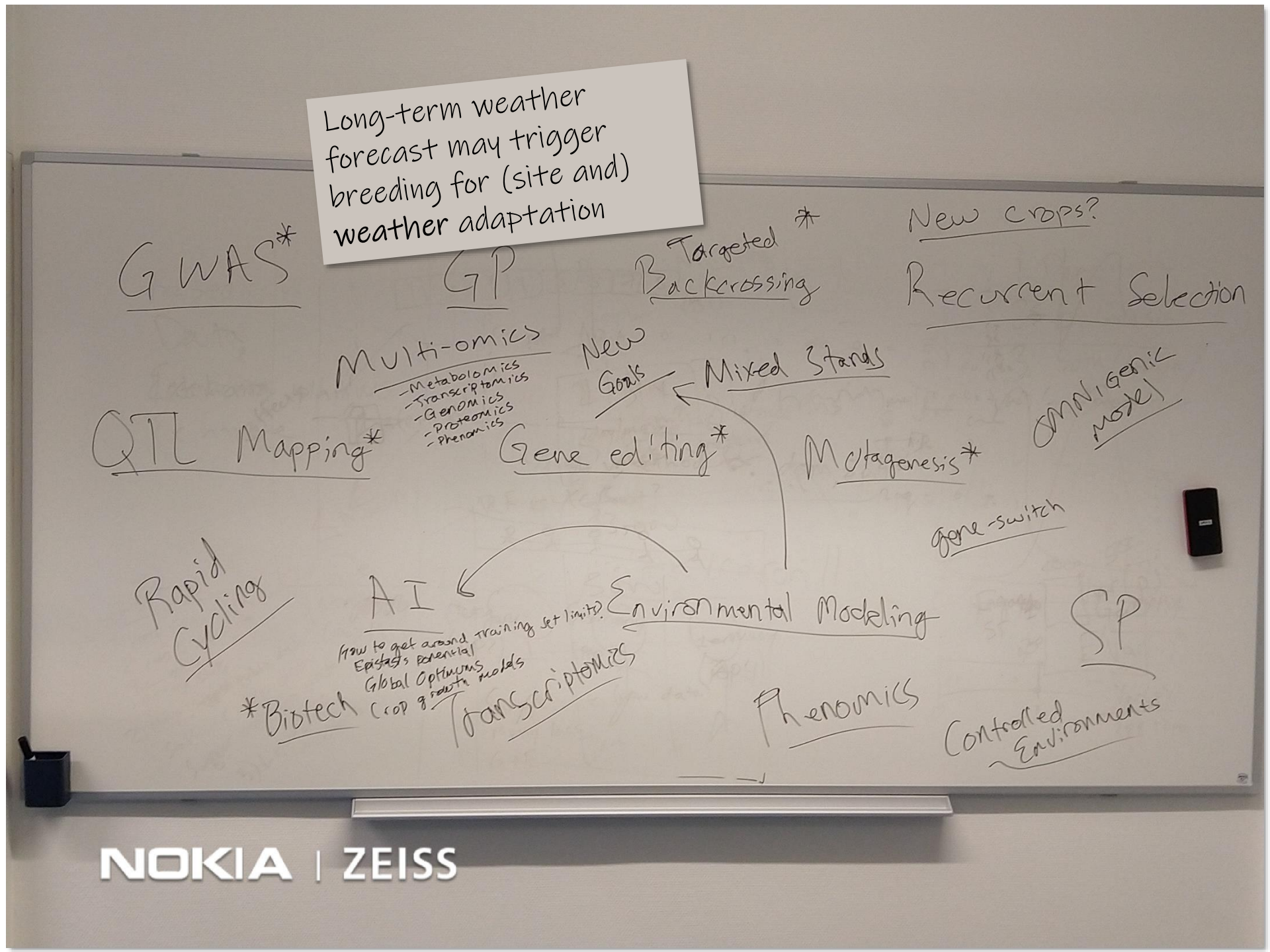
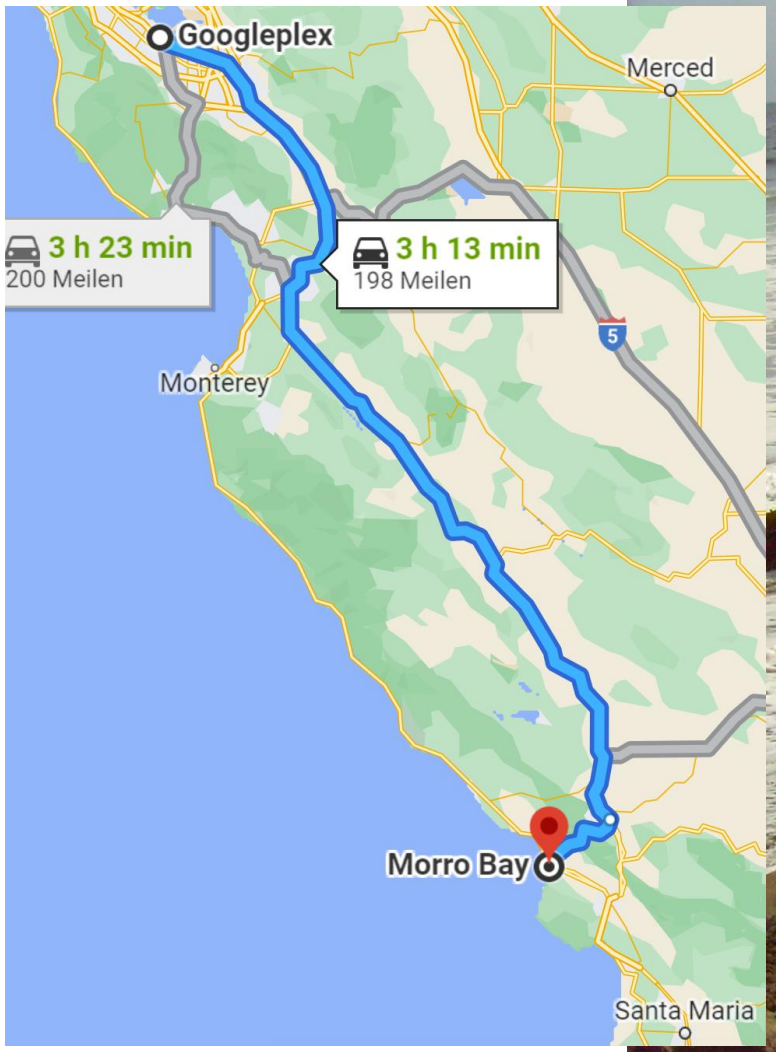
What about having the two genomes, maize and sorghum, joined in the same seed.
And then, in June, you 'tell' the alloploid maize-sorghum plants to switch off one genome and behave like sorghum-only (or like maize-only; same with two different cultivars of same species).

Mutzel et al., 2019. Doi: 10.1038/s41594-019-0214-1.
Molecular switch for the X chromosome.
"Scientists elucidate how the inactivation of the X chromosome is initiated ... "


Long-term weather forecast may trigger breeding for (site and) weather adaptation
GWAS*
GP
Targeted Backcrossing *
New crops?
Recurrent Selection
Multi-omics
-Metabolomics
-Transcriptomics
-Genomics
-Proteomics
-Phenomics
New Goals
Mixed Stands
QTL Mapping*
Gene editing*
Mutagenesis*
OMNIgenic model
gene-switch
Rapid Cycling
AI
How to get around training set limits?
Epistasis potential
Global Optimums
Crop growth models
Environmental Modeling
SP
*Biotech
Transcriptomics
Phenomics
Controlled Environments

NOKIA | ZEISS

Shoepeg grew in Göttingen already in summer 2018, waiting four you …



Ehssan at Morro Bay and ‚Stille Ozean' behind him, in 2006

Delicate Arch, Utah, 2006

Tschüss, Tim. Alles Gute dort drüben.
Wir werden Deinen Optimismus üben.
Es wird hier sicher weitergehen,
Du kannst uns googeln und so seh‘n
Was wir tun. Adieu nun. Shoot to moon.
We despair not. You do Google moon shot.