



REACCH

Regional Approaches to Climate Change - Pacific Northwest Agriculture

USDA



OSU

Oregon State
UNIVERSITY

Climate Zones for Hazelnut Production

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Background and Previous Research



Research Questions



Which weather variables are important in hazelnut production? Do average temperature, precipitation, etc. show statistically significant relationships to pollen shed and bloom changes over time?

Hazelnuts and Oregon



First introduced to Oregon in
mid-1800s

99% of N. Am Hazelnuts come
from Willamette Valley

Called *filberts*, from German
vollbart (full beard)

Corylus avellana , the European
hazelnut



Map of Hazelnut Growth Suitability



Hazel nut Phenology

Pollination Dec-Mar

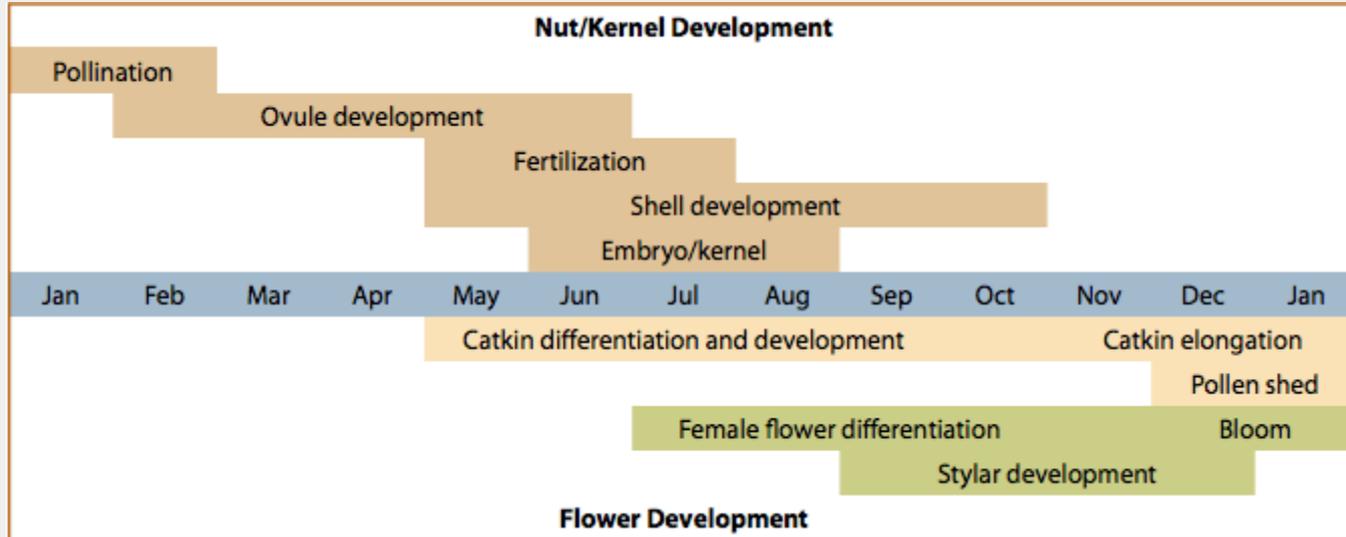
Fertilization May-July

Monoecious

Broad, wind susceptible leaves



Phenology Timeline



Previous Research



Suitable sites for growth:

- ◇ Mean temp in coldest month $<10^{\circ}\text{C}$ to provide sufficient chill
- ◇ Mean temp in hottest month $>31^{\circ}\text{C}$
- ◇ Mean annual rainfall $>750\text{mm}$
- ◇ Windbreaks required

Hazelnuts cannot tolerate excessive heat or a long dry season

Especially sensitive to drying in windy conditions

Not considered commercially productive until 4 yrs old

Certain varieties will not pollinate some other varieties

*The Effects of Climate Change on Spatiotemporal Changes of Hazelnut (*Corylus avellana*) Cultivation Areas in the Black Sea Region, Turkey*

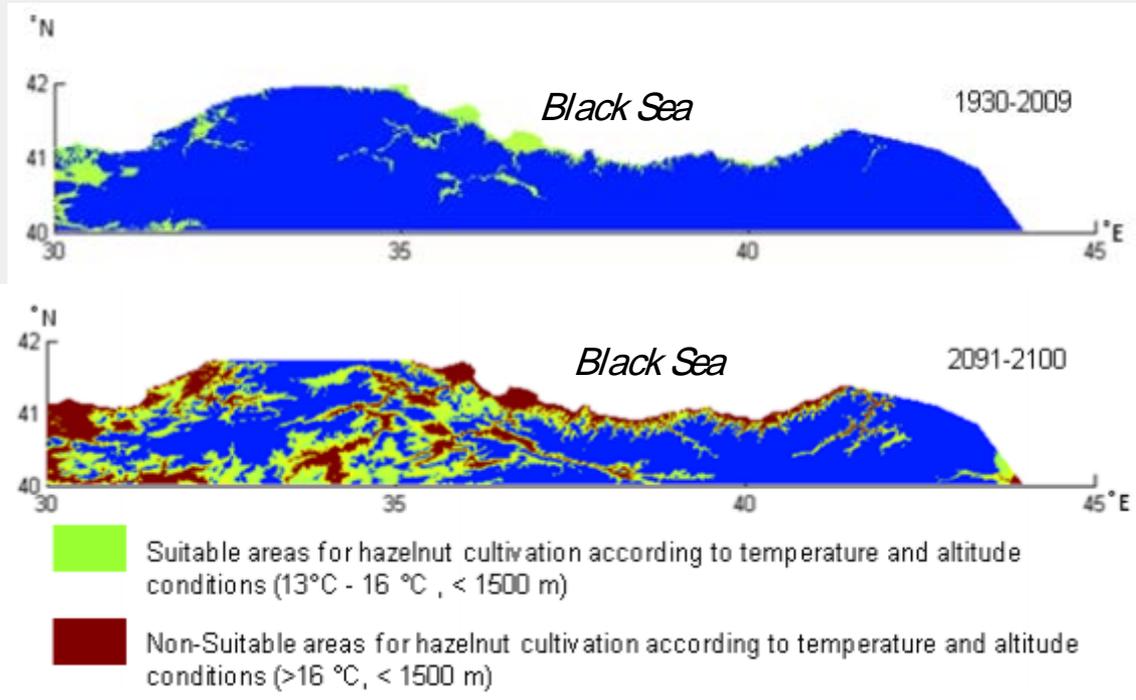


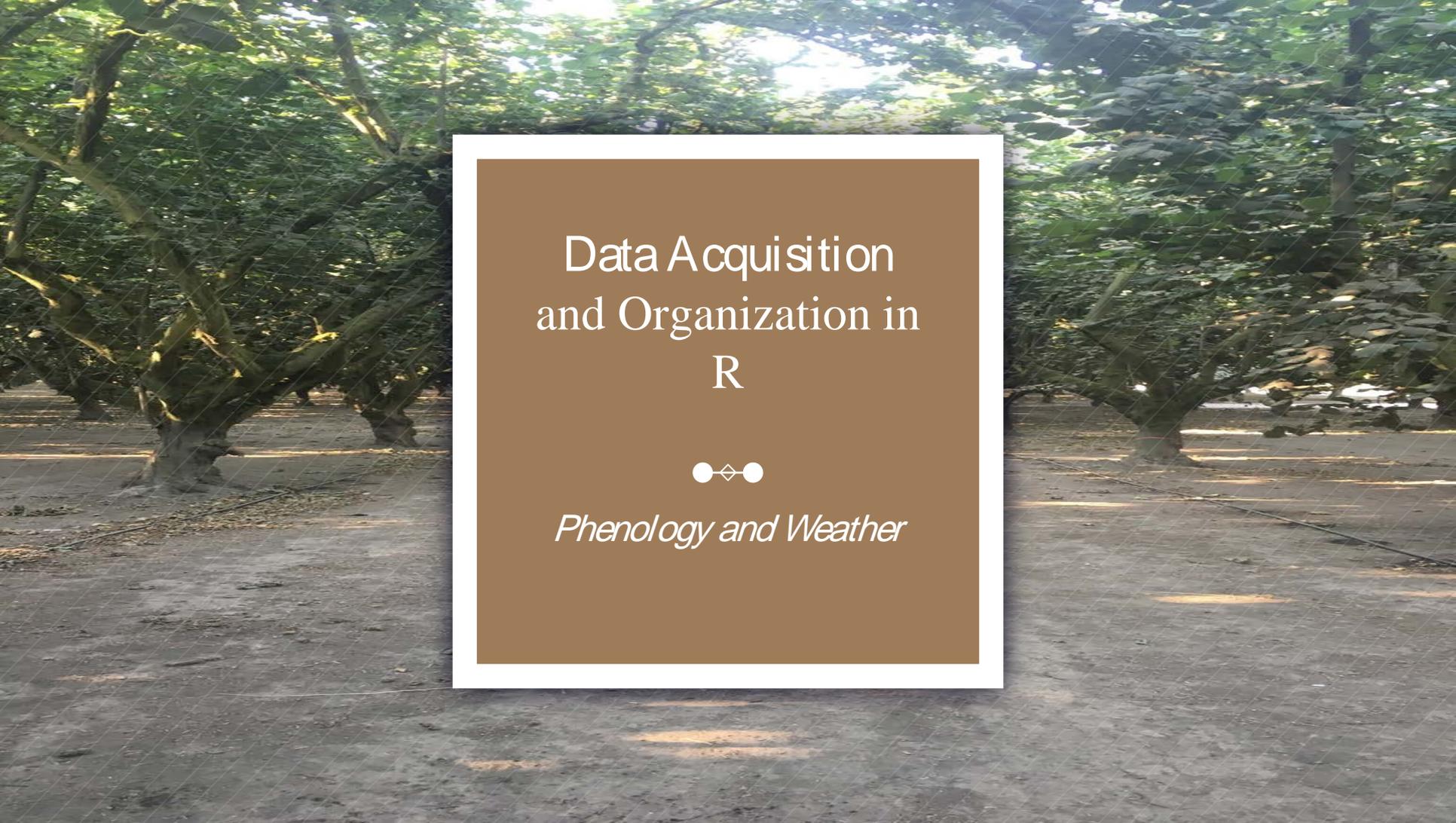
Temperature may cause vertical and horizontal changes in hazelnut growth areas

Coastline areas in Turkey from 0-250m predicted to see negative growing condition trends while 1500m and further to see improved growing trends



*The Effects of Climate Change on Spatiotemporal Changes of Hazelnut (*Corylus avellana*) Cultivation Areas in the Black Sea Region, Turkey*



The background of the slide is a photograph of a path lined with trees, with sunlight filtering through the leaves. A central white-bordered box contains the title text on a brown background.

Data Acquisition and Organization in R



Phenology and Weather



OSU Research Farm Phenology Data



Collection

2004-2017

Pollen shed start and end dates

Bloom start and end dates

Over 1,100 observations

Over 270 cultivars

Weather Data



AgriMet Weather Station

Since 1990

At least 30 types of weather variables over different time intervals throughout the day

Variables used:

Chilling hours, chilling units, precipitation, mean daily temp, and growing degree days



Organizing Data

The screenshot displays the RStudio interface with the following components:

- Source Editor:** Contains R code for generating data and fitting a linear model.

```
1  
2 rm(list = ls())  
3 N <- 1000  
4 u <- rnorm(N)  
5 x1 <- -2 + rnorm(N)  
6 x2 <- 1 + x1 + rnorm(N)  
7 y <- 1 + x1 + x2 + u  
8 r1 <- lm(y ~ x1 + x2)  
9  
10 |
```
- Console:** Shows the execution of the code and prompts for graphical output.

```
10:1 [Top Level] >  
Tapez <Entrée> pour voir le graphique suivant :  
Tapez <Entrée> pour voir le graphique suivant :  
Tapez <Entrée> pour voir le graphique suivant :  
>  
> ?lm  
> rm(list = ls())  
> N <- 1000  
> u <- rnorm(N)  
> x1 <- -2 + rnorm(N)  
> x2 <- 1 + x1 + rnorm(N)  
> y <- 1 + x1 + x2 + u  
> r1 <- lm(y ~ x1 + x2)  
> |
```
- Workspace:** Lists the objects created in the environment:

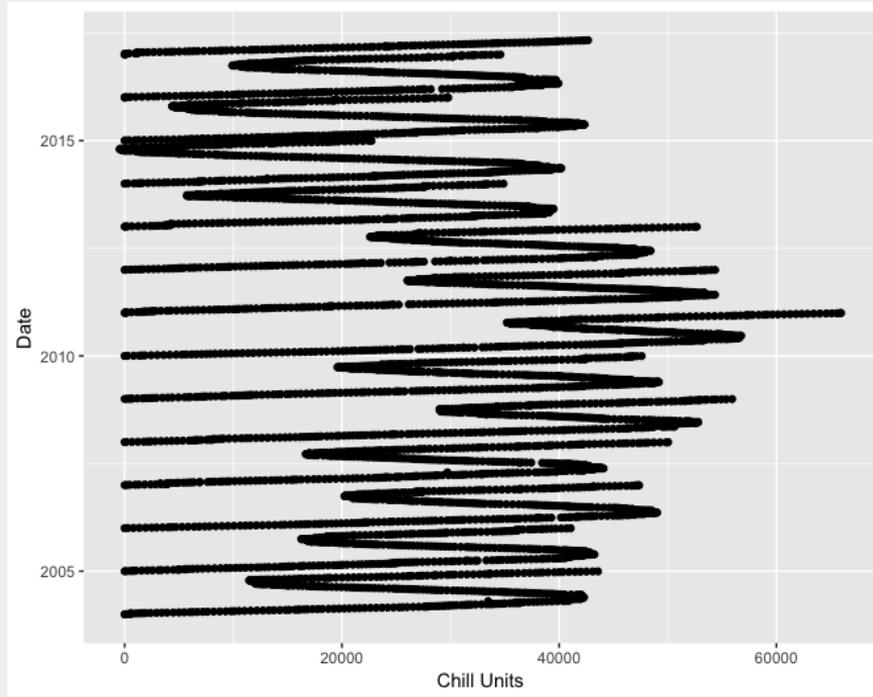
Object	Class
N	numeric
r1	lm
u	numeric
x1	numeric
x2	numeric
y	numeric
- Documentation Panel:** Shows the help page for the `lm` function, titled "Fitting Linear Models".
 - Description:** `lm` is used to fit linear models. It can be used to carry out regression, single stratum analysis of variance and analysis of covariance (although `av` may provide a more convenient interface for these).
 - Usage:**

```
lm(formula, data, subset, weights,  
method = "qr", model = TRUE, x =  
singular.ok = TRUE, contrasts =
```

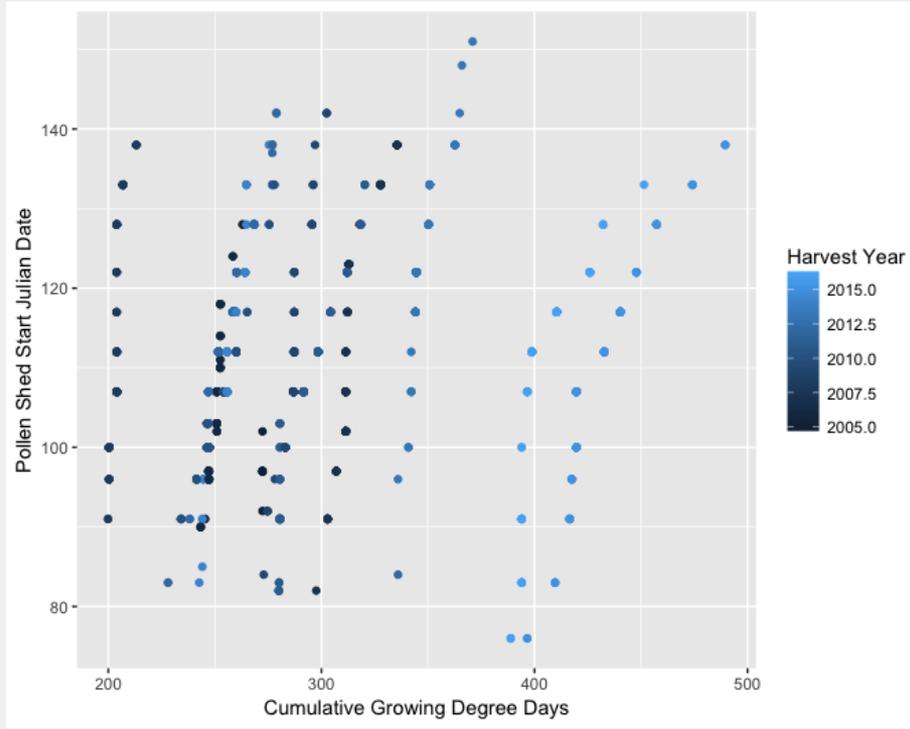
Findings



Weather Changes



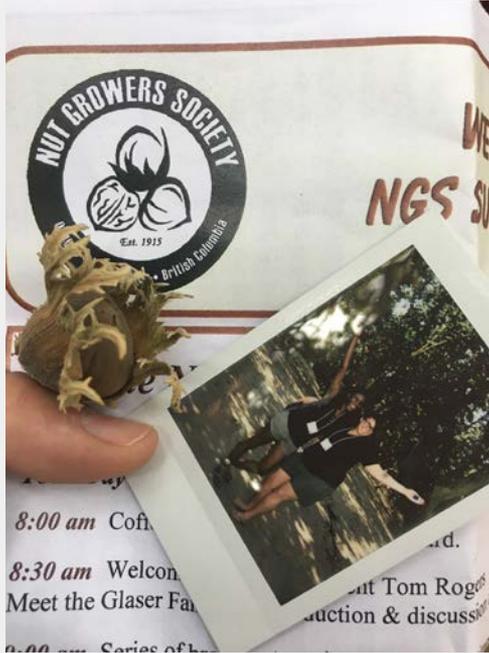
Weather and Phenology

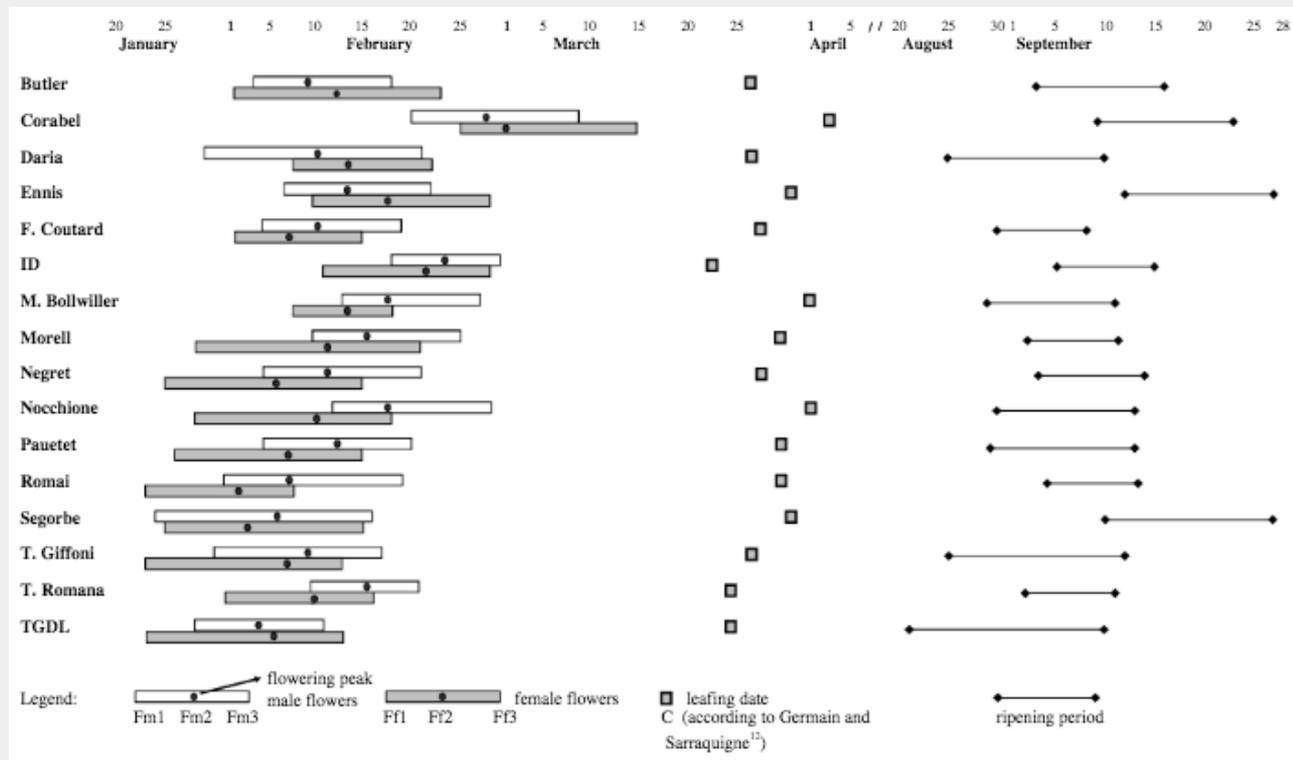


Extension Products and Industry



Nut Grower's Society





Conclusions



Phenology Trends

Inconclusive!

More work necessary.

Direction for Future Work

Ideally, the data we have will show trustworthy relationships.

Future weather forecast models

The background of the slide is a close-up, high-resolution photograph of numerous hazelnuts. The nuts are in various stages of processing, with some showing their characteristic reddish-brown, textured husks and others appearing as smooth, light-colored kernels. The lighting is bright, highlighting the natural textures and colors of the nuts.

Acknowledgements



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USDA

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References



[EM 9072, Growing Hazelnuts in the Pacific Northwest: Introduction](#)

[Characterisation of Selected Hazelnut Cultivars](#)

[Hazelnut Production in Spain](#)

[The effects of climate change on spatiotemporal changes of hazelnut \(*Corylus Avellana*\) cultivation areas in the Black Sea Region, Turkey](#)

Thanks!

Any questions?