



Forage Crops Adaptation to Global Warming

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A Few Members of Research Team



The Impacts of Global Warming on Perennial Field Crops In Atlantic Canada

Outline

• Strategies in crop breeding to address:



- Advances in incorporating traits to ameliorate the impact of climate change
- Gaps in incorporating traits to ameliorate the impact of climate change

Prediction of climate changes impacting cropping systems

Parameter	1971-2000	2011-2040	2041-2070	2071-2100
Mean Annual Temperature	5.1	6.4	7.6	9.0
Mean Summer Temperature	17.2	18.1	19.3	20.5
Mean Winter Temperature	-7.5	-5.8	-4.2	-2.3
Corn Heat Units (CHU)	2408.0	2747.1	3070.1	3476.7
Growing Season Length (>5°C)	163.3	181.8	197.2	214.6
Growing Degree Days (>10)	848.0	1007.2	1184.6	1399.5
Freeze-Thaw Cycles	102.2	92.1	85.1	77.3
Freeze-Free Season (days)	187.0	212.0	230.8	249.8
Hot Days (>30°C)	4.0	7.4	14.8	23.8
Water Surplus (mm)	735.0	801.8	810.3	844.8
Water Deficit (mm)	40.0	44.6	51.1	65.9

Source: Richards, W., Climatologist, Climate Change Scenarios NB Municipalities, NB ETF Project # 080185, March 2009

Global Warming Challenges and Opportunities of Forage Production in Atlantic Canada

- ✓ Increases of 2 to 6°C in air temperature
 ✓ Increase in frost-free days
- Precipitation unpredictable but will increase
 Increased evaporation and transpiration will result in drier conditions, particularly in summer.
- Extreme fluctuations in environmental conditions

Effects of climate change on performance of cultivars in Canada

• Biotic - Plant diseases

Biotic - Plant diseases

- What is possible?
 - earlier spring occurrence of diseases
 - $-\uparrow$ generations/year
 - $-\downarrow$ winter mortality
 - 1 summer mortality (heat stress and desiccation)
- Pests and Beneficials

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A Synopsis of Known and Potential Diseases and Parasites Associated with Climate Change



Includes:

- •Human •Animal
- Plant diseases

Anticipated net influence of climate change on selected plant diseases

	<u>Increase # (%)</u>	Decrease # (%)
Field crops	12 (34)	23 (66)

G.J. Boland, M.S. Melzer, A. Hopkin, V. Higgins, and A. Nassuth. 2004. Climate change and plant diseases in Ontario. Can. J. Plant Pathol. 26: 335–350.

Effects of climate change on performance of cultivars in Canada

- Biotic Plant diseases
- Abiotic
 - FreezingFlooding
 - ➢Drought
 - ≻Salt

- Stresses which pose severe constraints to forage productivity and in some cases result in crop failure
- ≻Acidic Soil-
- Interaction between abiotic and biotic diseases.



04/22/2008

Sub-Irrigation Trial January 11, 2017



Sub-Irrigation Trial January 20, 2017



Sub-Irrigation Trial January 26, 2017





Ideal winter scenario



Loss of snow cover (freezing rain, thaw-freeze events)



Flooding Sub-Irrigation Trial Spring, 2017

Flooding Sub-Irrigation Trial Spring, 2017

Waterlogging Sub-Irrigation Trial Spring, 2017

Winter Kill Sub-Irrigation Trial Spring, 2017

Crop Adaptations To Climate Change

• Historically, adaptations to climate change have been occurring in agriculture over many generations.

Crop Adaptations To Climate Change

• Historically, adaptations to climate change have been occurring in agriculture over many generations.

• However, these adaptations now need to develop at an accelerated rate because of the relatively rapid changes in climate.

AAFC Research: - Adaptation to the Impact of Climate Change on Performance of Forage Cultivars in Canada

Abiotic

- Freezing Quebec Research and Development Centre
- Flooding Kentville Research and Development Centre
- Drought London Research and Development Centre
- Salt Swift Current Research and Development Centre
- Acidic Soil Kentville and Lethbridge Research and Development Centres





Thank you!

Canada