Biotechnology and GMO

How plant biotechnology can “save the world”

Objectives of the lesson

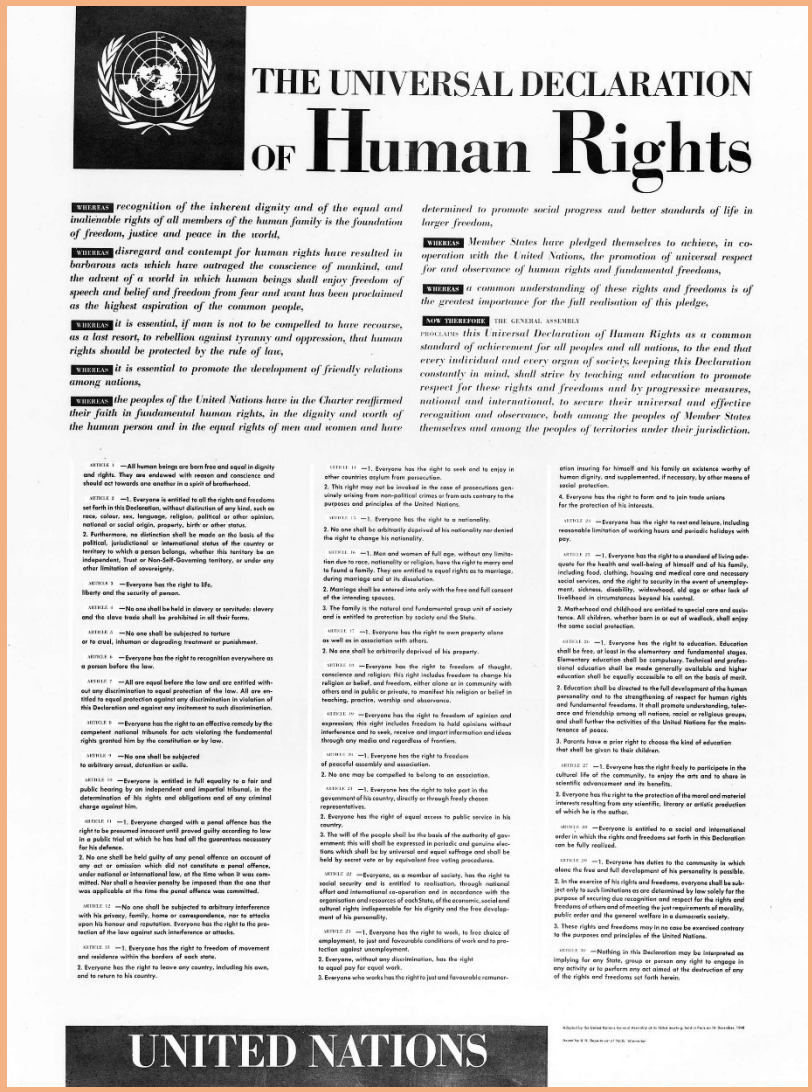
- To introduce the students to the concept of Plant Breeding and Biotechnology.
- To emphasize with the students the importance of plants in our everyday lives.
- To highlight with the students how Plant Biotechnology can be a solution to producing more food to feed a growing population.
- To introduce the term “GMO”.
- To explain ‘The Green Revolution’ and its impact on the developing world’s population.

Food is a basic human right

Universal Declaration of Human Rights (UN, 1948)

Article 25

- *"Everyone has the right to a standard of living adequate for the health and well-being of himself and his family, including food…"*



THE UNIVERSAL DECLARATION OF Human Rights

WHEREAS *recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice and peace in the world,*

WHEREAS *disregard and contempt for human rights have resulted in barbarous acts which have outraged the conscience of mankind, and the advent of a world in which human beings shall enjoy freedom of speech and belief and freedom from fear and want has been proclaimed as the highest aspiration of the common people,*

WHEREAS *it is essential, if man is not to be compelled to have recourse, as a last resort, to rebellion against tyranny and oppression, that human rights should be protected by the rule of law,*

WHEREAS *it is essential to promote the development of friendly relations among nations,*

WHEREAS *the peoples of the United Nations have in the Charter reaffirmed their faith in fundamental human rights, in the dignity and worth of the human person and in the equal rights of men and women and have determined to promote social progress and better standards of life in larger freedom,*

WHEREAS *Member States have pledged themselves to achieve, in co-operation with the United Nations, the promotion of universal respect for and observance of human rights and fundamental freedoms,*

WHEREAS *a common understanding of these rights and freedoms is of the greatest importance for the full realisation of this pledge,*

NOW THEREFORE THE GENERAL ASSEMBLY

PROCLAIMS *this Universal Declaration of Human Rights as a common standard of achievement for all peoples and all nations, to the end that every individual and every organ of society, keeping this Declaration constantly in mind, shall strive by teaching and education to promote respect for these rights and freedoms and by progressive measures, national and international, to secure their universal and effective recognition and observance, both among the peoples of Member States themselves and among the peoples of territories under their jurisdiction.*

UNITED NATIONS


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

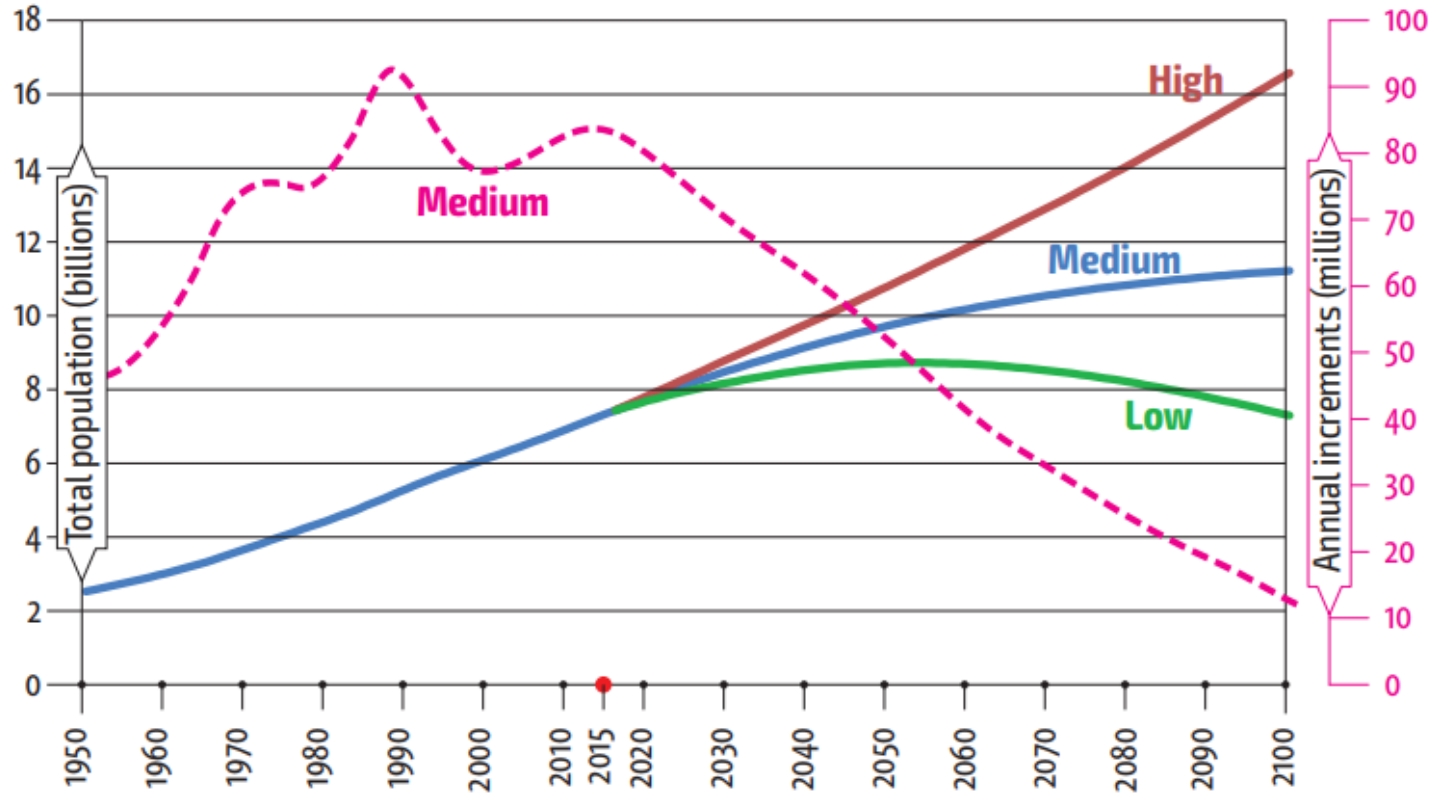

Food security is when
people have reliable access
to sufficient, affordable, nutritious
food to support a healthy life.

821 million

- The number of people who are “undernourished”.

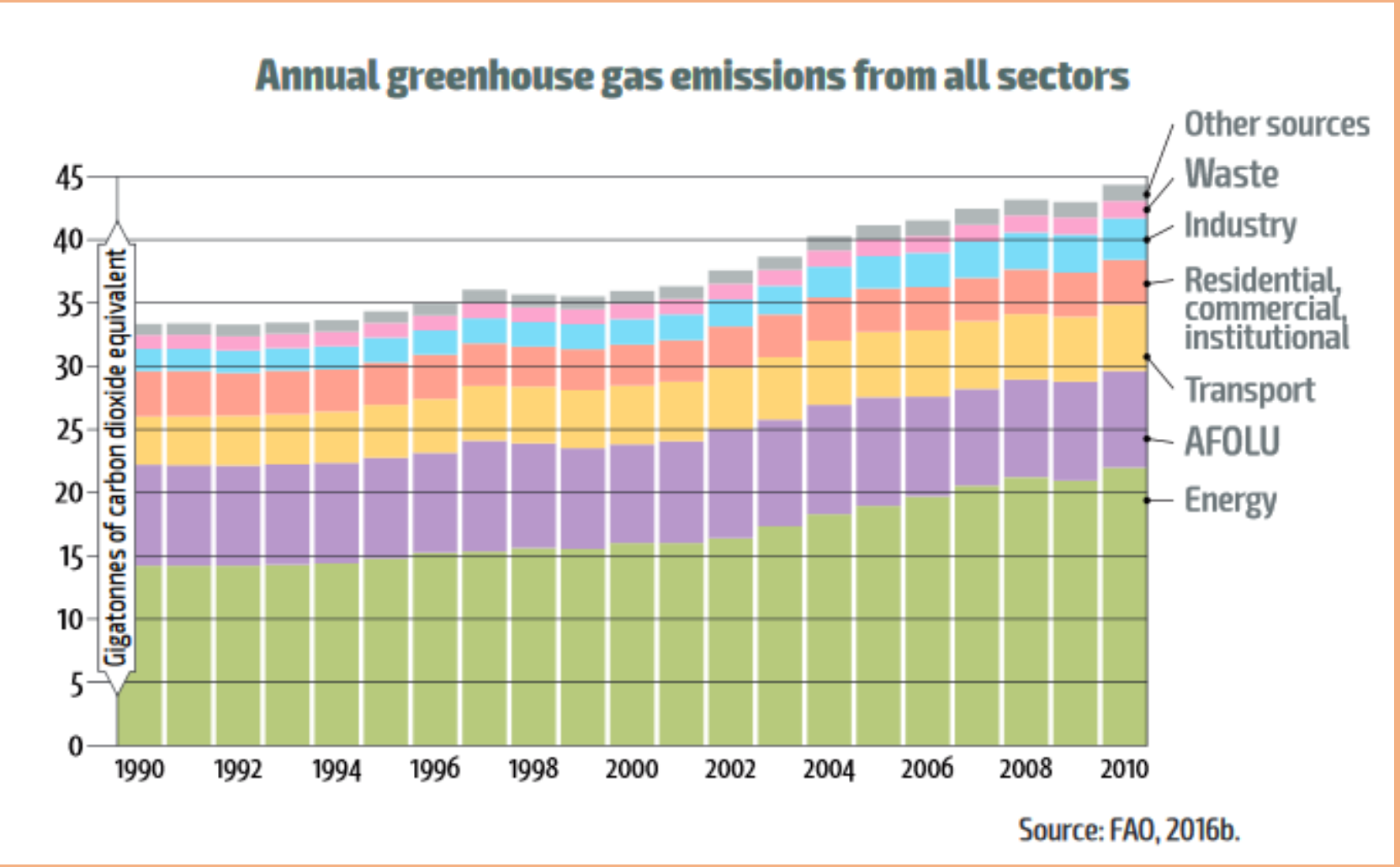
World population increase projected to reach 8.3 billion by 2020

Figure 1.1 Global population growth to 2100, by variant



Note: Annual increments are 5-year averages.
Source: UN, 2015.

But food production is a major contributor to global climate change



The Big Question

How can we waste less and produce more food to feed a growing human population whilst limiting our use of natural resources (water, land, etc.) and protecting our environment and biodiversity….all in the context of a changing climate?

Plant Biotechnology can be one part of the solution.

“Whoever could make two ears of corn grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country, than the whole race of politicians put together,” -

Ways we benefit from plants: Let's create a word cloud

- https://www.wooclap.com/YRZHHJ

- Code: YRZHHJ
- Let's do a word cloud and gather your thoughts!!!

Food

Clothing

Energy

Medicine

25% of the West's prescription drugs are plant derived.

Some of the best-known drugs derived directly from plants:
- Aloe vera

Plant breeding

- Clearly, human society relies on plants for a whole variety of reasons.

Plant breeding means improving plants to make them higher yielding, more resistant to disease, more resistant to environmental conditions.

We breed plants to breed better plants to support human development – food, medicine.

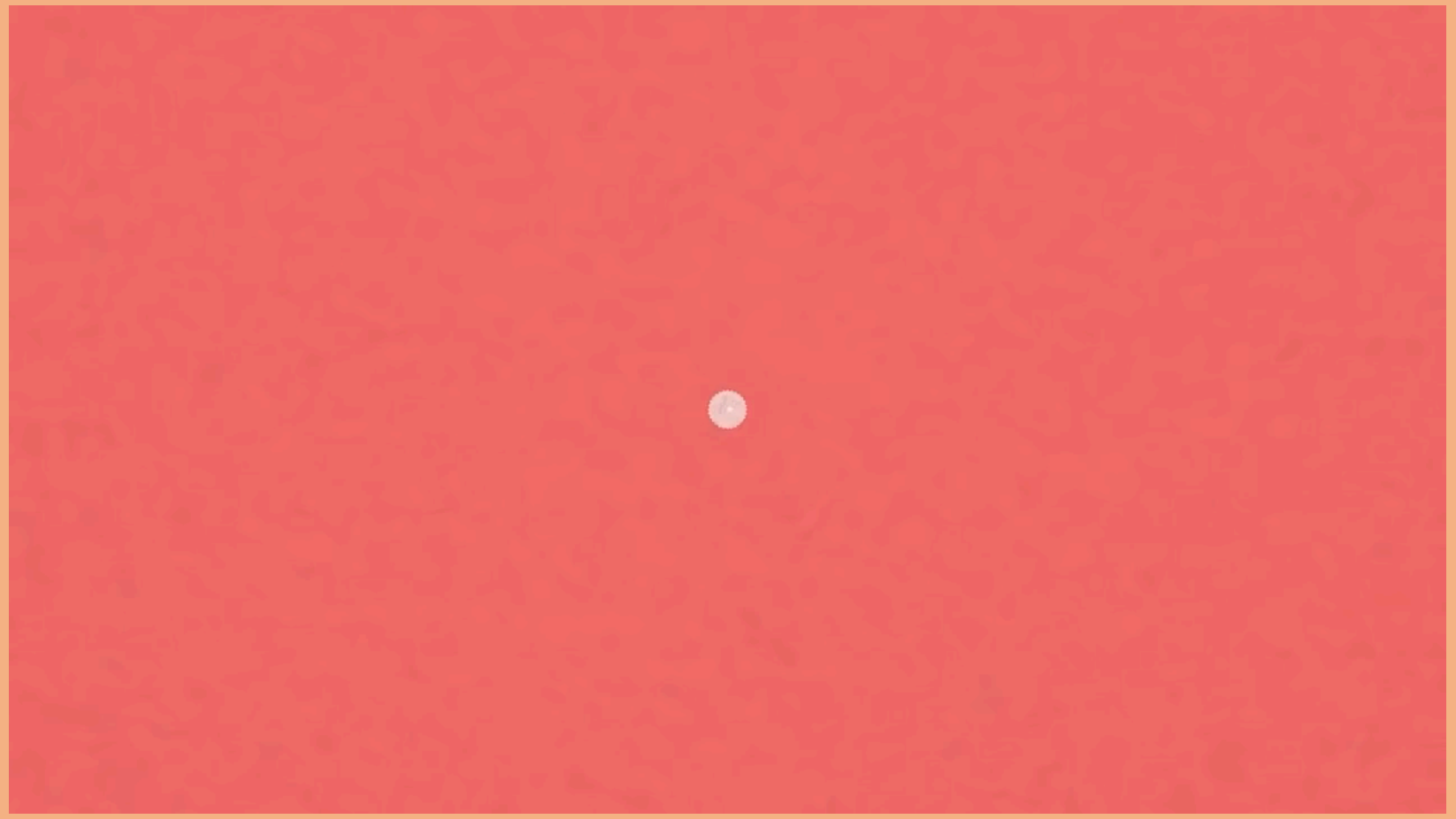
What is Biotechnology?

- “any technological application that uses biological systems, living organisms, to make or modify products for specific use.”

-UN Convention on Biological Diversity

https://www.youtube.com/watch?v=SnkHmwTKksQ

Biotechnology…..Let's watch a video



Genetically Modified Organisms

- **Genetic modification is the process of changing the DNA of any living thing (Plants, animals or micro-organisms) in a way that does not occur in nature.**

Which crops have been modified?

- So far, most GM crops have been modified to help overcome two of the major problems faced by commercial farmers, namely insect pests and weeds.
- As an alternative to spraying insecticides onto the crop, it has been possible to introduce genes that allow the plant to manufacture insecticides.
- It is estimated that 62% of global cotton production involves the use of genetically modified cotton.

Remember Golden Rice and its benefits- a genetically Modified Organism

- Genetic modification could also be used to help create plant varieties with other properties to give foods improved nutrient levels (increased Vitamin A in rice or increased polyunsaturated oils in cereals).

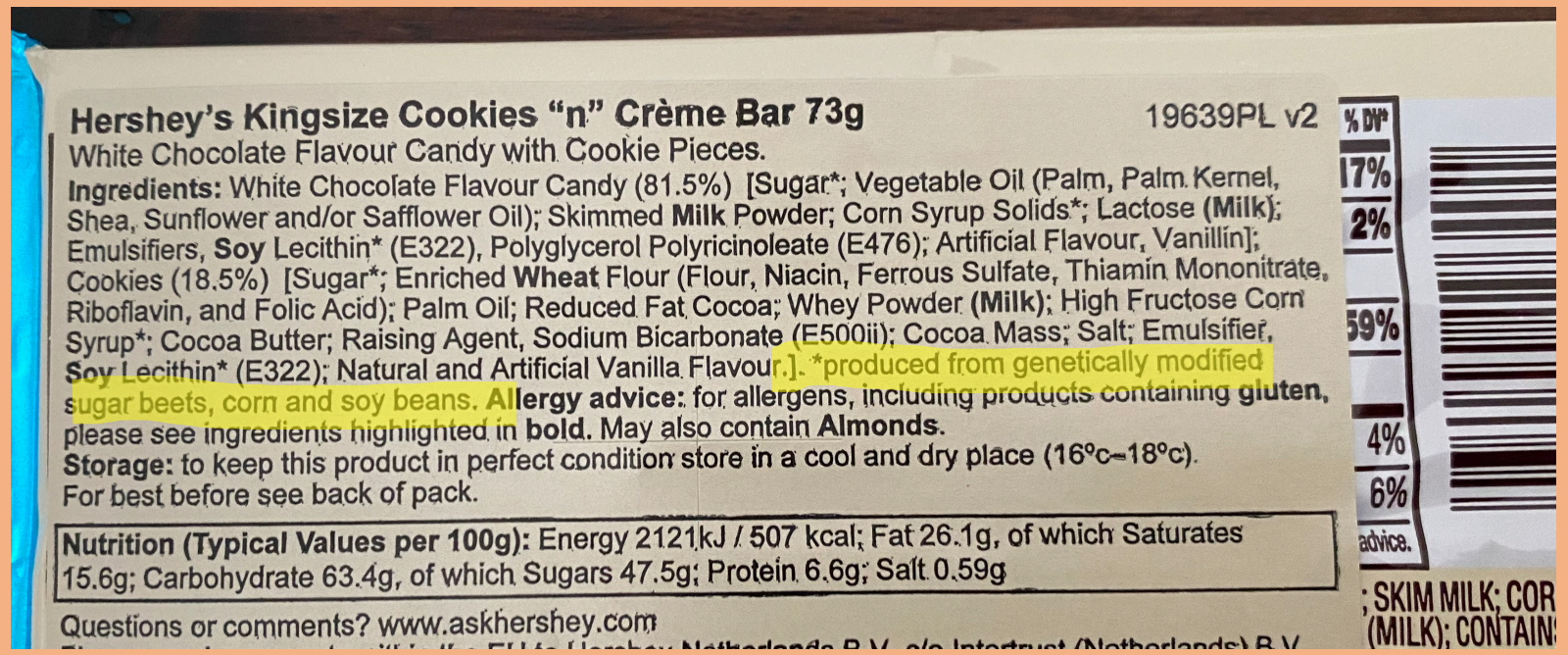
How can we tell if GM products are on sale in Ireland?

- All products made using GM ingredients must be labelled as such.
- **GM foods are only authorized for sale if they are judged not to present risk to health or the environment, and to be of no less nutritional value than the foods they are intended to replace.**

On balance the advantages of genetically modified (GM) food outweigh any dangers.

Treat Yourself

Look at the Ingredients list of your chocolate bar!



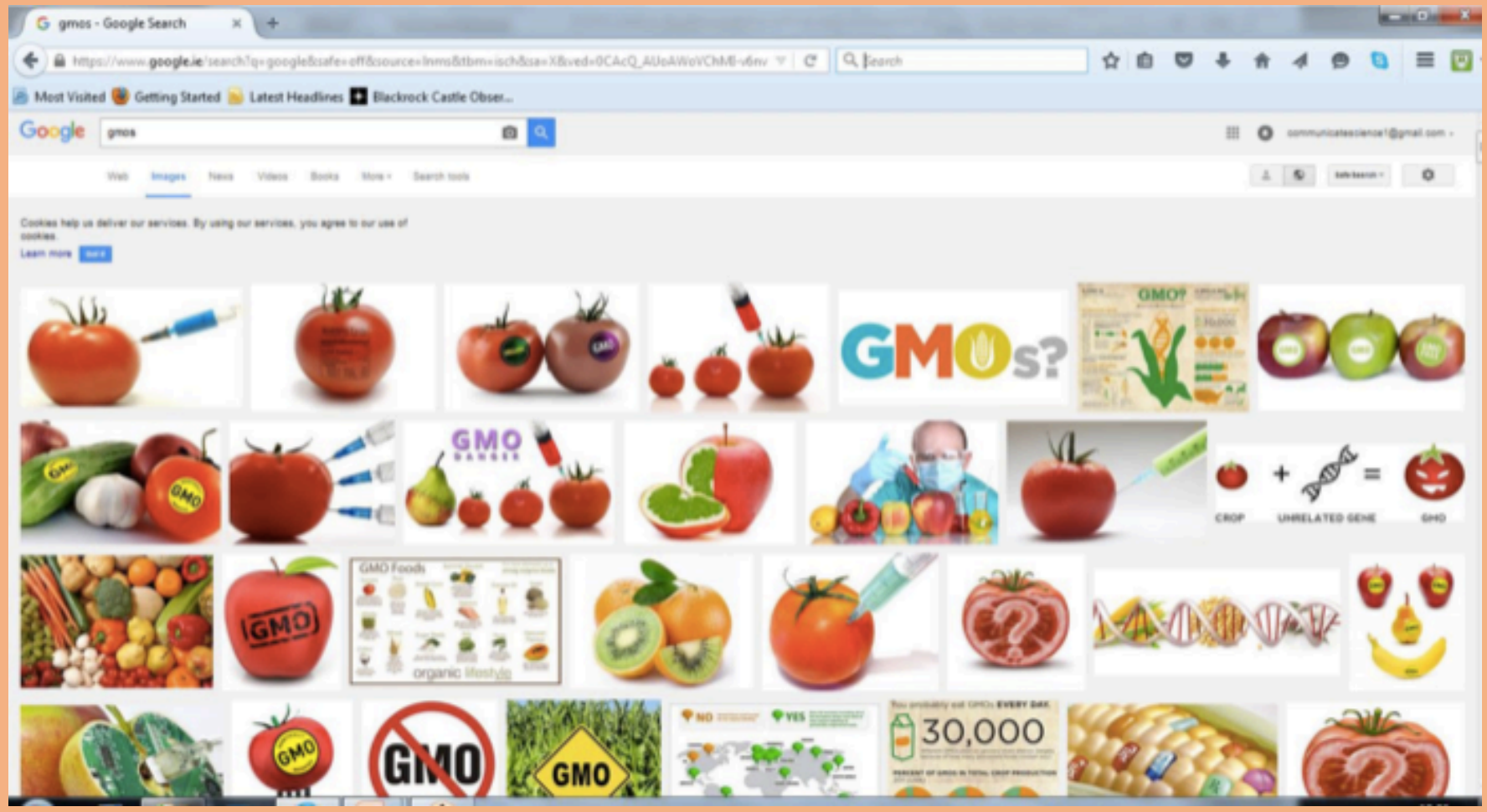
“GM crops are not the problem but part of the solution to sustainably feeding 9 billion people”.

- The European Union, the Royal Society and the US National Academy of Sciences all conclude that GM crops are safe and effective.

- The global population is estimated to increase to 9 billion by 2050 and the Food and Agriculture Organization estimates that global food demand will increase by 70%.

- In this context we need to consider all the options. GM approaches within plant breeding are one of the potential tools.

However, if we google GMOs….



The reality..

The Green Revolution

Norman Borlaug (1914-2009)

“Father of the Green Revolution”

“You can’t build a peaceful world on empty stomachs and human misery”

- Borlaug worked in Mexico after his PhD and developed high-yielding dwarf wheat varieties. Such varieties were less prone to falling over during wind and rain.

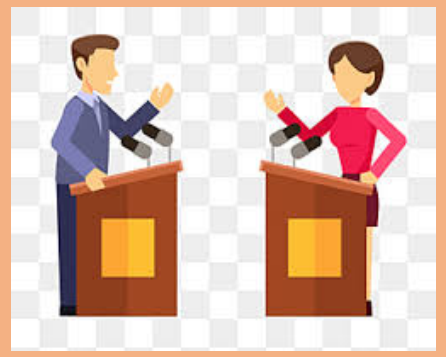
- Borlaug led the introduction of these new varieties into Mexico, India and Pakistan.

- Mexico within 20 years doubled its wheat harvest.

Borlaug was awarded the Nobel Peace Prize in 1970 for “a technological breakthrough which makes it possible to abolish hunger in the developing countries in the course of a few years”.

“The man who saved a billion lives”

Debate?



Genetically modifying food crops through Biotechnology can be one of the solutions to World Hunger. Using Biotechnology we can harvest, high-yielding, pest-resistant, nutrient-rich crops to feed our ever-growing human population.

Do you agree with the above statement. Do you believe that we should be consuming genetically modified organisms. Do you believe that such produce should be clearly labelled to the consumer as a GMO. Do you think there is a better solution to fighting World Hunger particularly in the developing world.


Kahoot!

Learning Outcomes

At the end of the lesson students should be able to:

- Define Plant Breeding and Biotechnology.
- Recite the importance of plants in our everyday lives with examples.
- Highlight how Plant Biotechnology can be a solution to producing more food to feed a growing population.
- Explain the term “GMO”.
- Explain ‘The Green Revolution’ and its impact on the developing world’s population.