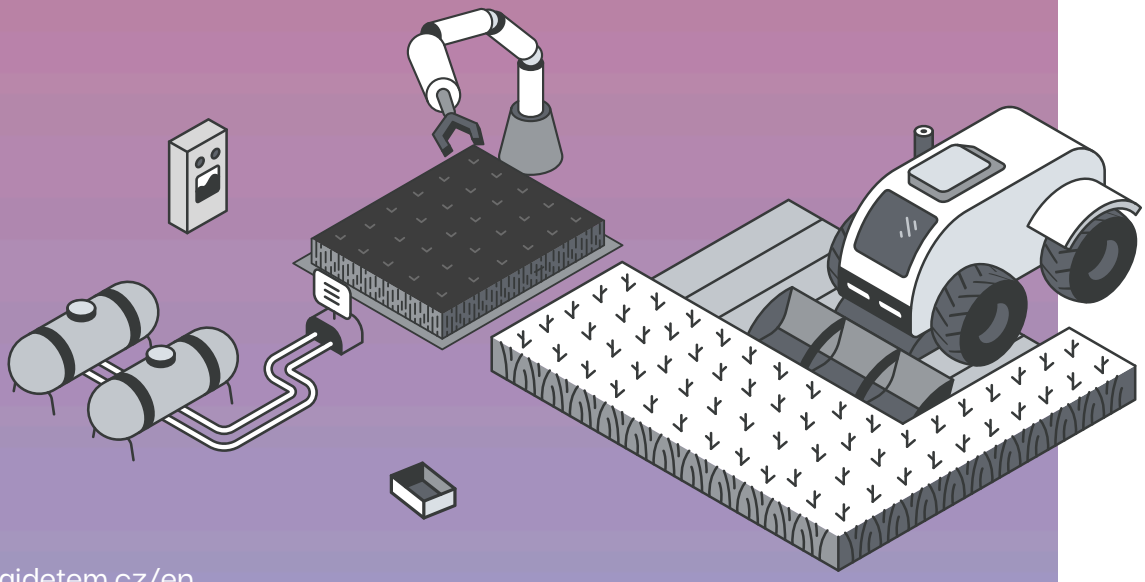
AI for Children

Artificial Intelligence Curriculum for Elementary and Secondary Schools

# Geography

## Smart Technologies in Agriculture

### Smart Farming Simulator Board Game



kurikulum.aidetem.cz/en

Created by: Eva Nečasová, Kačka Čiháková
Smart Farming Simulator game developer: Petr Hofman
Game testing: Pavel Vala, Eva Nečasová, Jitka Šimková
Subject lead: Renata Skývová
Expert guarantors: Jan Bím, Pavel Kordík, Stanislav Rajtmajer
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Form for comments

These teaching materials were translated using ChatGPT.
Please note possible imperfections in the expressions or wording.

# Geography – Smart Technologies in Agriculture

## A few words to begin

Dear Teacher,

you are receiving a teaching material designed to support education in the field of artificial intelligence at the elementary and secondary school level. The aim of this activity is to introduce students to smart technologies, often powered by artificial intelligence, in agriculture. Today, and increasingly in the future, these technologies help bring us closer to more sustainable farming. They also serve as a valuable source of data, such as electricity usage. In addition to smart technologies, students will also learn about different types of soil and which crops are suitable to grow in them, along with their characteristics.
Thank you for your enthusiasm and energy in educating students in the field of artificial intelligence.

– AI for Children team

⚠ Print the board game!

This lesson is based on an activity in which students play the board game Smart Farming Simulator. Before the lesson, please print all parts of the board game. The accompanying guide will help you prepare for teaching and provides information for educators on how smart technologies are used in agriculture.

Lesson presentation in PDF

Editable presentation in Canva

## Lesson Overview

**Prior Knowledge/Recommended Age, Lesson Length**
Children aged 11–15, 90 minutes (ideally in single block).

**Building Blocks**
Soil types, smart technologies in agriculture.

**What Are the Students Learning?**
Students describe the use of smart technologies in agriculture, analyze their impacts and evaluate their contribution to improving production and sustainability through the board game Smart Farming Simulator. At the same time, they consider how these technologies can help address global challenges such as drought, pests, or soil degradation.

**Why Are They Learning This?**
Students understand the importance of using smart technologies in agriculture for a more complex and sustainable future.

**How Do We Know They Have Learned It?**
Students provide examples of how smart technologies are used in agriculture. They can name key soil types found in the USA.

**Tools**
Teacher: projector and presentation slides.
For each student group (4 students):
1× die,
1× land map,
2× info sheets (shared in pairs),
2× sets of crop cards,
1× set of technology cards,
4× accounting ledgers.

**Digital Competence**
Facilitating Learners' Digital Competence.

**Bloom's Taxonomy**
Remembering: Students list major soil types and selected examples of how smart technologies are used in agriculture.
Applying: Students apply their knowledge during the game by making decisions about using technologies and considering their impact on crop yields.
Analyzing: Students analyze the outcomes of their gameplay decisions, exploring the relationships between key soil types, crops, technologies, and their effectiveness in addressing global challenges.

**Five Big Ideas**
5-C-I AI & the Economy (Impacts of AI on Sectors of Society).

Note: Gender equality is key for AI for Children, but for brevity, we use masculine formulations in our teaching materials.

# Glossary of terms

**Artificial Intelligence (AI)**
There is no single universally accepted definition of artificial intelligence. What all definitions share, however, is the idea that it is a system capable of simulating human thinking and behavior. Artificial intelligence usually takes the form of a computer program and is used to solve tasks that previously required significant human intellect and were therefore considered uniquely human. It is also, among other things, a scientific field whose roots go back to the first half of the 20th century. This field seeks not only to understand intelligent systems, but above all to create them.

**Machine Learning (ML)**
Just as humans can learn from examples and experience, machines created by humans can do the same. They use an approach called machine learning. This allows artificial intelligence systems to go beyond being just a set of pre programmed instructions and instead develop new solutions on their own. The goal of machine learning methods is to discover patterns in large volumes of data. Machine learning is a subfield of artificial intelligence.

**Big Data**
There is no single fixed definition of big data, but it is generally characterized by its massive scale, the speed at which it is generated, the variety of formats, sizes, and structures, and often lower accuracy or consistency. Big data can include images, videos, audio, text, or so called digital traces such as records of user behavior. It is a result of the rapid growth of the internet, along with the significant decrease in the cost of storing and processing data. The volume is typically so large that it requires new approaches, such as machine learning methods, to process it effectively.

**Big Data in Agriculture**
In agriculture, big data is used to improve the efficiency, precision, and sustainability of food production. Data comes from a variety of sources, including field and machine sensors, weather stations, satellites, drones, and other smart technologies. These data sets contain information about soil conditions, moisture, temperature, nutrient levels, the presence of pests and diseases, and even the growth of individual plants.
By applying machine learning and big data analysis, farmers can better plan planting, optimize irrigation and fertilization, predict risks, and respond quickly to changing conditions. Big data in agriculture enables more targeted crop care, reduces resource waste, and increases both yield and product quality.

# Preparation for teachers

## Artificial intelligence in agriculture

The goal of this activity is to help students understand the role of smart technologies (often powered by artificial intelligence) in agriculture. Today, and even more so in the future, these technologies allow us to move toward more environmentally friendly farming without reducing crop yields. The main areas of use include:

**Data collection and analysis:** Artificial intelligence can gather and evaluate data on soil, weather, and crop health. This enables farmers to make better decisions about what and when to plant in order to maximize yields and use resources more efficiently.

**Automation of routine tasks:** Many repetitive tasks such as irrigation, plowing, harvesting, or the application of fertilizers and pesticides can be managed by AI. This saves farmers time and effort.

**Prediction and prevention:** AI helps predict risks such as crop diseases, pest outbreaks, or weather changes. This allows farmers to respond early, reducing potential damage and increasing crop stability.

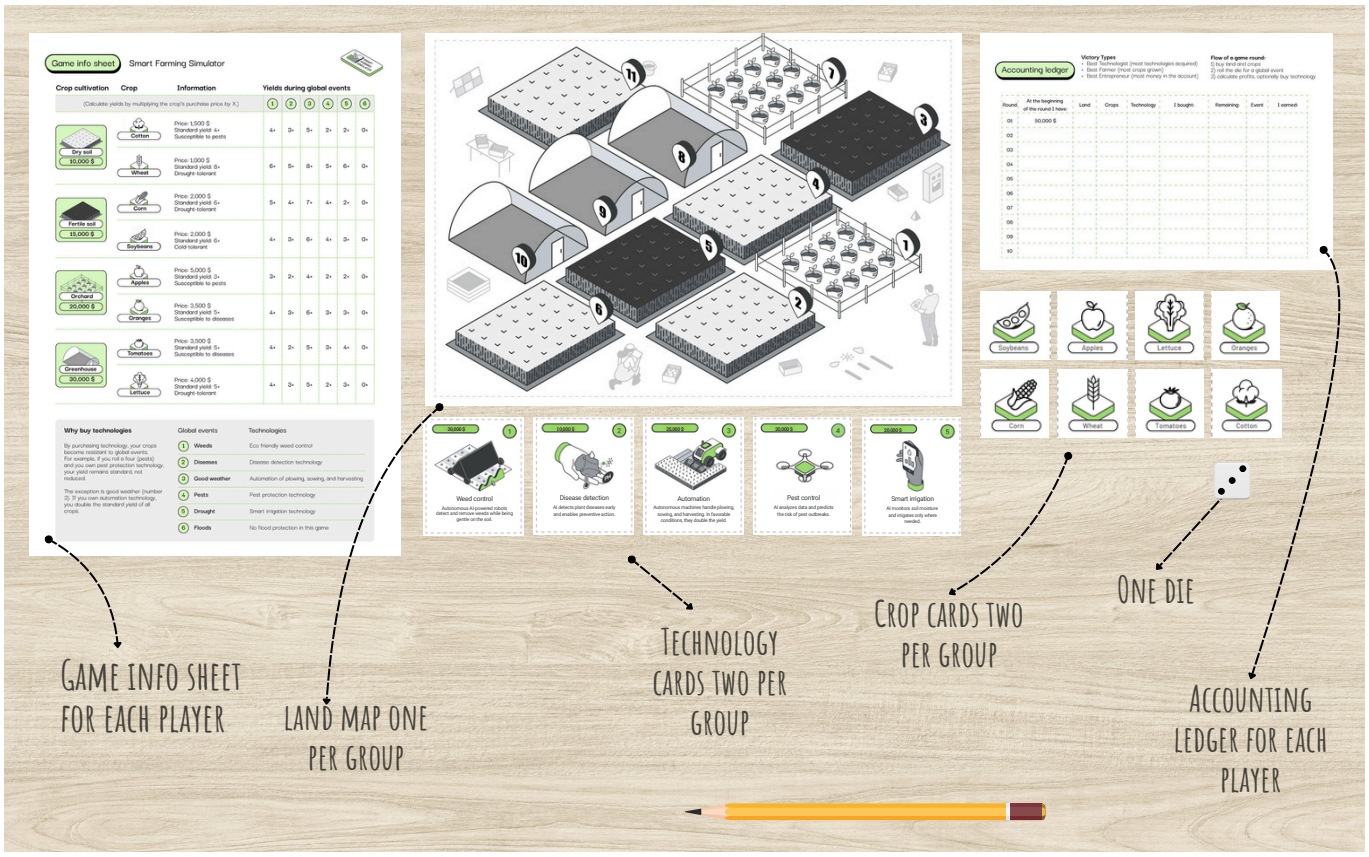
**Resource savings:** AI helps farmers conserve water, energy, and other resources through more precise management. This not only supports sustainability–for example, by enabling targeted application of fertilizers or pesticides–but also reduces operating costs.

Watch a video about the use of AI in agriculture: youtube.com/watch?v=_tijHjup-gM (6:52).

## Smart Farming Simulator board game

We have created a board game for students in which they take on the role of modern farmers managing their land and crops. Each player starts with a set budget, which they invest in buying land, planting crops, and acquiring smart technologies that help protect their harvest from negative impacts. Each round begins with players purchasing land and planting crops according to soil type. Then they roll a die to find out which global event will affect their crops–this could be drought, pests, or plant diseases. If players have invested in technologies, they can better withstand these challenges and increase their yields. At the end of each round, players calculate their profit based on the harvest and may choose to buy more crops or technologies. The game is simple enough for most children to understand and, based on testing, they also find it engaging and fun.

Please keep in mind that some elements have been significantly simplified to support smooth gameplay.




## How to play Smart Farming Simulator

**Game setup**
Students are divided into groups of four (minimum three, maximum five per group).
Each group receives a land map, info sheets with game instructions, crop cards, and technology cards, which are placed on the table. Each player also receives a personal farm record book, where they will track their expenses and income. All players start with an initial budget of 50,000 $.

**Round overview (the game consists of 10 rounds, each representing one calendar year)**
1) Players buy land from the map. They can choose between two soil types, an orchard, or a greenhouse. Each player may purchase only one plot per round. The group must agree on who buys what.
2) Players plant crops on the land they purchased (one crop per plot) and record all purchases in their farm record book.
3) One player rolls the die to determine which global event will affect the entire group. Based on this event, players calculate their yields (profits) using the table in the info sheet. Profits are calculated by multiplying the purchase price of the crop by the yield factor linked to the global event.
4) Players may decide to buy a technology to protect their crops in the following rounds. They may also lend money to each other or buy and sell land. Crops must be purchased again each round, while land and technologies are one-time purchases.

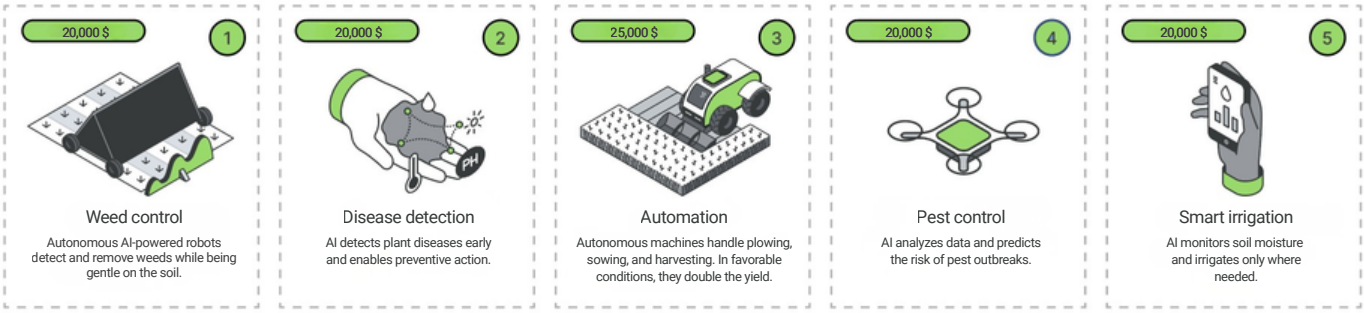
**Global events**
Players take turns rolling the die to determine which global event will affect all group members' crops. Each number on the die represents a different event (with the relevant technology that can reduce or eliminate its impact shown in parentheses):

1 – Weeds (technology: Weed control)
2 – Diseases (technology: Disease detection)
3 – Good Weather (technology: Automation of plowing, planting, and harvesting)
4 – Pests (technology: Pest control)
5 – Drought (technology: Smart irrigation)
6 – Floods (no available technology for flood protection in this game)

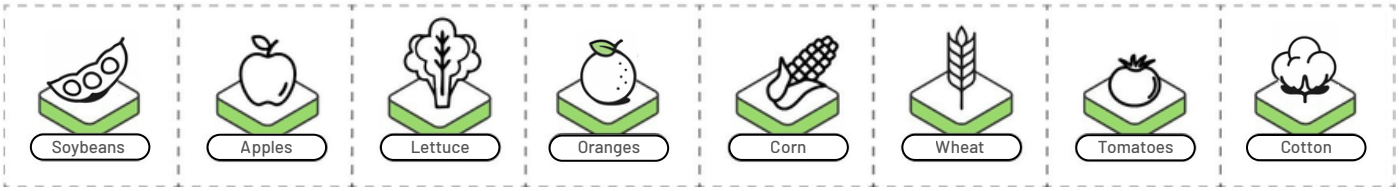
Based on the global event, players multiply the yields of their crops. They determine their profits using the info sheet and record them in the accounting ledger. Technologies available for purchase help offset the negative effects of global events.

**Technologies**
Players can purchase technologies that help protect crops and increase yields. Available technologies include:

Weed Control (1) - Autonomous tractors with AI identify and remove weeds while protecting the soil.
Disease Detection (2) - AI detects early signs of plant diseases, allowing for timely intervention.
Automation of plowing, sowing, and harvesting (3) – Autonomous machines handle all three tasks and double the standard yield.
Pest Control (4) - AI analyzes data to predict the risk of pest outbreaks.
Smart Irrigation (5) - AI monitors soil moisture and irrigates only where needed.




**Crops**
+ Corn – vulnerable to drought
+ Soybeans – vulnerable to diseases
+ Wheat – vulnerable to drought
+ Cotton – vulnerable to pests and drought
+ Apples – vulnerable to pests
+ Oranges – vulnerable to cold
+ Tomatoes – vulnerable to diseases
+ Lettuce – vulnerable to pests




**Victory Types**
+ Best Technologist (most technologies acquired)
+ Best Farmer (most crops grown)
+ Best Entrepreneur (most money in the account)

# Engage

10 min

Think about it.

**Do you think some crops grow better in certain areas and worse in others?**
**If yes, what factors might influence crop growth?**
Crop growth depends on many factors, including climate, soil type and quality, water availability, temperature, sunlight, and the presence of pests or diseases. Some crops grow best in warm, sunny areas, while others prefer cooler climates and higher humidity. Healthy soil rich in nutrients is essential, but human actions–such as irrigation, fertilization, and pest control–can also help or hinder growth. All these factors determine whether a crop will thrive in a given area.

**What elements do plants absorb from soil to grow?**
Plants absorb key nutrients like nitrogen, phosphorus, and potassium from the soil–these are essential for growth and development. They also need other minerals such as calcium, magnesium, and sulfur, as well as trace elements like iron, zinc, and copper. These nutrients support the growth of roots, stems, leaves, and fruits.

# Understand

60 min

10 min
Opening Discussion

Presentation slide 02–03

**Students explore soil types (presentation slides 02-03)**
If you like, play a short video (02:50) that gives an overview of soil types. The link is also available on slide 02 of the presentation. Help students understand that different plants grow better in different soils, and that some soils are richer in nutrients than others.

**Explain to students:** Different crops thrive in different places based on soil composition. But soil alone doesn't determine yield size or quality. Other key factors include temperature, water availability, and sunlight. When conditions are not ideal, complications can arise–such as crop diseases or pest outbreaks. Climate change brings more instability, including extreme weather like heavy rainfall, floods, droughts, or hailstorms, which can damage crops. Farmers also face ongoing challenges from weeds that compete with crops for nutrients and moisture.

**Question for students: Which technologies could help increase the efficiency of agriculture while supporting sustainable land management?**
Do not discuss their answers yet. To help them better understand how smart technologies can be used in agriculture, students will now play the Smart Farming Simulator board game.

50 min
Smart Farming Simulator

**Divide the students into groups of four.**
Give each group the following materials:
1× die,
1× land map,
2× info sheets (shared in pairs),
2× sets of crop cards,
1× set of technology cards,
4× accounting ledgers.

Presentation slide 04–12

**Explain the game rules (presentation on slides 04–12).**
+ What the game looks like (slide 04)
+ How each round works (slide 05)
+ Land map (slide 06)
+ Crop cards (slide 07)
+ Accounting ledger (slide 08)
+ Technology cards (slide 09)
+ Global events (slide 10)
+ Victory types (slide 11)
+ Cooperation options (slide 12)

**Students play Smart Farming Simulator (10 rounds).**
Observe the students and check in regularly to make sure they understand everything. Based on our testing, students usually have no trouble grasping the rules. Interestingly, they often choose very different strategies. Some groups prefer not to cooperate at all, while others even decide to merge their farm record books into one.

Presentation slide 13

**After the game, play the video on smart technologies in agriculture (presentation slide 13).**
Show the video on the use of AI in agriculture (6 minutes): youtube.com/watch?v=_tijHjup-gM (6:52)

# Reflect

20 min

5 min
Discussion: soil types

**TIP for discussions**
The discussion doesn't have to be led frontally. You can collect responses from all students using online tools such as Mentimeter, Slido, or Padlet.

**Discuss with the class. If possible, project the map of the USA again and review the soil types found across the country.**

**In the game, you worked with two general soil types – fertile soil and dry soil.**
**What other soil types can you find on the map, and where are they located?**

**During the game, you worked with different soil types. Which types did you use? Did you notice that some had higher yields than others? If so, why do you think one type of soil produced better results?**

Black soil provided higher yields because it is richer in nutrients and organic matter, retains water more effectively, and offers better growing conditions overall.

5 min
Discussion: game strategy

**Selected students from the group present the strategies they used during the game and the results they achieved.**

You can share the following questions with the students, which they will then respond to:

+ What was your main strategy when choosing land and crops? Why did you choose it?
+ Which technologies did you invest in, and how did they impact your yield?
+ What role did cooperation or competition with other players in your group play? Would greater involvement from others have helped?
+ What was the difference between soil types (e.g. dry soil vs. fertile soil) in terms of yield and how you used them strategically?
+ If you played the game again, what would you do differently and why?
+ What other technologies do you think could be useful in agriculture?

10 min
Discussion groups: global events

**Divide students into their original groups (used during the gameplay). Assign them the following tasks:**
Each group selects one global event that occurred during the game (e.g. drought, pests, crop diseases).
.
Together, they answer the following questions:
+ Which technology in the game helped reduce the impact of this event?
+ How is this technology applied in the real world?
+ What were the advantages and disadvantages of using it in the game?
+ How could this technology support more sustainable agriculture?

Each group will briefly present their conclusions, focusing especially on:
+ How the selected technology contributed to production efficiency and sustainability.

# If there's time left...

Discussion

**Can you think of examples of how smart technologies are used in agriculture? What are they?**

**Data collection and analysis:** Artificial intelligence can collect and analyse data on soil, weather, and crop health. This helps farmers make better decisions about when and what to plant to maximise yields and use resources more efficiently.
**Automation of routine tasks:** Repetitive tasks like irrigation, ploughing, harvesting, or applying fertilisers and pesticides can be managed by AI, saving farmers time and effort.
**Prediction and prevention:** AI helps predict risks such as crop diseases, pests, or weather changes. Early warnings allow farmers to act quickly, reducing damage and improving harvest stability.
**Resource savings:** AI helps farmers save water, energy, and other resources through more precise control. This supports sustainability and reduces operating costs.

## Accounting ledger

**Victory Types**
+ Best Technologist (most technologies acquired)
+ Best Farmer (most crops grown)
+ Best Entrepreneur (most money in the account)

**Flow of a game round:**
1) buy land and crops
2) roll the die for a global event
3) calculate profits, optionally buy technology

| Round | At the beginning of the round I have: | Land | Crops | Technology | I bought: | Remaining: | Event | I earned: |
|---|---|---|---|---|---|---|---|---|
| 01 | 50,000 $ | | | | | | | |
| 02 | | | | | | | | |
| 03 | | | | | | | | |
| 04 | | | | | | | | |
| 05 | | | | | | | | |
| 06 | | | | | | | | |
| 07 | | | | | | | | |
| 08 | | | | | | | | |
| 09 | | | | | | | | |
| 10 | | | | | | | | |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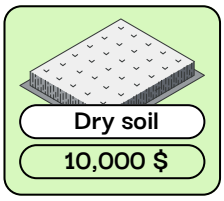
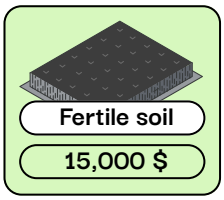
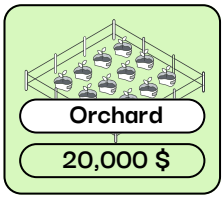
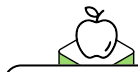
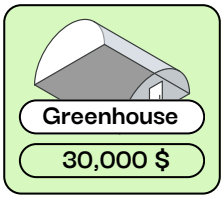
|---|---|---|---|---|---|---|---|---|
| 01 | 50,000 $ | | | | | | | |
| 02 | | | | | | | | |
| 03 | | | | | | | | |
| 04 | | | | | | | | |
| 05 | | | | | | | | |
| 06 | | | | | | | | |
| 07 | | | | | | | | |
| 08 | | | | | | | | |
| 09 | | | | | | | | |
| 10 | | | | | | | | |

Game info sheet

# Smart Farming Simulator

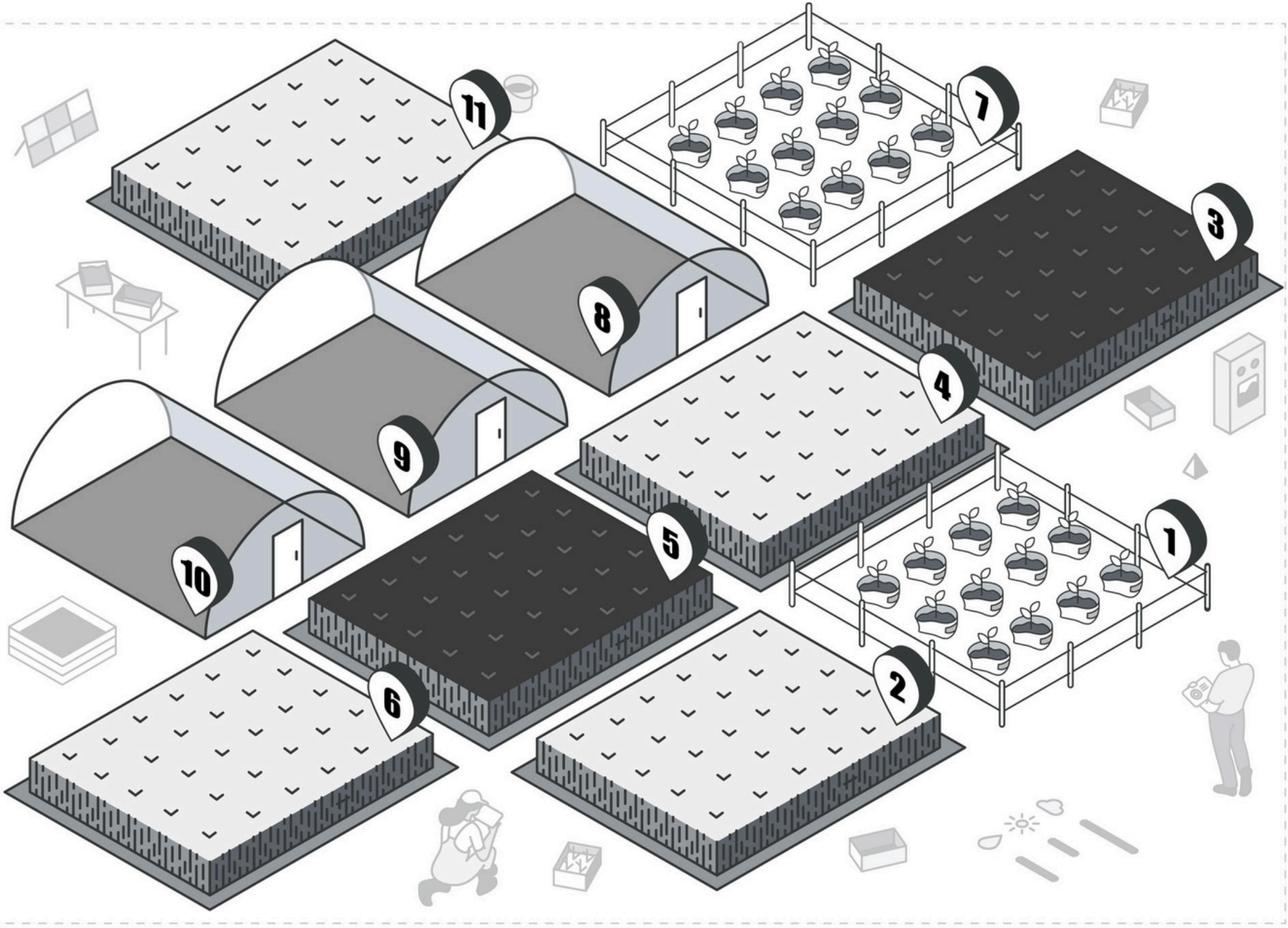
| Crop cultivation | Crop | Information | Yields during global events | | | | | |
|---|---|---|---|---|---|---|---|---|
| (Calculate yields by multiplying the crop's purchase price by X.) | | | 1 | 2 | 3 | 4 | 5 | 6 |
|  Dry soil 10,000 $ |  Cotton | Price: 1,500 $<br>Standard yield: 4×<br>Susceptible to pests | 4× | 3× | 5× | 2× | 2× | 0× |
| |  Wheat | Price: 1,000 $<br>Standard yield: 8×<br>Drought-tolerant | 6× | 5× | 8× | 5× | 6× | 0× |
|  Fertile soil 15,000 $ |  Corn | Price: 2,000 $<br>Standard yield: 6×<br>Susceptible to drought | 5× | 4× | 7× | 4× | 2× | 0× |
| |  Soybeans | Price: 2,000 $<br>Standard yield: 6×<br>Susceptible to diseases | 4× | 3× | 6× | 4× | 3× | 0× |
|  Orchard 20,000 $ |  Apples | Price: 5,000 $<br>Standard yield: 3×<br>Susceptible to pests | 3× | 2× | 4× | 2× | 2× | 0× |
| |  Oranges | Price: 3,500 $<br>Standard yield: 5×<br>Susceptible to diseases | 4× | 3× | 6× | 3× | 3× | 0× |
|  Greenhouse 30,000 $ |  Tomatoes | Price: 3,500 $<br>Standard yield: 5×<br>Susceptible to diseases | 4× | 2× | 5× | 3× | 4× | 0× |
| |  Lettuce | Price: 4,000 $<br>Standard yield: 5×<br>Susceptible to pests | 4× | 3× | 5× | 2× | 3× | 0× |

## Why buy technologies

By purchasing technology, your crops become resistant to global events. For example, if you roll a four (pests) and you own pest protection technology, your yield remains standard, not reduced.

The exception is good weather (number 3). If you own automation technology, you double the standard yield of all crops.

| Global events | | Technologies |
|---|---|---|
| 1 | Weeds | Eco friendly weed control |
| 2 | Diseases | Disease detection technology |
| 3 | Good weather | Automation of plowing, sowing, and harvesting |
| 4 | Pests | Pest control technology |
| 5 | Drought | Smart irrigation technology |
| 6 | Floods | No flood protection in this game |


11
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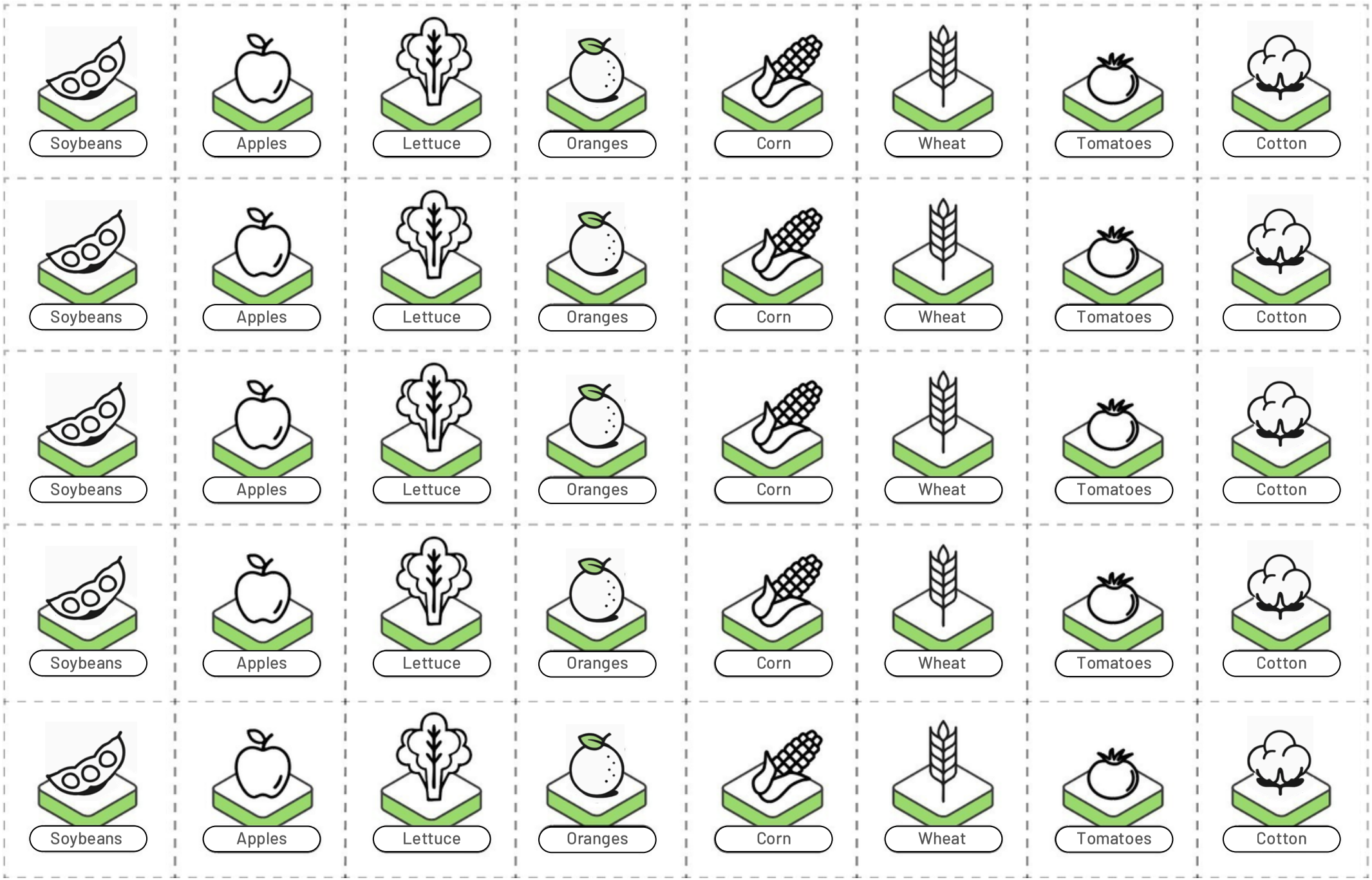
Soybeans
Apples
Lettuce
Oranges
Corn
Wheat
Tomatoes
Cotton
Soybeans
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Oranges
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Soybeans
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Lettuce
Oranges
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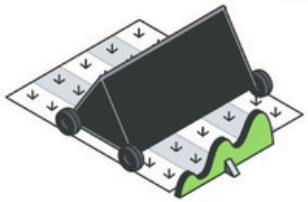
Tomatoes
Cotton
Soybeans
Apples
Lettuce
Oranges
Corn
Wheat
Tomatoes
Cotton

20,000 $ 1



## Weed control

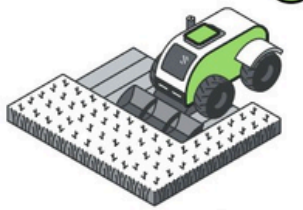
Autonomous AI-powered robots detect and remove weeds while being gentle on the soil.

20,000 $ 2


## Disease detection

AI detects plant diseases early and enables preventive action.

25,000 $ 3



## Automation

Autonomous machines handle plowing, sowing, and harvesting. In favorable conditions, they double the yield.

20,000 $ 4

## Pest control

AI analyzes data and predicts the risk of pest outbreaks.

20,000 $ 5

## Smart irrigation

AI monitors soil moisture and irrigates only where needed.

20,000 $ 1

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20,000 $ 2


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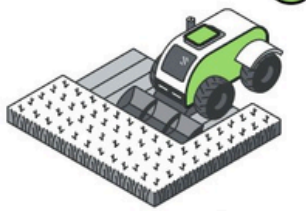

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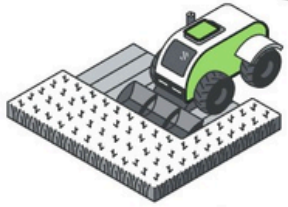

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