



## **World Robot Olympiad 2018**

Regular Category

Junior

Game Description, Rules and Scoring

**FOOD MATTERS**

# **PRECISION FARMING**

Version: Final Version January 15<sup>th</sup>



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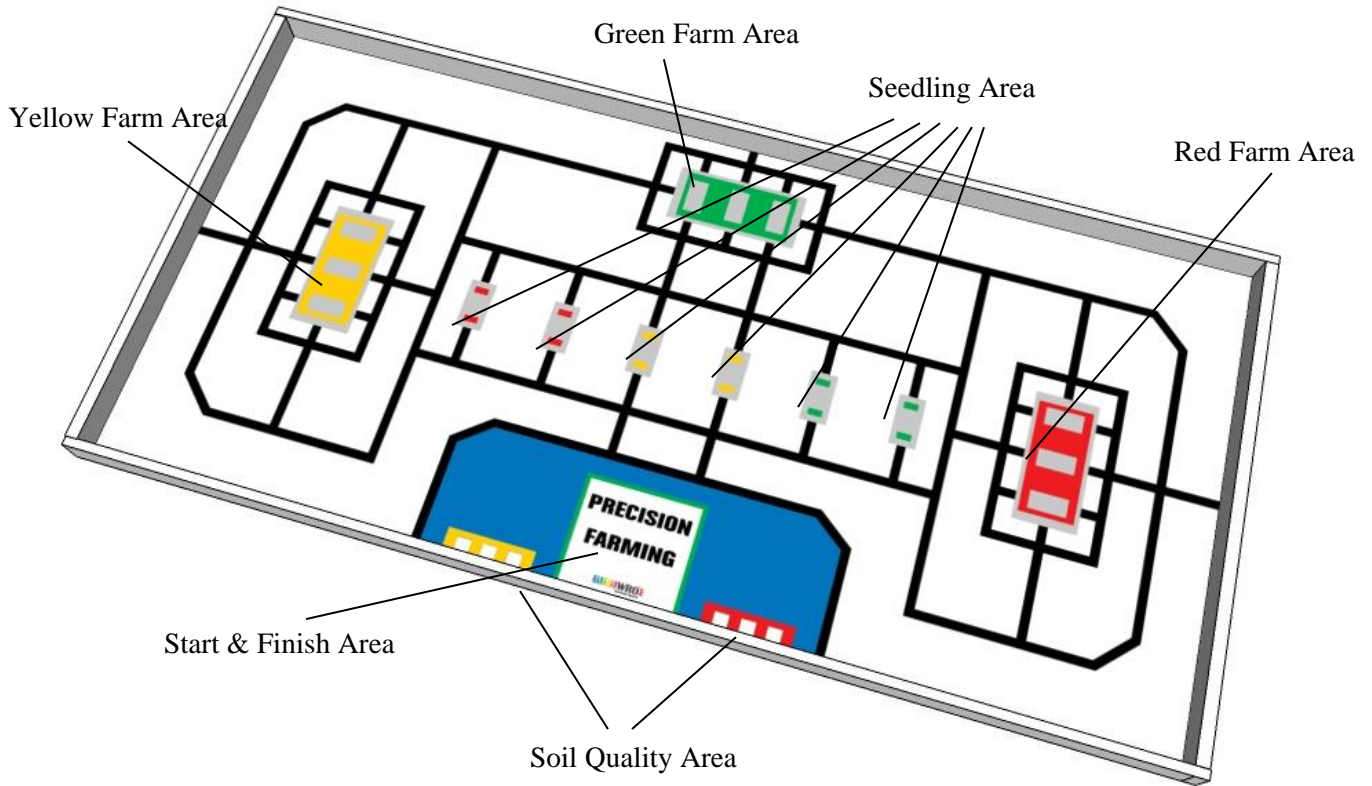
## Introduction

With a growing population in the world, more and more food needs to be produced every year.

One way to get an increased food production is to use technologies like robots, drones, and satellites to improve the usage of arable land. Satellites and drones can provide accurate data on the soil quality of the different areas of the arable land. This data can be used by robots (self-driving tractors) to plant different seedlings on the land depending on the soil quality. In this way, the seedlings are adapted to the growing environment, which will improve the growth of the seedlings.

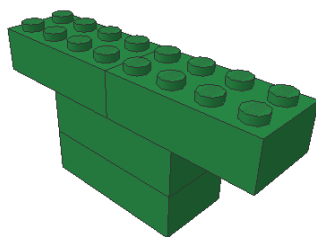
The mission of the robot is to gather data on the soil quality of the fields of different farms and use this data to plant different seedlings depending on the soil quality.

# 1. Game Description

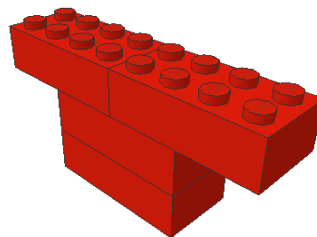


The Junior Challenge is to make a robot that can plant different kinds of plants in the fields of three farms depending on the soil quality of the fields.

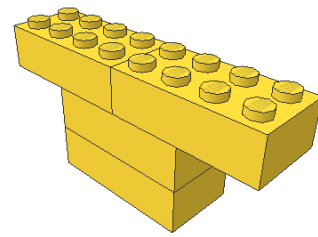
There are three kinds of plants represented by three LEGO models:



Green Plant



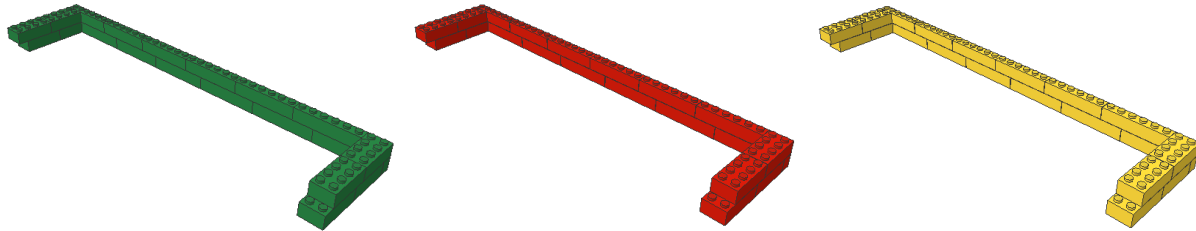
Red Plant



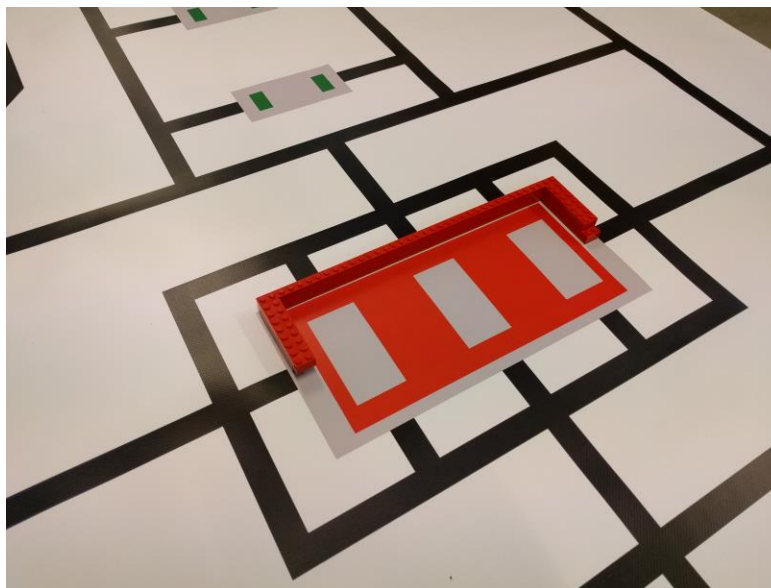
Yellow Plant

Twelve plants are placed in the Seedling Area, **four of each color**.

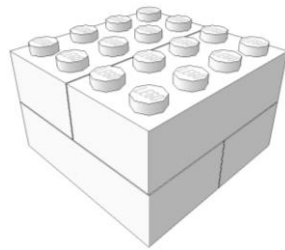
The Green Farm, the Red Farm, and the Yellow Farm represent the three different farms on the game mat. The green plants must be planted in the fields of the Green Farm, the red plants in the Red Farm, and the yellow plants in the Yellow Farm. Walls protect the fields of the three farms:



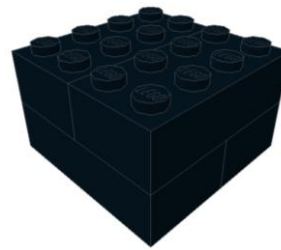
The Green Farm is a fertile area so the robot can plant three plants from the Seedling Area on the three fields of the Green Farm. The walls have to be placed in front of the farm to protect the fields of the three farms (see example for the red farm below):



In the Red and Yellow Farms, the robot can only plant red or yellow plants in the fields with a matching soil quality. The robot can retrieve the soil quality of the three fields of the Red and Yellow Farm from the two corresponding areas with Soil Quality Data. In each of the two Soil Quality Data areas, there are three LEGO blocks representing the soil quality of each of the three fields in the Red and the Yellow Farms. A white block represents a field with enough nutrients to grow plants. A black block represents a field without enough nutrients for plants:



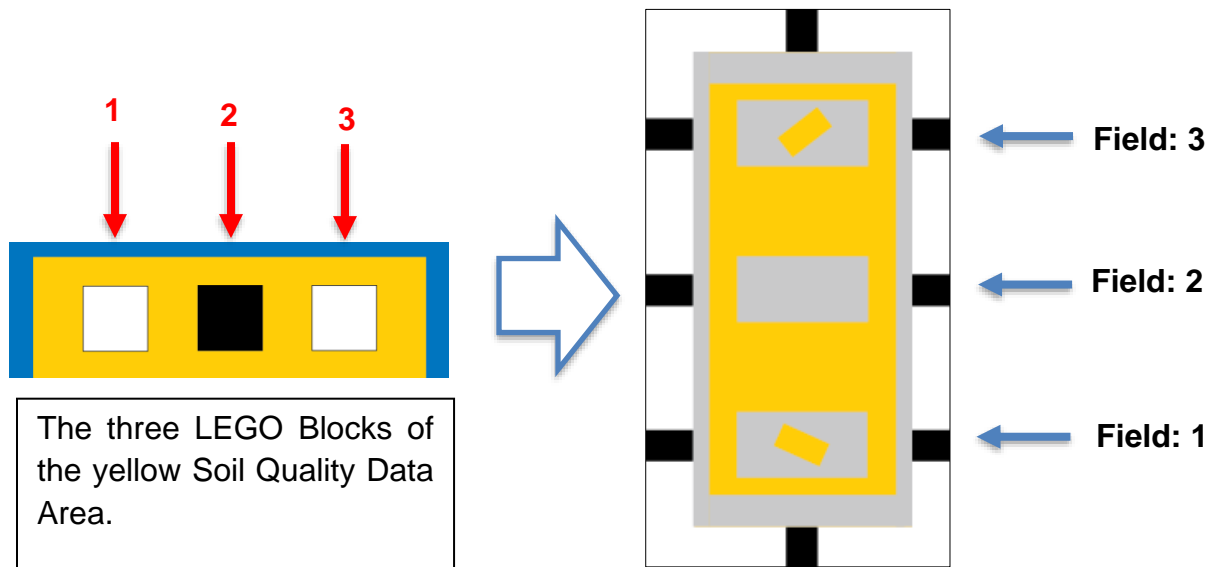
White Block



Black Block

There are four white blocks and two black blocks in the two Soil Quality areas.

The three LEGO blocks in the yellow Soil Quality Data Area represent the soil quality of the three fields of the yellow farm as follows:



The three LEGO blocks in the red Soil Quality Data Area represent the soil quality of the red farm in a similar way.

The robot must start from within the Start & Finish Area. After the mission, the robot must return to the Start & Finish Area.

## 2. Game Rules

- Before each round, the 6 Soil Quality Blocks are randomly placed on the 6 white squares in the Soil Quality Data areas as shown in figure 2.1

The random placement of the 6 blocks may be accomplished manually as follows:

- The 6 white squares are numbered 1 to 6 as in figure 2.1

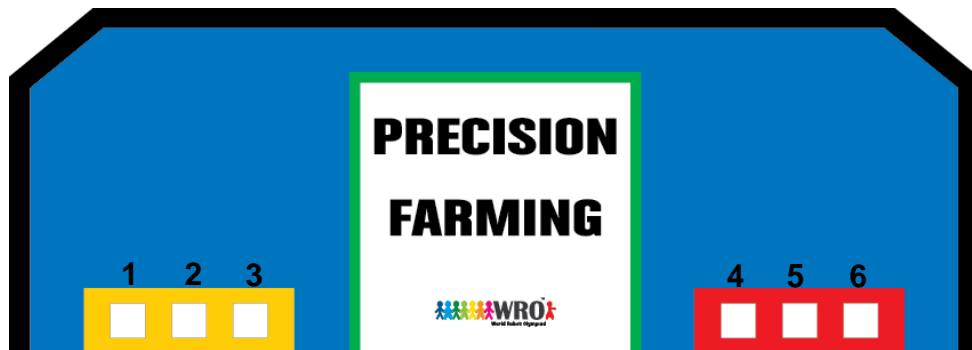
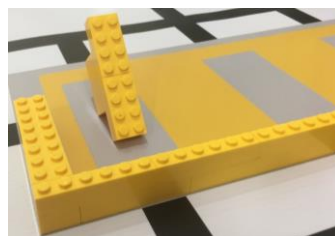
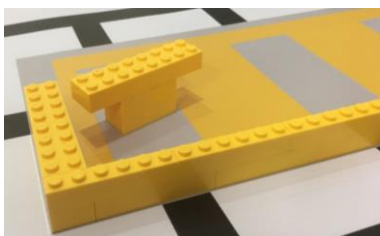
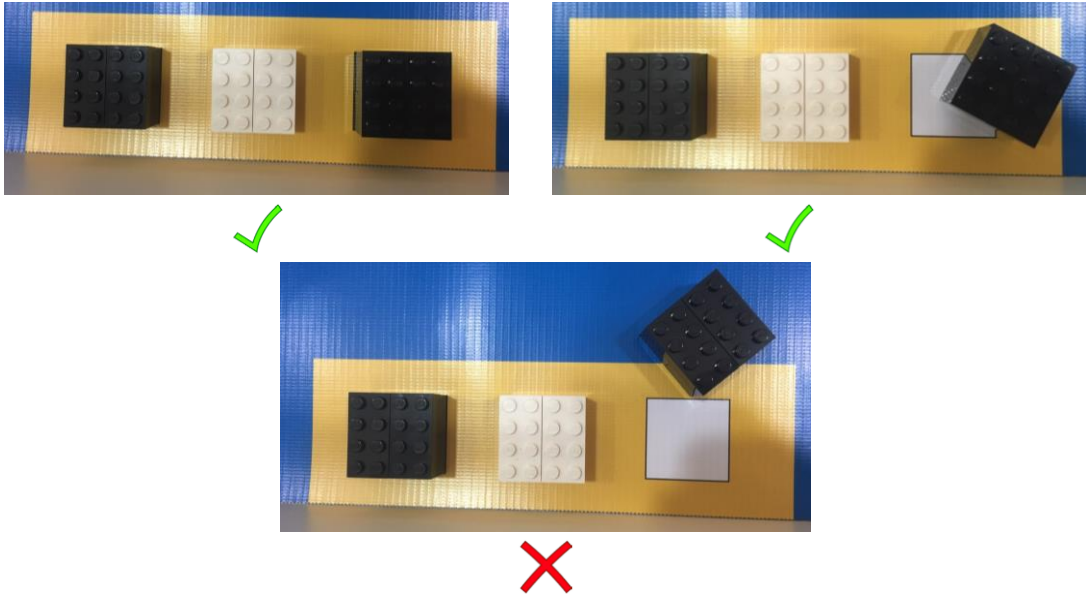


Figure 2.1

- Put 4 white blocks and 2 black blocks into a non-transparent box.
  - Shake the box to mix the 6 blocks.
  - Take the blocks one by one from the box and put them on the white squares starting from square number 1.
- Each plant to be moved must be moved from the Seedling Area to a field in a farm area that matches the color of the plant. The plants must be placed completely inside a grey square in the farm area, in an upright position, and the plant must be undamaged. See the figure below for examples of proper and improper placement. **Only one plant is allowed to be planted in one grey square.** If multiple plants are in a grey square area, only the one plant with the highest points will be counted.



- The soil quality data blocks must remain at their initial locations. This means that some part of each block must touch the white square where it was initially placed and the blocks must be undamaged.



- The robot will start within the Start & Finish Area (The green line is not included). The mission is completed when the robot completely stops within the Start & Finish Area (The green line is included). Cables are allowed to be outside of the Start & Finish area.
- The robot must not damage any wall or move any wall from its initial location. If this happens a penalty is given provided this does not result in a negative score (see Game Rules 5.15).

### 3. Scoring

Maximum score = 180 points

**Scoring Table:**

Tasks	Points Each	Total
Place any plant <b>completely</b> within a grey area in the <b>green farm</b> , undamaged and in an upright position.	10	30
Place any plant <b>partly</b> within a grey area in the <b>green farm</b> , undamaged and in an upright position.	5	15
Place any plant <b>completely</b> within a grey area of a yellow or red farm of the correct color, matched with soil quality data, undamaged and in an upright position.	25	100
Place any plant <b>partly</b> within a grey area of a yellow or red farm of the correct color, matched with soil quality data, undamaged and in an upright position.	10	40
All soil quality data blocks touch the white square of their initial locations. Points only given if at least one plant in a farm gets points and no plant is placed in a farm <b>not matched with soil quality data</b> .		25
Remaining 5 plants touch the grey squares around their initial locations in the Seedling Area. Points only given if at least one plant in a farm gets points.		15
Robot damages any wall or moves any wall from its initial location.	-5	-15
Robot completely stops within Start & Finish Area (only gets these points if other points are assigned)		10
<b>Maximum Score</b>		<b>180</b>

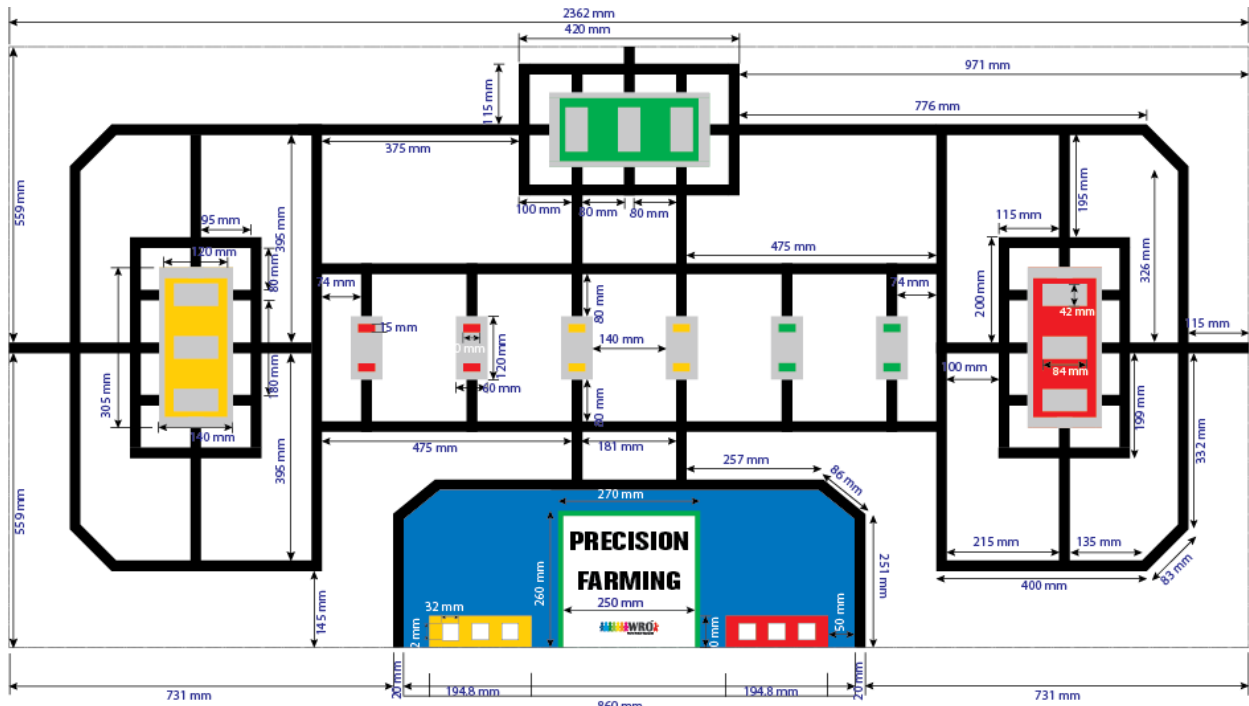
### 4. Table Specifications

a. The internal dimensions of a game table are 2362 mm x 1143 mm.







- b. The external dimensions of the table are 2438 mm x 1219 mm.
- c. The primary color of a table surface is white.
- d. Height of the borders:  $70 \pm 20$  mm

## 5. Game Mat Specifications



- a. All black lines are  $20 \pm 1$  mm.
- b. Dimensions may vary within  $\pm 5$  mm.
- c. If the table is larger than the game mat, put the starting area to the wall and center the mat to the left and right.
- d. We recommend to print the game mat with matt finish without reflecting colors.

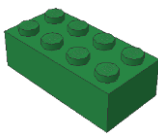
### Color Specification

Color Name	CMYK				RGB			RGB Sample
	C	M	Y	K	R	G	B	
Red	0	100	100	0	237	28	36	
Blue	100	47	0	0	0	117	191	
Yellow	0	19	100	0	255	205	3	
Green	88	0	100	0	0	172	70	

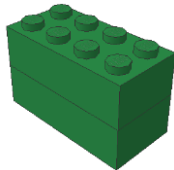
## 6. Game Object Specifications

**12 plants are needed: 4 green, 4 yellow and 4 red plants.**

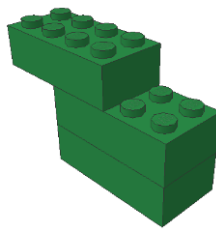
Each plant has four 2x4 LEGO bricks



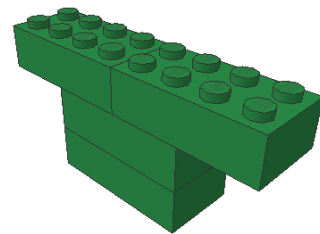
Step 1



Step 2



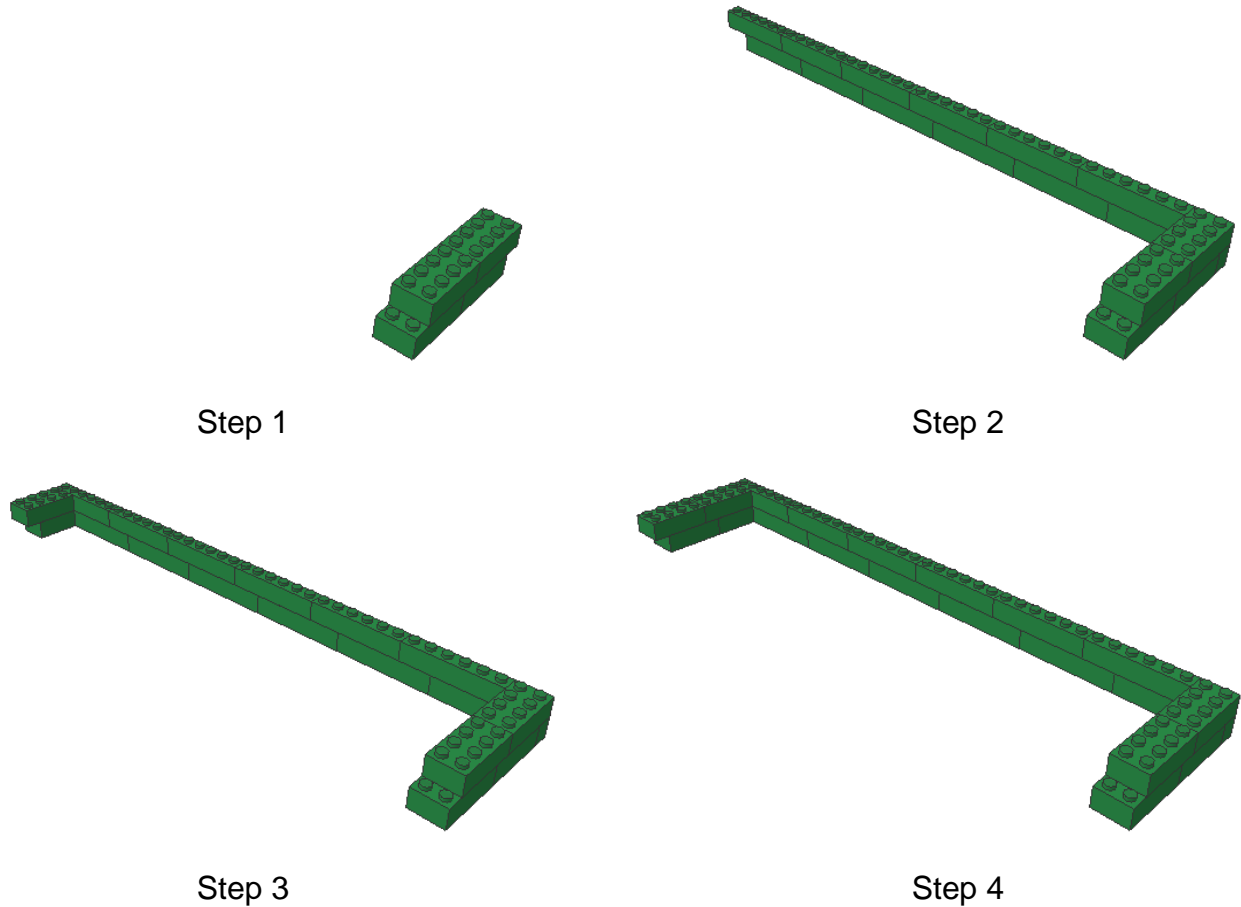
Step 3



Step 4

**3 walls are needed: 1 green, 1 yellow and 1 red wall.**

Each wall of the farm area has eight 2x4 LEGO bricks and twelve 1x6 LEGO bricks.



**6 blocks are needed: 2 black blocks and 4 white blocks.**

Each soil quality block has four black 2x4 LEGO bricks.

