

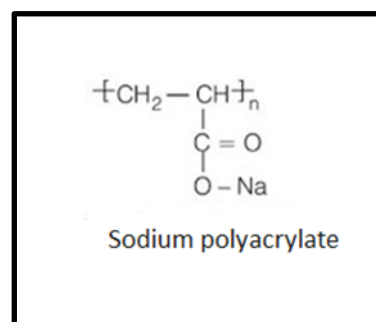
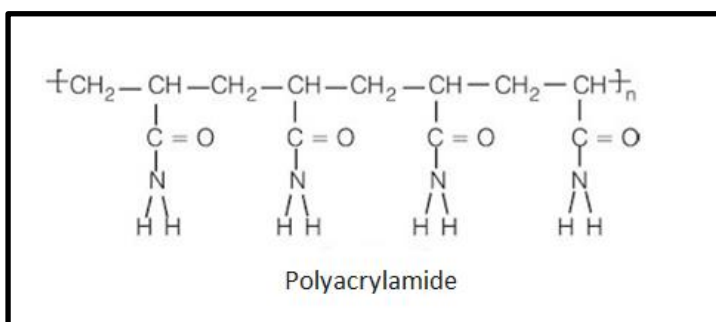
Polygrowth

What is the influence of a superabsorbent polymer on plant growth?

With this experiment, we have the objective of studying the influence of a superabsorbent polymer incorporated in soil on plant growth.

Polymers have become more and more important to us. For example, disposable diapers contain sodium polyacrylate, a superabsorbent polymer (SAP), in other words, a polymer which has a high affinity with water.

The most commonly used polymers today are polyacrylamide (water absorbed by hydrogen bonds) and sodium polyacrylate (it absorbs water by osmosis to balance the concentration of sodium ions inside and outside the polymer).



1 - Chemical structure of sodium and polyacrylamide

The following table shows the increase of sodium polyacrylate mass after 50 minutes in contact with different water samples and solutions:

Sample	Sodium polyacrylate mass/g	Hydrated sodium polyacrylate mass/g	Mass of water absorbed /g
Distilled water	0,25	35,25	35,00
Mineral water	0,25	29,98	29,73
Tap water	0,25	21,51	21,26

Solution (1% NaCl)	0,25	4,77	4,52
Solution (10% NaCl)	0,25	3,08	2,83

About 3.5 billion ha of land have been degraded by human activities. The ecological restoration of those lands is a major challenge for mankind. Rainfall changes from a blessing to a menace since it is not kept in the soil and therefore causes erosion. A solution for the recovery of those lands could be the application of superabsorbent polymers (SAPs) to those soils. These substances have the same characteristics as an “artificial humus” as they are hydrophilic. They have the following advantages for the recovery of degraded lands:

- Increase the availability of water in the soil which enables the plant to survive longer under water stress.
- SAP amendment to soils reduces the evapotranspiration rate of the plants.
- Induce a significantly higher growth rate in plants growing on SAP amended soil.

The benefits of SAP overcome its cost taking in account its degradability and how it will make soil fertile again!

Materials:

- SAP (superabsorbent polymer);
- 3 used vases;
- 3 Seeds of fava beans;
- Soil;
- 150 ml of Water per vase.

Procedure:

- 1 - Withdraw the cellulose pulp and the sodium polyacrylate (superabsorbent polymer) from the diapers;
- 2 - Fill half of each vase with soil;

3 - Place 2.936g of the substances previously removed from the diapers on top of the soil contained in vase 2 and 4.713g in vase 3. Vase 1 is the control so superabsorbent polymer isn't incorporated.

4 - Put a small layer of soil on top of the one made in step 3, place the seeds and then cover them with some more soil;

5 - Water just one time with 150 ml per vase;

6 - Data collection of variables, plant growth.

Treatment and discussion of results:

The following table and graph show the difference in plant growth with SAP and without SAP.

Days	Vase 1/cm	Vase 2/cm	Vase 3/cm
1	0	0	0
3	0	1	1
5	0	3	2,5
8	1	4	3,5
10	2,5	5,5	4,5
12	3,5	6,5	5
14	5	7,5	6,5
16	5,5	9	8,5
19	6,5	11,5	11
21	7,5	12	12
23	7,5	13,5	14
26	8	15,5	16
29	8,5	17	18
31	9,5	20	22
33	13	24	27
35	16	27	38

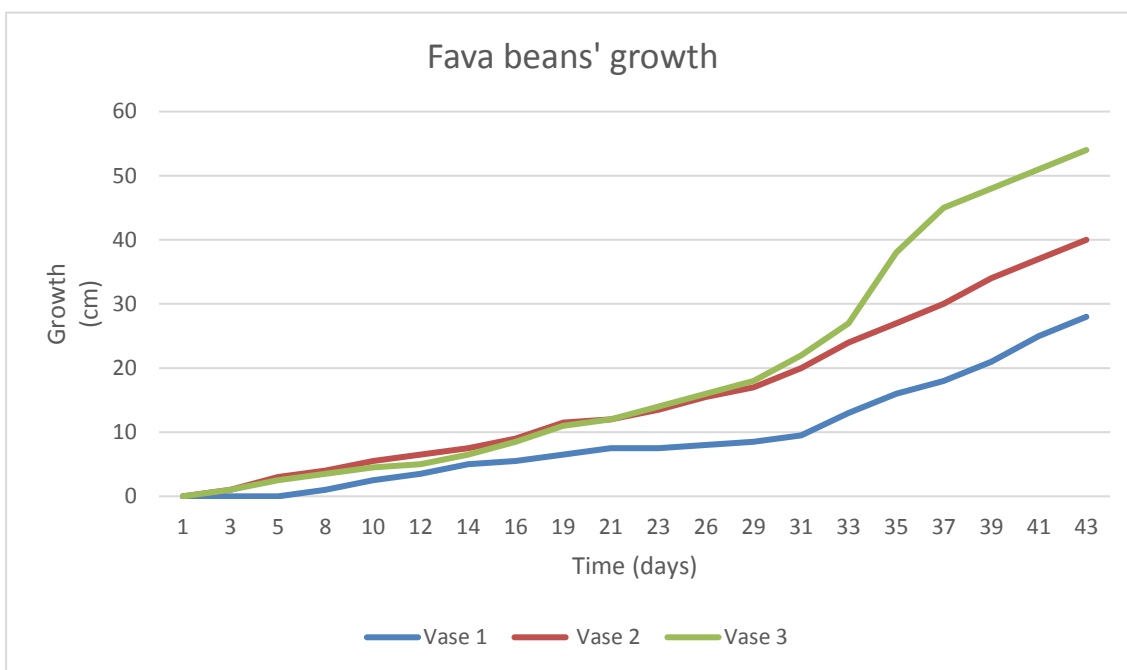


37	18	30	45
39	21	34	48
41	25	37	51
43	28	40	54

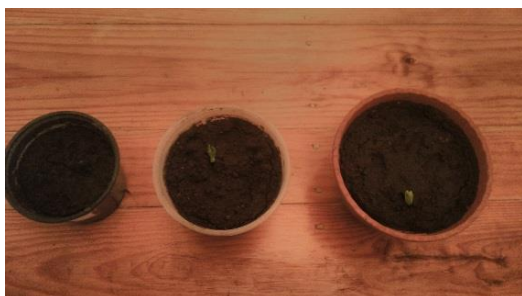
Vase 1- without SAP

Vase 2- with 2,936g of SAP

Vase 3- with 4,713g of SAP



Results:



Day 5



Day 8





Day 14



Day 19



Day 29



Day 35

Conclusion:

This experiment enabled us to verify that the use of superabsorbent polymer in soil can influence plant growth positively. In a controlled environment (same temperature and watering) we observed that the seeds planted with SAP grew much faster than the one planted without. Therefore, we can conclude that the presence of SAP in the soil retains water and enables the plant to absorb it gradually according to its needs.

The use of SAP has great potential for the sustainability of agriculture. Water for irrigation can be saved as it retains in the polymer reducing the rate of evaporation. Millions of used diapers can be recycled thus reducing the production of waste.

Source: <http://qnesc.sbg.org.br/online/qnesc15/v15a09.pdf>



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