

THE EFFECTS OF SOAKING *Abelmoschus esculentus*
(LADY'S FINGER) SEED IN DIFFERENT LIQUID
MEDIUM

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(Creating the community of Excellence)

The Effects Of Soaking Abelmoschus esculentus (Lady's Finger) Seed In Different Liquid Medium

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The Effects Of Soaking Abelmoschus esculentus (Lady's Finger) Seed In Different Liquid Medium

ABSTRACT

Soaking seeds before planting can significantly decrease the amount of time it takes for a seed to germinate. It also helps to break down the seed's natural defenses against what it expects from Mother Nature, which then allows it to germinate faster.

This project is mainly done to analyse the effectiveness of seeds soaked in different liquid medium at different time duration. I used 100ml tap water, 100ml tender coconut water, 100ml diluted Cow dung and 100g Aloe Vera Gel as soaking medium. I selected the seeds of Lady's Finger (*Abelmoschus esculentus*) for planting. The seeds are soaked for different time duration – for 3hours, 6 hours and 24 hours in the liquid medium to determine which duration is suitable for faster germination. I potted 2 kg garden soil with 100 g of organic manure in each of 13 earthen pots. I planted three such soaked seeds in the pots. One pot was kept for comparing the growth of seeds without soaking. This is my Control. I kept all the pots in a place where they are exposed to equal amount of sunlight and air. I poured 100ml of water every day in all the pots. I observed the growth of seed and tabulated the results.

Through my experiment ***I found that the seeds soaked in Cow dung give maximum growth especially the ones soaked for 6hours.*** Germination was very low in seeds soaked for 3hrs in different water medium.



INTRODUCTION

Seeds too think when to start up!

All seeds need moisture levels which plays a big role in alerting a seed to optimal grow times.. The seed itself is actually a seed coat (like a coat of arms) that protects the embryo (future plant) inside.



The seed coat stays intact until the proper conditions (temperature, moisture, lightness or darkness) present themselves for the plant to emerge. By soaking the seeds, we can quickly boost the moisture content around the seeds, which signals to the seed that it is now safe to grow.

CONDITIONS NECESSARY FOR GERMINATION



Suitable Temperature, Water (moisture), Air (oxygen) and and sunlight are necessary for seed germination

Suitable Temperature

Most flowering plants germinate best in cool-weather, as they germinate best at temperatures that range from 45 to 65 degrees Fahrenheit. Colder temperatures delay germination and may cause seed decay due to the soil's initial spring dampness. Planted too late into the warm months, the seeds germinate poorly, if at all, when daytime temperatures exceed 75° F.

Water

In addition to heat, flowering plants need moisture to germinate. While dormant, flowering plant (pea seeds) store food in their endosperms, or inner tissues, and in their cotyledons, or first leaves. As they absorb water, this food is released and converted into energy needed by the developing embryo. Pea seeds deprived of water shrivel and die, while those that receive too much water become water-logged and start to decay. Proper watering ensures that the soil around the bases of the pea vines is damp but not saturated, with additional watering scheduled during dry spells.

Air

In the dormant condition the seeds respiratory rate is very low and so oxygen is required in very small quantities. But for germination, oxygen is needed in large quantities. The seeds obtain oxygen that is dissolved in water and from the air contained in the soil. If soil conditions are too wet, an anaerobic condition persists, and seeds may not be able to germinate.

Sunlight

Some seeds need light for germination, while in some seeds germination is hindered by light. Germinating pea seeds do not need light to complete the first stage of their growth, all of which takes place below the soil. A small root is the first thing to emerge on one end of the seed, followed by a small sprout bearing two small leaves called a cotyledon. Once the cotyledon rises above the soil, light becomes a crucial factor in the pea plant's proper development. At least 6 hours of direct sunlight are needed at this stage to encourage the plant to produce its own food through the process known as photosynthesis.

Response to Temperature:

Once the temperature feels just right, and there's enough moisture to cause the seed coat to swell and rupture (thereby releasing its food stores and coaxing the embryo to develop), germination starts. If it is too cold or too wet, too warm or too dry for that particular seed, it will fail to germinate at all. By soaking seeds ahead of time seeds are ready to sprout by the time it gets stick in the soil.

Why time of sowing is important?

If we sow them too soon, they could rot in the ground from a cold and rainy spring. If sown too late, they could struggle to flower once the heat sets in. The same goes for sowing them too late in fall as well; a sudden frost might hit before they have a chance to germinate.

Soil condition:

Soaking is particularly useful for gardeners with heavy clay or super sandy soil. Clay is difficult to moisten evenly if it's allowed to dry out; and once it does stay wet, it can hold moisture for too long, causing seeds to rot. On the flip side, sand drains very quickly, making it a challenge to keep seeds (especially those near the surface) moist enough for germination to occur.

IMPORTANCE OF SOAKING

Soaking for sowing:



If the seeds are already wet, and the seed coats have absorbed enough water for the first root to emerge, that could mean a much earlier harvest than sowing seeds that were dry. It also relieves some of the stress of ensuring your soil is adequately damp after you've sowed a row of seeds — a task that's a little trickier when starting seeds outside versus inside.



What to Soak

Soaking is beneficial for pea seeds as well as other seeds with thick, hard coats, such as fava beans (*Vicia faba*), beets, cucumbers, corn, and squash, Big seeds, Wrinkled seeds. In general, the tougher the seed, the better it will fare with soaking.

How Long to Soak

For thick-skinned seeds like peas, aim for 8 to 10 hours (or overnight). For thin-skinned seeds like snap beans, soak for 2 to 4 hours. For all other seeds in between, the appropriate length of time to soak is more an art than a science. We want to soak them long enough so that the coats begin to swell, but not so long that they just split or rot.

When to Sow the Seeds

Once the seeds soften a bit and start to swell (an appearance that we will become familiar with the more often we soak the seeds), sow them in the ground immediately. You'll often find that by soaking your seeds ahead of time, you've shaved a few days to even a week or more off the germination time.

Why seeds float?

Seeds may float because they lack viable embryos or nutrient stores, making them less dense than "good" seeds that sink. Or, they may float because they have air pockets inside, which don't always affect seed vigor or viability. The only sure way to test germination is to use the coffee filter method.

STATEMENT OF THE PROBLEM

Some types of seeds actually contain germination inhibitors that are designed to prevent a seed from germinating inside the fruit. These inhibitors must be leached away before a seed can germinate. In nature with natural rainfall, this process can take some time. But with soaking, this process will speed up. But how long soaking should be done? Which liquid could be the best soaking medium?

HYPOTHESIS

The seed soaked in cow dung water medium will give maximum growth.

DESIGN OF STUDY

INDEPENDENT VARIABLE:

- Liquid Medium (Cow Dung water,Aloe Vera gel, Tender coconut water, Tap Water)

DEPENDENT VARIABLE:

- Growth of plant

CONTROLLED VARIABLES:

- Seed, soil, manure,water, pot size, sun light.

MATERIALS:

- Lady's Finger Seed
- Soil
- Manure (Vermi Compost)
- Weighing Machine
- Scale
- Measuring jug
- Mud Pots (13)
- Cow Dung
- Aloe Vera
- Tender coconut water
- Tap Water

PROCEDURE:

1. Measure the capacity of single pot (3kg).
2. Multiply by 13 and according to that amount collect soil from the garden.
3. Collect 26 kg of soil from the garden and mix 1.3 kg of vermicompost. (2kg soil and 100 g vermicompost per pot)
4. Put equal amount of soil in all the pots and label the pots as Control, Cow dung-3hrs, Cow dung-6hrs, Cow dung-24hrs, Aloe Vera-3hrs, Aloe Vera-6hrs, Aloe Vera-24hrs, Tender coconut-3hrs, Tender coconut-6hrs, Tender coconut-24hrs and Tap Water-3hrs, Tap Water-6hrs and Tap Water-24hrs.
5. ***Prepare Cow Dung Water Medium: Add 100g of fresh cow dung with 100ml water.***
6. Soak the seeds in the different liquid medium like Cow Dung water medium, Aloe Vera gel (100 ml), Tender coconut water (100ml) and Tap Water (100ml) in a bowl for about 3 hrs, 6 hrs and 24 hrs.
7. Sow the soaking seed in the pots at planned intervals (3hrs, 6hrs and 24 hrs).
8. Sow 3 seeds which have not been treated in any liquid medium in the control pot.
9. Place all the pots in a place where all the pots get equal amount of sunlight.
10. Water equal amount of water to all the plants daily.
11. Observe the growth of seed.
12. Measure the growth of the plant.

COLLECTION OF DATA- PHOTOGRAPHS



COLLECT THE SOIL



SELECT THE POT



MEASURE THE SOIL



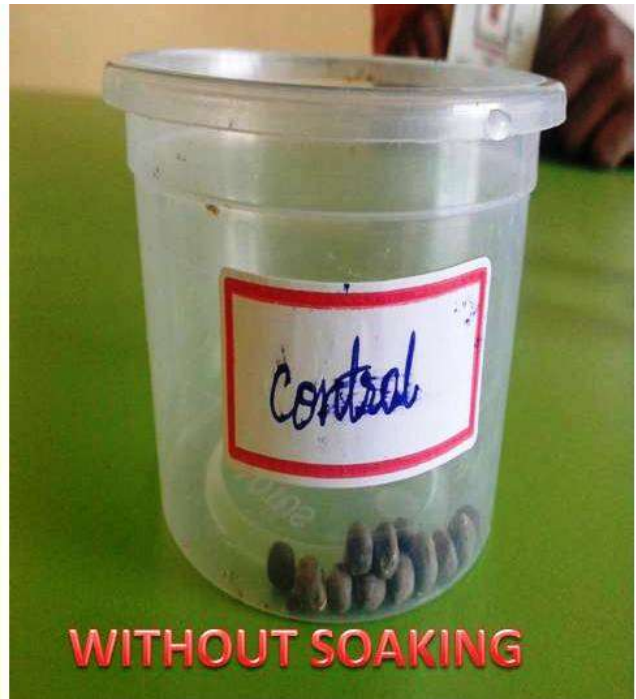
PUTTING SOIL



Samples



SEED TEST



WITHOUT SOAKING



SOWING SEED



SOWING ALOEVERA SEED



SOWING COCONUT SEED



SOWING TAP WATER SEED



SOWING GOW DUNG SEED

DAY 3





DAY 4

Measure the length
4th Day



DAY 4



DAY 4



DAY 5



DAY 5



DAY 6



DAY 6



DAY 6



DAY 7



DAY 7



DAY 7



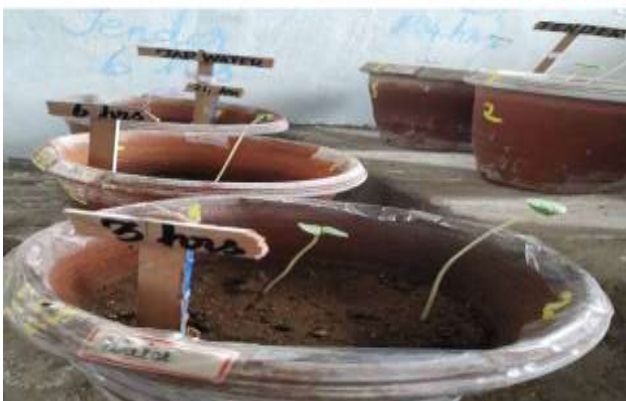
DAY 7



DAY 7



DAY 8



DAY 8



DAY 8



DAY 9



DAY 9



DAY 10



DAY 10



DAY 11



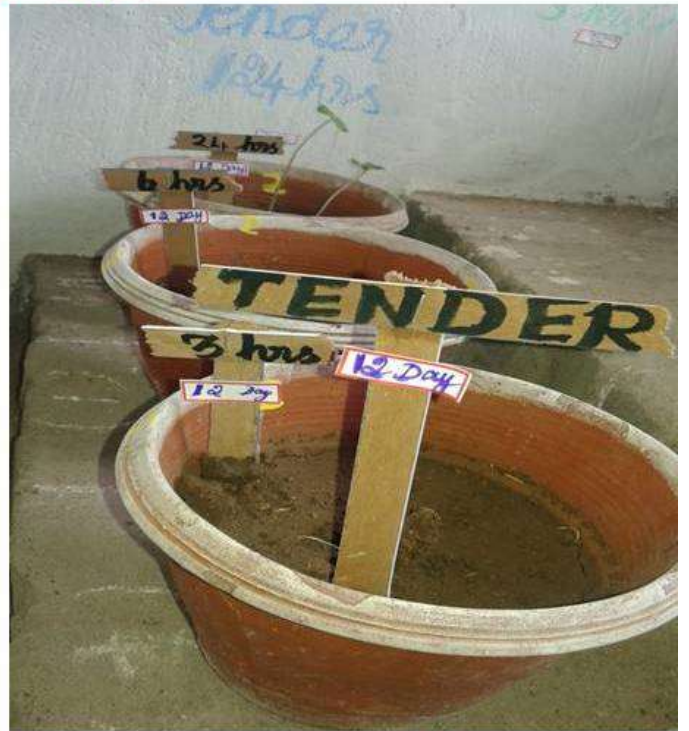
DAY 11



DAY 12



DAY 12



DAY 15









TABULATION

THE EFFECTS OF SOAKING ABELMOSCHUS ESCULENTUS SEED IN DIFERENT LIQUID MEDIUM

Total capacity of the pot: 3 kg

Weight of soil taken per pot: 2 kg

Quantity of organic manure per pot: 100 g

Type of seed used : Lady's Finger (*Abelmoschus esculentus*)

Liquids taken: Tap Water (100 ml), Tender Coconut water (100 ml), Cow Dung Water(100 ml), Aloe Vera gel (100 ml)

Table 1: CONTROL (Without soaking)

Seeds	Length of the plant (in cm)													
	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
Seed 1	0	0	1	4	7	11	12	12	13	13	13	13	13	14
Seed 2	0	0	0.5	2.5	8	11	12	13	14	14	14	14	14	14
Seed 3	0	0	1	2.5	8	12	15	17	18	19	19	19	19	19

Table 2: Effect of Sowing Time in TAP WATER in the Growth Rate of *Abelmoschus esculentus*

Sowing time (hours)	Seeds	Length of the plant (in cm)													
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
3	Seed 1	0	0	0	0	0	1	4	6	7	7	8	8	8	9
	Seed 2	0	0	0	3	6	8	10	11	12	12	12	12	12	12
	Seed 3	0	0	0	0.5	2	4	5	5	5	0	0	0	0	0
6	Seed 1	0	0	0	1	1	1	3	5	8	12	0	0	0	0
	Seed 2	0	0	0	0	1	2	3	5	6	6	0	0	0	0
	Seed 3	0	0	0	2	4	8	11	12	14	14	14	14	14	14
24	Seed 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed 2	0	0	0	0	0	0	0	3	6	6	7	7	7	7
	Seed 3	0	0	0	0.5	3	6	9	10	11	12	12	12	12	12

Table 3: Effect Of Soaking Time in TENDER COCONUT WATER in the Growth Rate of *Abelmoschus esculentus*

Soaking time (hours)	Seeds	Length of the plant (in cm)													
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
3	Seed 1	0	0	0	0	0	0	0	0	5	10	0	0	0	0
	Seed 2	0	0	0	0	0	0	0	0	6	12	0	0	0	0
	Seed 3	0	0	0	0	0	1	2	4	4	4	4	4	4	0
6	Seed 1	0	0	0	0	0	1	1	8	10	11	11	0	0	0
	Seed 2	0	0	0	2	6	10	11	14	15	0	0	0	0	0
	Seed 3	0	0	0	2	4	7	8	9	0	0	0	0	0	0
24	Seed 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed 2	0	0	0	1	6	9	12	12	12	13	14	14	14	15
	Seed 3	0	0	0	0	0	0	0	1	2	3	4	6	9	12

Table 4: Effect Of Soaking Time In COW DUNG in the Growth Rate of *Abelmoschus esculentus*

Soaking time (hours)	Seeds	Length of the plant (in cm)													
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
3	Seed 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed 2	0	0	0	0.5	0.5	0.5	0	0	0	0	0	0	0	0
	Seed 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Seed 1	0	0	0.5	2	6	8	10	10	11	12	0	0	0	0
	Seed 2	0	0	1	5	8	12	14	16	17	18	0	0	0	0
	Seed 3	0	0	0	3	8	12	12	14	17	18	18	19	19	19
24	Seed 1	0	0	0	0	1	3.5	8	12	14	15	16	16	16	17
	Seed 2	0	0	0	2	8	12	14	15	17	18	18	18	18	18
	Seed 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

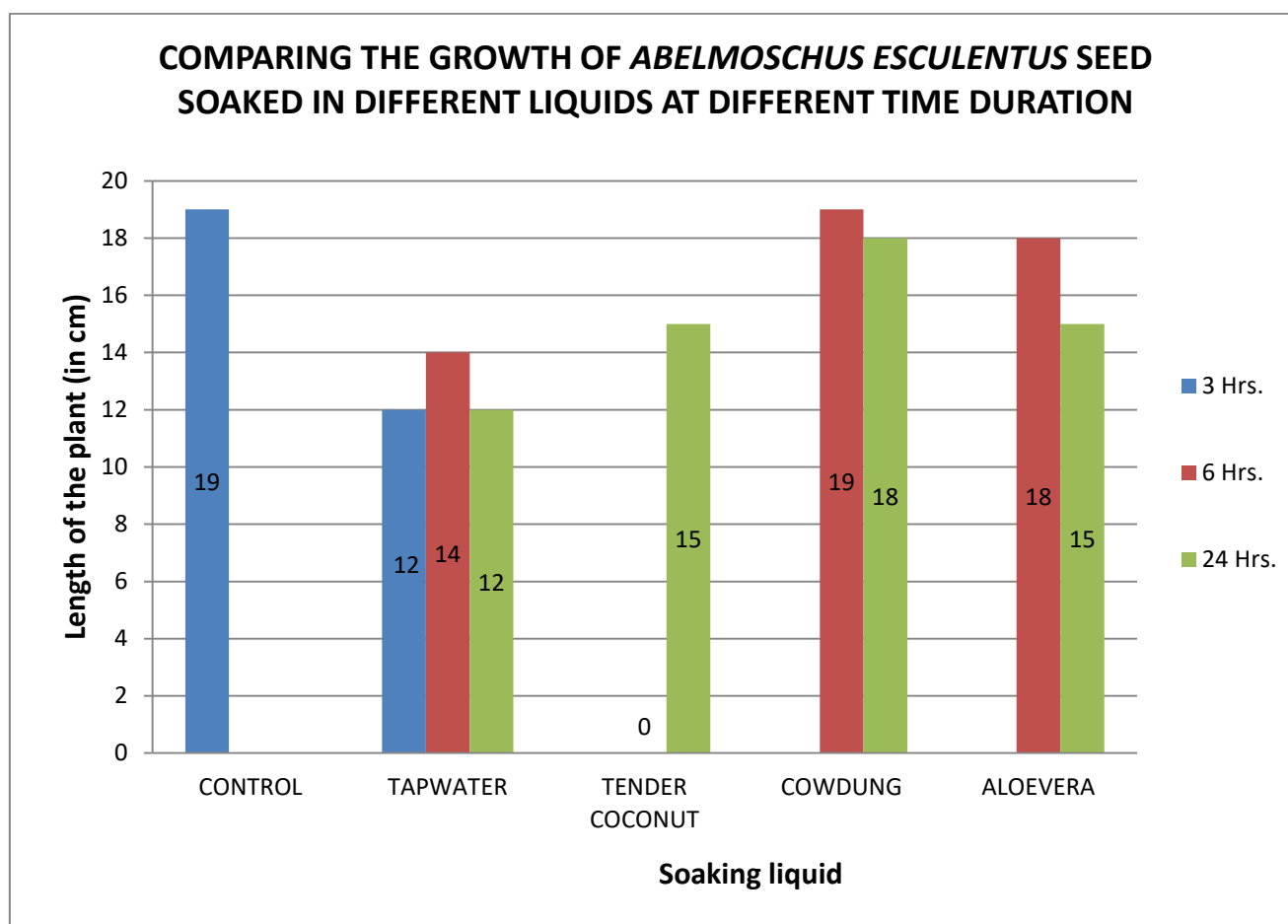
Table 5: Effect Of Soaking Time in ALOE VERA GEL in the Growth Rate of *Abelmoschus esculentus*

Soaking time (hours)	Seeds	Length of the plant (in cm)													
		Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15
3	Seed 1	0	0	0	0	0	0	1	6	7	8	10	10	10	0
	Seed 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed 3	0	0	0	0	0	0	1	5	7	8	11	13	14	0
6	Seed 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Seed 2	0	0	0	3.5	8	12	13	15	15	16	17	18	18	18
	Seed 3	0	0	0	0	0	0	1	1	2	3	4	4	4	5
24	Seed 1	0	0	0	3.5	7	10	12	13	15	15	15	15	15	15
	Seed 2	0	0	0	3	8	9.5	11	13	14	15	15	15	15	15
	Seed 3	0	0	0	2	7	9	10	12	13	14	14	14	14	14

GRAPHICAL REPRESENTATION

COMPARING THE GROWTH OF *ABELMOSCHUS ESCULENTUS* SEED SOAKED IN DIFFERENT LIQUIDS AT DIFFERENT TIME DURATION (For graphical purpose the maximum growth in each medium is selected)

Soaking time	Control (without soaking)	Growth of seed in Soaking Liquid (cm)			
		Tapwater	Tender Coconut water	Cow Dung Water	Aloe-vera Gel
3 Hrs.	19	12	0	0	0
6 Hrs.		14	0	19	18
24 Hrs.		12	15	18	15



RESULTS AND DISCUSSION

- In my research the seeds soaked in different water medium started its growth from 3rd day onwards. In Seeds soaked in tap water for 6hrs sprout has emerged for about 3cm on third day.
- On 4th day, control seed shown its growth and 2cm cleavage was observed in seeds soaked in 6hrs coconut water. 1cm growth was observed in seed soaked in cow dung water for 6hrs.
- On 5th day, 4cm growth was observed in control. 3cm growth was observed in seed soaked in Tap water for 6hrs. 2cm growth was observed in seed soaked in coconut water for 6Hrs. 5cm in seed soaked in cow dung water 6 hrs. 3.5cm in seed soaked in aloe vera gel for 24 hrs.
- On 10th day, 18cm growth was observed in control, 14cm in seed soaked in tap water (6hrs), 15cm in seed soaked in coconut water(6hrs) , 17 cm in seed soaked in cow dung water (both 6 hrs and 24 hrs) and 15cm in in seed soaked in aloe vera gel (both 6 hrs and 24 hrs).
- On 15th day, 19 cm growth in control, 14 cm in seed soaked in tap water (6 hrs), 15 cm in tender coconut water (24 hrs), 19 cm in seed soaked in cowdung (6hrs) and 18cm in seed soaked in aloe vera gel (6hrs).
- The plant of seeds soaked in tender coconut water for 3hrs, 6hrs was broken.
- Through my experiment I found the seeds soaked in cowdung give maximum growth.
- One interesting thing I observed was the seeds those are soaked for 6 Hrs in different water medium show good growth compared to 24 hrs but those plants are not strong enough to withstand. But the plants of seeds soaked in 24hrs are strong enough. Number of seeds grown in 6hrs is less than 24 hrs.
- Germination is very low in seeds soaked for 3hrs in different water medium.
- In tap water atleast one seed shows growth for all the three time duration.
- In tender coconut water soaked seed the height suddenly increases within short time but the plants easily broken because of the weak stem.
- Rating of the soaked water medium based on the growth of the plant on final day
 1. 6 hrs Cow dung water
 2. 24 hrs Cow dung water and 6 hrs Aloe Vera
 3. 24 hrs Aloe Vera and 24 Hrs Tender Coconut
 4. 6 hrs Tap water
 5. 3 hrs Tap water and 24 Hrs Tap water

CONCLUSION

- My hypothesis “The seed soaked in cow dung water medium will give maximum growth” is proved.

FUTURE ENHANCEMENT

- I want to continue my experiment in garden area by growing different seeds soaked in cow dung water and aloe vera gel and research the growth rate up to the flowering and harvesting stage. I wish to share the idea to the farmers for getting high yield.

APPLICATION

- Soak seeds before planting. This is a way to get quicker germination once the seeds are in the ground, a technique known to almost every gardener and practiced universally: Soaking garden seeds, both vegetable and flower seeds, will swell and soften them and get their little embryonic selves thinking about coming out into the light of day.
- **ALOE VERA:** Aloe Vera is the best pesticide so we will get good condition of vegetables. **Aloe vera** is most commonly used as a topical medication, rubbed onto the skin rather than eaten. It has long been known as a treatment for sores, particularly burns, including sunburns.
- **COW DUNG:** It has anti biotic and a highly immunity power. So it is very useful to the consumer. Cow manure is rich in minerals, especially nitrogen, phosphorus, and potassium. It can support the growth of beneficial microorganisms when it's mixed with soil.
- **TENDER COCONUT:** It is healthy drink that is why I chosen this for our good health It has CYTOKININE. So it gives fastest cell division to the seed for germination. Providing 19 calories in a 100 millilitres (3.5 imp fl oz; 3.4 US fl oz) amount, coconut water is 95% water and 4% carbohydrates, with protein and total fat content under 1% each (table). Coconut water contains small amounts of vitamins and dietary minerals, all under 10% of the Daily Value (DV).
- **WATER:** Water is a best medium and farmers use this medium for soaking seed. So I select this medium. Water for injection is on the World Health Organization's list of essential medicines. The most important use of water in agriculture is for irrigation, which is a key component to produce enough food. Irrigation takes up to 90% of water withdrawn in some developing countries and significant proportions in more economically developed countries (in the United States, 42% of freshwater withdrawn for use is for irrigation).

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