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A Review On Study Of Seed Germination Patterns Of Selected Plants Under Altered Soil Conditions By Adding Different Components Of Panchagavya

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Abstract: Seed germination is an important aspect in plant growth as the higher the quality of seed germination, better the yielding. Panchagavya is mainly made up of five cow products which are cow urine, cow dung, cow milk, curd and ghee. Study of (Kumar S, et al., 2020,) have shown that addition of concentrated 2% panchagavya helps in higher germination of plants as well as their root and shoot length. (Vaithiyanathan T, et al., 2022) reported that higher concentration of panchagavya is toxic to germination of crops. However, the lower concentration of panchagavya increases seed germination. Hence, more diluted form can be used and utilized for agricultural fertilization.

Keywords*:* *Seed Germination, Cow, Panchagavya, Seed Physiology*

I. Introduction:

Plants, as multicellular eukaryotic organisms, have been very crucial and an important aspect to the humankind. The most evident are the various ways that plants help humans, such as food sources, timber, paper, medicines, and a host of other uses as well. (Introduction to Plants and Botany, Box 1-1: Plants and People, including students, Pg no. 9). The phrase "plant development" encompasses a wide range of physical, physiological, and genetic changes that impact a plant's appearance, behavior, and interactions with its environment. (Patel M, et al., 2023). Development, germination, respiration, and degradation within the context of seed development indicators comprise the purview of seed physiology. (Paat F. J., 2021. Seed Physiology, MMB Press)

Seed physiology is the study of the functions and processes involved in seed development, germination and regulation, and the use of seed reserves throughout the early phases of germination and seedling growth. Seeds have always piqued the interest of plant physiologists and agriculturalists. (Bordolui S. K, et al., 2024). The germination process is the one that is most sensitive to temperature as well as moisture since many seeds go through a dormant phase and require a certain temperature and moisture level to germinate. It is a crucial stage of growth and development. Temperature has a major impact on both the germination of seeds and the subsequent establishment of seedlings (Patel M, et al., 2023). A seed needs to go through a number of stages before it can germinate, one of which is for the seed to have food storage. (Miransari and Smith, 2009., M. Miransari, D.L. Smith, 2014.) Plants require sixteen nutrients for growth and development, according to Arnon and Stout (1939).

Germination is the restart of active embryo growth following a period of hibernation. There are two types of germination: epigeal and hypogeal. (Verma V, 2007). Apart from these two, there is a third type of seed germination known as viviparous. (Sinha R K, 2004).

The internal and exterior structures of seeds vary greatly. These changes are, to a large extent, connected to dispersal and germination methods, and may include the size and position of the endosperm and embryo, the structure, texture, and color of the seed coat, as well as the overall shape and dimensions of the seed. (Boesewinkel F, et al., 1984)

II. Panchagavya and its elements:

Cows are revered as gods and even as mothers. The term panchagavya, which means "five cow-derivatives" in Sanskrit, refers to three direct constituents: cow milk, cow dung, and cow urine; the two derived products are curd and ghee. Both cow urine and cow dung is excretory product. (Mohan Maruga Raja, M. K., et al., 2021).

According to numerous academics and scientists, cow-derived products are a rich source of important components, minerals, and hormones. This is why the Vedas suggest using cow-derived products. Consequently, there is a growing trend in the usage of panchagavya- a term that refers to five main compounds derived from cows, namely: milk, ghee, curd, urine, and dung as its byproducts. (Dhama K, et al., 2013).

(Kumar S, et al., 2020) conducted a study where effects of panchagavya was seen on seed germination and it showed that various concentrations of the panchagavya showed higher rate of germination and the one with the concentration of 2% displayed highest germination (86%), as well as the shoot and root lengths and had the most significant improvement amongst all others.

(Vaithiyanathan T, et al., 2022) used different concentrations of panchagavya (control, 10%, 20%, 30%, 40%, and 50%) on the seed of *Vigna radiata* L., where control was treated as water. Results in morphological characteristics showed that the lower proportion (10%) of panchagavya made a higher growth and percentage in the germination rates whereas the higher proportions lead towards the lowest percentage in the germination rates, growth of the seedlings, dry and fresh weights as well.

III. Bio-chemical Tests:

The protocols of (Lowry O.H, et al., 1951), (Nelson N, 1944) and (Sadasivam S., et al., 1992) were reviewed for the aspect of conducting the biochemical tests of Enzyme proteins, Reducing sugars and Total Chlorophyll Content respectively.

a) For Enzyme Proteins: (Lowry O.H, et al., 1951)

1 ml seed leachate was mixed with 5 ml Lowry 'C' and incubated at room temperature for 10 minutes. After that, 0.5 ml of Folin-Ciocalteau's reagent was added and incubated for 10 minutes at room temperature. He prepared blanks in the same manner. Optical density was measured at 600m. The casein regression formula was used to calculate the results.

X = 302 Y + 11.28

The result was represented in milligrams of soluble proteins released per gram seed.

Preparation of the reagents:

i. Lowry's reagent:

Lowry 'A': 2% Na2CO + 0.1N Naoh

Lowry 'B': 0.5% CuSO + 1% Na-K tartrate

Lowry 'C': 50ml Lowry 'A' + ml Lowry 'B'

ii. Folin-Ciocalteau's Reagent (IN):

Dilute commercially available reagent (2N) with an equal volume of DW.

b) For Reducing Sugars: (Nelson N, 1944)

ml of seed leachate and 1 ml of Nelson Somogyi's reagent were combined and placed in a boiling water bath for 20 minutes. After cooling the tube, 1 ml arsenomolybdate was added, and the total volume was increased to 20 ml using DW. Optical density was measured at 540m. He prepared blanks in the same manner. It was calculated using the glucose regression technique.

X = 204.78 Y + 3.27

Results were represented as mg sugar leached per g seeds.

Preparation of the reagents:

i. **Nelson Somogyi's reagent:**

50ml Nelson 'A' + 2ml Nelson 'B'

- Nelson 'A': 12.5g NaCO3, 12.5g Na-K tartrate, 10g NaHCO3, and 100g Na SO were dissolved one by one and 500ml of final volume was made up with Distilled Water.
- Nelson 'B': 15g CuSO4.7H2O dissolved in 100ml of Distilled Water.

ii. **Arsenomolybdate reagent:**

Dissolve 25g of ammonium molybdate in 450ml DW and add 21ml of concentrated HSO4. Then, dissolve 3g sodium arsenate in 25ml DW and mix the two solutions. Incubate at 37°C overnight before being used.

c) For Total Chlorophyll Contents: (Sadasivam S., et al., 1992)

In a clean mortar, 1 gram of finely cut and well mixed representative leaf or fruit tissue was mixed. 20mL of 80% acetone was added to the tissue to grinded into a fine pulp. Supernatant to a 100mL volumetric flask was transfered after centrifugation at 5,000 rpm for 5 minutes. The residue was grinded in 20mL of 80% acetone, centrifuged, and the supernatant was transferred to the same volumetric flask. This step was repeated until the residue becomes colorless. Washing the mortar and pestle well with 80% acetone, then collecting the clear liquid in the volumetric flask. Using 80% acetone, fill the capacity to 100mL. Read the solution's absorbance at 645, 663, and 652m against the solvent (80% acetone) blanks.

Calculation

Calculate the amount of chlorophyll present in the extract mg chlorophyll per g tissue using the following equations:

mg chlorophyll a/g tissue = 12.7 (A63) - 2.69 (Abs) × V/1000 x W

mg chlorophyll b/g tissue = 22.9 (A64s) - 4.68 (A63) x V/1000 x W

and mg total chlorophyll/g tissue = 20.2 (A6s) + 8.02 (A63) x V/1000 x W

where, A = absorbance at specific wavelengths,

V = final volume of chlorophyll extract in 80% acetone

and W = fresh weight of tissue extracted.

IV. Conclusion:

Plants, as multicellular eukaryotic organisms, play a vital role in human life by providing essential resources such as food, timber, paper, medicines, and various other uses. The development of plants involves a complex interplay of physical, physiological, and genetic changes that influence their appearance, behavior, and interactions with the environment. Seed physiology, which encompasses the study of seed development, germination, and regulation, is crucial for understanding the early stages of plant growth and seedling development. Seed germination is a critical phase in the life cycle of plants, influenced by factors like temperature, moisture, and light. The germination process is highly sensitive to environmental conditions, with temperature and moisture playing key roles in triggering seed dormancy release and subsequent growth. Seeds undergo various stages before germination, including the accumulation of food reserves necessary for the growth of the embryo. The structure of a seed is complex, consisting of the seed wall, embryo, endosperm, and a variety of components such as carbohydrates, proteins, lipids, minerals, nucleic acids, alkaloids, growth hormones, amino acids, and phenolics. The internal and external structures of seeds vary significantly, impacting dispersal and germination methods. Orchid seeds, for example, can be as light as 0.000002 grams each, highlighting the diversity in seed characteristics. Panchagavya, a traditional Indian mixture derived from cow products like milk, curd, ghee, urine, and dung, has garnered attention for its potential benefits in seed germination. Research by Kumar et al. (2020) demonstrated that different concentrations of panchagavya led to higher germination rates, with a 2% concentration showing the most significant improvement in germination rates, shoot and root lengths. This highlights the potential of panchagavya as a natural and sustainable solution for enhancing seed germination and plant growth. Biochemical tests for enzyme proteins and reducing sugars offer valuable insights into seed characteristics and composition. Enzyme protein tests quantify soluble proteins released per gram of seed, while reducing sugar tests measure sugar leached per gram of seed, providing essential information on seed quality and nutritional content. Additionally, tests for total chlorophyll content offer a way to quantify chlorophyll levels in plant tissues. Chlorophyll is a crucial pigment for photosynthesis, and measuring chlorophyll levels can provide insights into the health and vitality of plants. These tests can be useful for agricultural and horticultural applications, as well as for research and development purposes. In conclusion, understanding the physiology of seed germination and the biochemical composition of seeds is essential for optimizing plant growth and development. Panchagavya has shown promise as a natural and sustainable solution for improving seed germination and plant growth, and biochemical tests can provide valuable information about seed quality and plant health.

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