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RESEARCH ARTICLE

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GERMINATION PERCENTAGE STUDIES IN DIFFERENT VARIETIES OF WHEAT IN REFERENCE OF NUTRITIVE VALUE OF GERMINATING WHEAT

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ABSTRACT

Germinating wheat known as wheat jwara is the good source of nutritionally important substances, like as antioxidants, minerals, vitamins and dietary fiber. Wheat germination process by different various methods affected wide range of compounds. The varieties selected for the studies conducted in unsoaked and soaked seeds of the different wheat varieties viz Raj 3765, Raj 3077, GW 173, PBW-343, HD 2687, Lok-1, WH-147, and Raj-3777. The germination percentage was found almost the same in both in unsoaked and soaked seeds. The first four prominent varieties which found the highest germination percentage are Raj 3777, Raj 3077, Raj 3765, PBW 343 followed by GW 173 and WH 147 in all the systems of germination. Raj 3777 and Lok-1 found to be good in saline situation but the germination percentage was very poor. In the case of hard water, the germination percentage found to be slight better as comparison of saline treatment. The varieties found to be good for germination in hard water are WH 147 and HD 2687 followed by Raj 3077 and Raj 3777.

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INTRODUCTION

In terms of production, Wheat (*Triticum aestivum* L.) of family Poaceae is the second major crop in India and contributes 25 percent of the total food grain production of the country. The Wheat grains contain proteins and carbohydrates in the ratio of approximately 1:6 and 1:7 which is optimum for human nutrition. Wheat is the main crop of temperate climatic regions of Europe, Asia and North America. Almost one third of the world Wheat grain production is obtained in Asia. It is one of the most ancient crop cultivated as long as 6500 years ago in Iraq, 600 BC in Egypt, 2500- 300BC in India and China. The Wheat plant is native to some regions of India, Iran and the Mediterranean Sea coast. The process of grain formation in Wheat is conventionally divided into three periods i.e. grain formation, grain swelling and grain maturation. The present studies will be based on the nutritive utility in terms of varieties difference in the germinating Wheat in the different popular varieties. A final popular draft is made for popularizing germinated Wheat as a Social – Consciousness and valuable health – food.

Importance of the Wheat Grass: The germinating Wheat is gaining a much awaited popularity as targeted to nutrition food. At times and again the importance of germinating Wheat as unique food for correcting many health hazards related to weakness, fertility, cancer and many more is coming up as modern health food.

A small plant of Wheat is called 'Jwara' or wheat grass or wheat germ. Wheatgrass has 70% chlorophyll. Significant enhancement of chlorophyll is marked in wheat grass which is accurately similar in structure to blood haemoglobin. Important function of haemoglobin is to carry oxygen in different areas of the human body, chlorophyll also performs the same purpose like haemoglobin. Because of this chlorophyll is often known as "the green blood of plant life". The high levels of chlorophyll of wheatgrass (jwara) can be easily absorbed by our blood. The high chlorophyll content is a powerful detoxifier that helps in cleansing the liver, cells, tissues and blood. Germinating Wheat contains vitamin A, vitamin B complex, vitamins E, C and K. Vitamin E and vitamin C are powerful antioxidants, which are very helpful to prevent the aging process of the body and also help in preventing blood clots and are a remarkable enhancement of the immunity of the body's system. Wheat grass also contains 82 minerals found in soil out of the 92. It has Ca⁺⁺, Mg⁺⁺, iron, Zn, K⁺, phosphorus and cobalt. Germinating wheat also contains numerous amino acids, building blocks of proteins. Germinating wheat provides proteins so there is no need to break down the proteins into amino acids. The high level of enzymes found in germinating wheat helps in the metabolism of nutrients to help the repair mechanism of cells and tissues. It is a known fact that Wheat has a great strength and it (provides strength to face diseases in our body) makes our immune system strong. Thus, it is very useful in our life. Doctor calls the extract of Jwara as "Nectar Juice" it protects our body from all types of diseases. Extract of Wheat Jwara possesses the quality of blood purification and it enhances the level of Hemoglobin.

It has washes out foreign bodies and toxins from human body, which makes our body healthy. Now days we have been suffering from different types of incurable diseases. Costly medicines leave side effects in the modern time. In such circumstances we will have to follow the path of nature. It is incontrovertible that naturopathy keeps our body healthy without any side effects. Extract of Wheat Jwara is also a type of natural drink. Its use is highly beneficial. Its extract is highly beneficial in fatal disease such as cancer. It has rich nutritious value. Regular use of it strengthens our body and protects our body from ailments. A lot of contents are found in the extracts of Wheat Jwara in natural form such as: active enzymes, minerals, fibers, Vitamins and Nutrients. By this reason extract of Wheat Jwara is called Natural Panacea. The present studies will be based on the improvement of the germinating Wheat.

Selection of the varieties: Seeds of the eight wheat varieties were procured from Rajasthan Seed Corporation and National Seed Corporation. The varieties selected for the studies are Raj 3765, Raj 3077, GW 173, PBW-343, HD 2687, Lok-1, WH-147, and Raj-3777.

Water Absorption Studies: The progress of water absorption by wheat grains was studied by several scientists. Water uptake is the physical rather than physiological processes. At the time of germination there is increase in the rate of water uptake. All the eight varieties were used to see the Water Absorption Studies. 50gm seeds of each variety were taken in 100 ml of distilled water for water absorption studies at 24h, 48h, 72h and 96 h. The maximum water absorption were observed in the variety HD-2687 followed by GW-173, Raj-3077 and Lok-1 at 96 hrs. The difference between in the fresh weight and original weight were recorded after the study of water absorption.

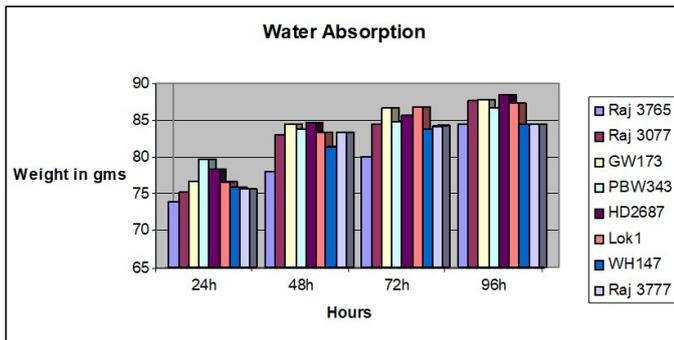


Fig. 1. Water absorption studies in eight varieties of wheat

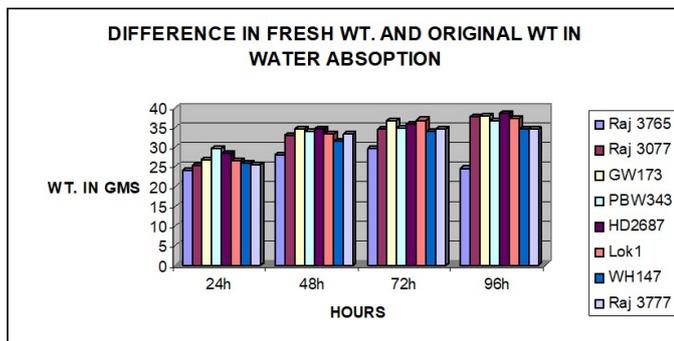


Fig. 2. Difference in fresh weight and original weight in water absorption studies in eight varieties of wheat

Germination percentage of seeds: In a seed germination, the plant embryo in the seed resumes to grow after a period of dormancy. After such process, the seedling emerges. The length of dormancy varies according to crops. The seed of some plants like the poaceae family and some tropical plants sprouts immediately, but some requires a resting stage prior to germination. The germination of cereal seeds have a widely studied physiological processes, concerning the pathways of starch and sucrose metabolism (Beck and Ziegler, 1989;

Fincher, 1989; Ap Rees, 1992). The starchy endosperm contains most of the nutrients, required for the growth of germinating wheat seedlings. The majority of published research work are the aerobic process of wheat seed germination. It is related with availability of carbohydrate for tolerance to anaerobic conditions of plants (Mohanty, Wilson and Ap Rees, 1993; Perata and Alpi, 1993; Armstrong, Brindle and Jackson, 1994; Ricard *et al.*, 1994). The seed germination was observed in the various methods in which seeds with germination of radicle emergence of 2 mm upto 120h. (Heydecker, 1972, Lang 1965). The germination % was calculated as follows:

$$\text{Germination Percentage} = \frac{\text{Number of germinated Seeds}}{\text{Total Number of Seeds}}$$

The percentage of germination was calculated in the presence of light.

The germination percentage will be calculated in the direct germination of the seeds in the presence of light. Two types of parameters were observed:

- A. Germination percentage in unsoaked seeds
- B. Germination percentage in soaked seeds.

Germination Percentage in unsoaked Seeds

Seed germination in soil with normal tap water: Germination percentage calculated in the seeds in Plastic Pots contains soil with normal tap water. The highest germination were observed in the variety Raj 3077 followed by Raj- 3765, GW173, Raj 3777, PBW343, HD2687, WH147 and Lok-1.

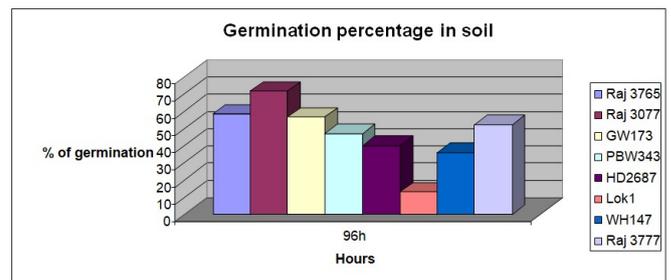


Fig. 3. Germination percentage in soil with normal water

Seed Germination in pot soil with RO water

Seed germination were observed higher in Raj-3777 followed by WH-147, Raj-3077, PBW-343, Raj- 3765, GW-173 and Lok-1 in the pot contains soil with RO water.

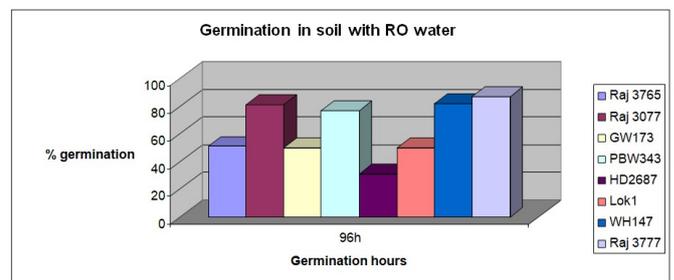


Fig. 4. Germination in soil with RO water

Seed Germination in folded cotton: The Germination percentage was calculated in cotton folded system. In this system the germination started earlier as comparison of the soil. The percentage of germination will be higher in Raj 3777 followed by Raj 3765, HD-2687, PBW-343, WH-147, Raj-3077, Lok-1 and GW- 173.

Seed Germination in cotton cloth: Seed germination was observed in cotton cloth (the cloth should be five fold in linear fashion). In this system the germination percentage were recorded to be higher in Raj

3777 followed by Raj 3077, Raj 3765, WH 147, PBW343, GW-173 and Lok-1.

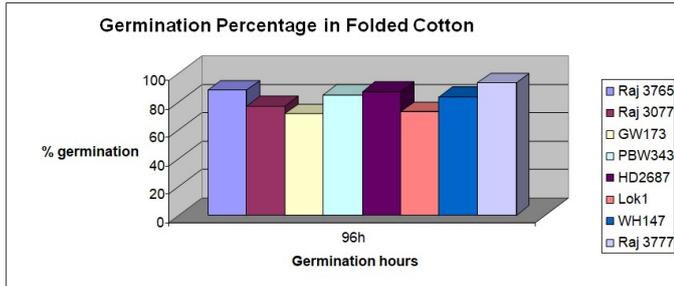


Fig. 5. Germination percentage in folded cotton

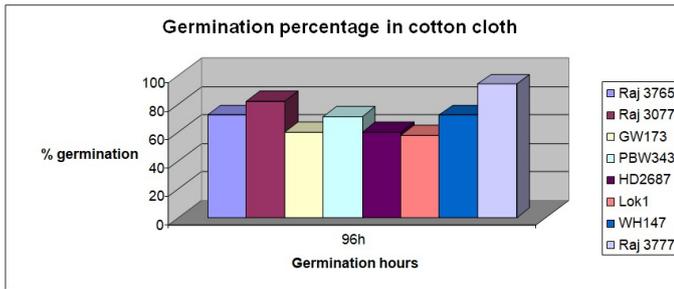


Fig. 6. Germination percentage in cotton cloth

Seed Germination in Paper Towel: The germination percentage were observed higher in Raj 3777, followed by WH 147, GW173, Lok-1, HD-2687, Raj 3077, Raj 3765 and PBW-343. But the growth of the seedlings was not healthy as found in the soil and cotton folded.

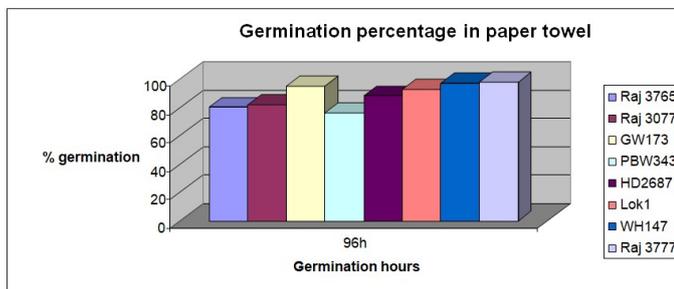


Fig. 7. Germination percentage in paper towel

Seed Germination in the river sand containing normal tape water: The tape water was used to saw the germination percentage. The germination percentage was higher in WH 147 followed by Raj 3077, PBW-343, GW-173, Raj 3777, Raj 3765, HD-2687 and Lok-1. The growth in the river sand was good.

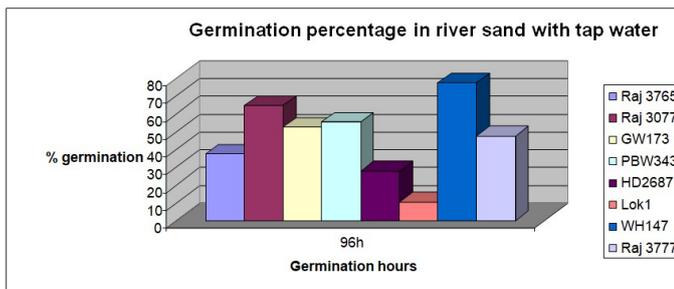


Fig. 8. Germination percentage in river sand with tap water

Seed Germination in river sand containing RO water: The germination percentage was higher in the variety Raj 3077, followed by Raj 3765, GW-173, PBW-343, WH-147, HD-2687, Lok-1 and

Raj-3777. The germination in RO water was very good in the respective varieties.

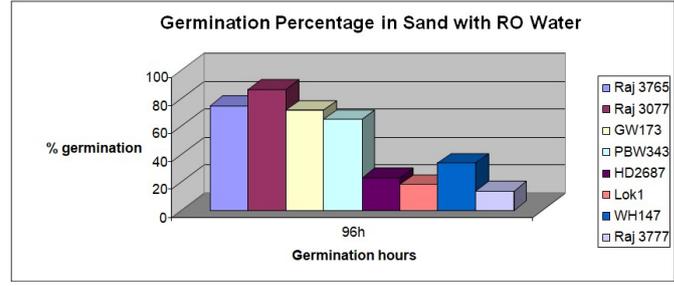


Fig. 9. Germination percentage in river sand with RO water

Seed germination in saline water: Salt inhibits wheat germination and growth. Salt water changes the pH of soil and locks up nutrients that wheat needs to grow. Salt affects the plant to take up water by altering the osmotic process by which water enters in the roots of the wheat. Osmosis is the process in which water and nutrients passes from low salinity to high salinity. If the soil has a higher salinity than the wheat, no moisture will enter the roots of the plant. Seed Germination percentage was calculated in saline water. The 0.2% salinity was obtained by the mixture of CaCl₂, CaCO₃, NaCl₂, Mg₂CO₃ and MgCl₂. The percentage were higher in the variety Raj 3777 followed by Lok-1, PBW-343, WH-147, Raj 3077, HD-2687 and Raj 3765. The percentage of the seeds found almost nil in the variety GW-173. In all the varieties the germination was highly affected by salinity. The percentage ratio was 7 to 63%.

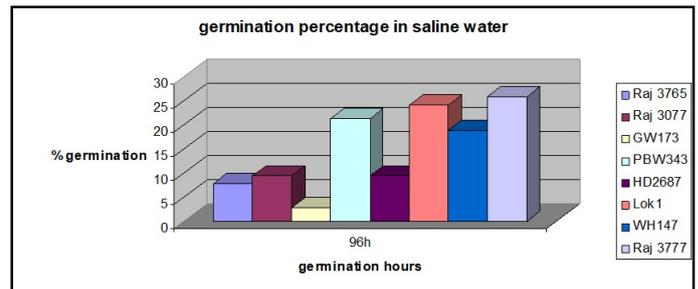


Fig. 10. Germination percentage in saline water

Seed Germination in hard water: The hard water was prepared by the chemicals MgCO₃, MgSO₄, CaSO₄ and CaCO₃. The germination percentage was higher in the variety WH-147 followed by HD-2687, Raj 3077, Raj 3777, Lok-1, GW-173 and PBW-343.

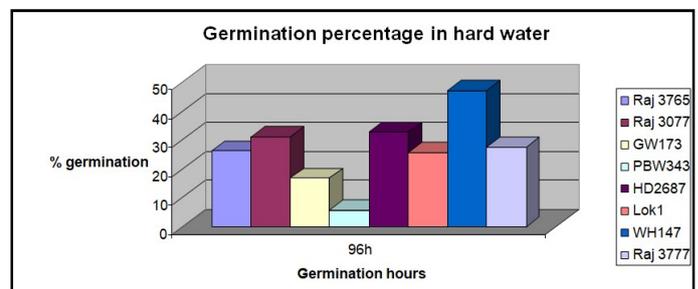


Fig. 11. Germination percentage in hard water

Germination Percentage in Water Soaked Seeds

Seed Germination in soil containing normal tape water: Higher percentage was observed in Raj 3077 followed by Raj 3765, GW-173, Raj 3777, HD-2687, PBW-343, WH-147 and Lok-1.

Seed Germination in soil containing RO water: Higher percentage was observed in Raj 3777 followed by WH-147 Raj 3077, PBW-343.

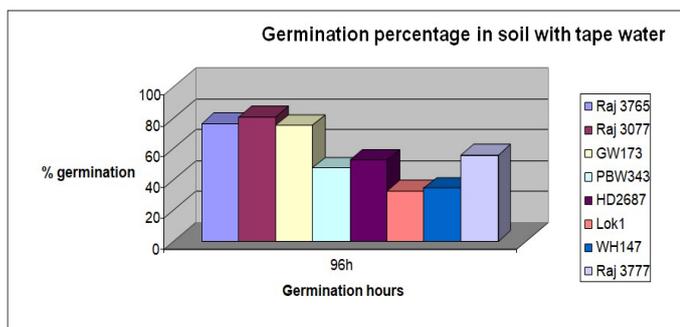


Fig. 12. Germination percentage in soil with tape water

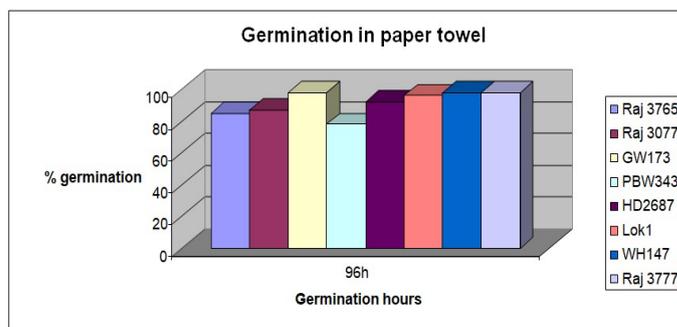


Fig. 16. Germination percentage in paper towel

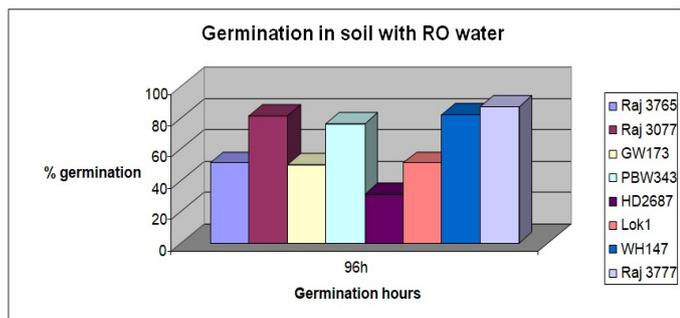


Fig. 13. Germination percentage in soil with RO water

Seed Germination in river sand with tape water: The germination percentage was higher in Raj 3765 followed by Raj 3077, Lok-1, WH147, Raj 3777, PBW 343, GW 173 and HD 2687.

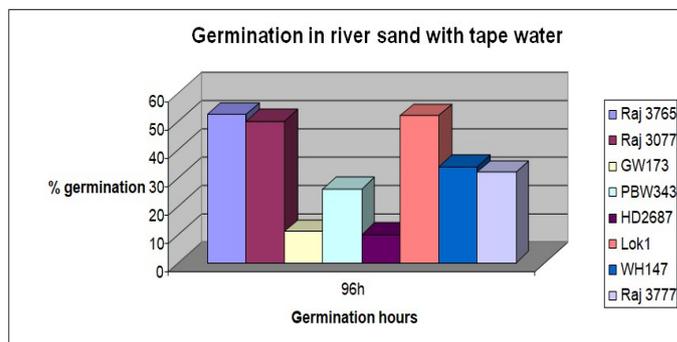


Fig. 17. Percentage of germination in river sand with tape water

Seed Germination in folded cotton: The highest percentage were observed in Raj 3777 followed by Raj 3765, HD 2687, PBW343, WH 147, Raj 3077, Lok-1 and GW 173.

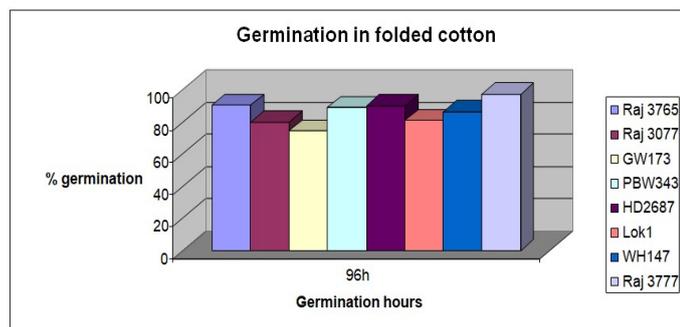


Fig. 14. Germination percentage in folded cotton

Percentage Seed Germination in river sand with RO water: This method found the better results in germination as compared with normal tape water. The highest percentage of germination were observed in Lok-1 followed by WH 147, Raj 3765, Raj 3077, Raj 3777, PBW 343, GW 173 and HD 2687.

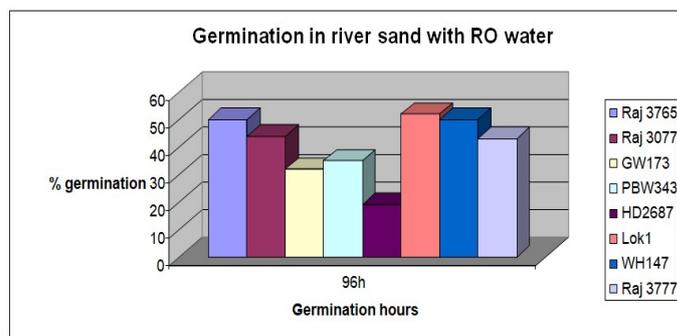


Fig. 18. Germination percentage in river sand with RO water

Seed Germination in cotton cloth: Seed germination also observed in soaked seeds. The variety Raj 3777 observed the highest germination followed by Raj 3077, Raj 3765, PBW 343, WH 147, GW 173, Lok-1 and HD 2687.

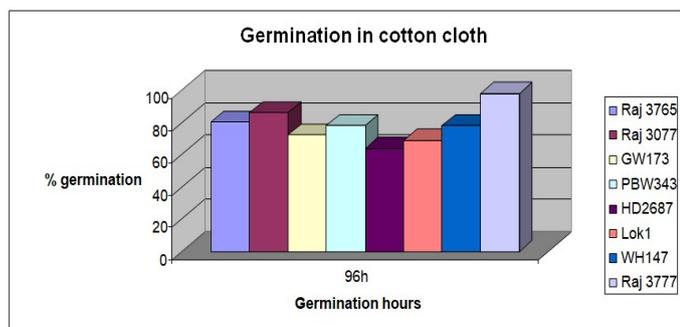


Fig. 15. Germination percentage in cotton cloth

Seed germination in saline water: The germination was poor in the saline water. The highest germination were observed 29% in the variety PBW 343 followed by Raj 3777,WH 147, HD 2687,lok -1, Raj 3077, Raj 3765 and very poor germination observed in the variety GW 173.

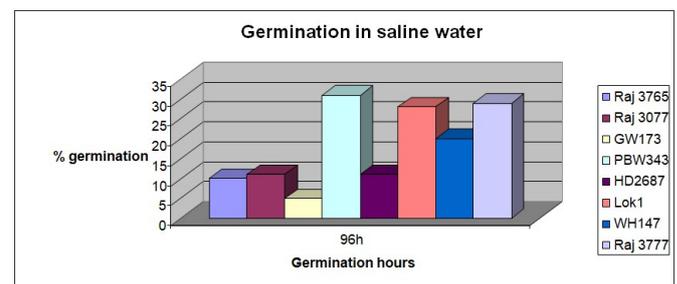


Fig. 19. Germination percentage in saline water

Seed Germination in paper towel: Seed germination was observed highest in the wheat variety Raj 3777 followed by GW 173, WH 147, Lok-1, HD 2687, Raj 3077, Raj 3765, and PBW 343.

Seed germination in hard water: In the last the germination percentage also calculated of the soaked seeds in hard water and compared with without soaked seeds. The germination percentage was observed approximately 60% in the variety WH 147 followed by HD 2687, Raj 3077, Raj 3765, Lok-1, Raj 3777, GW 173 and in PBW 343.

et al., 1994; Hanhijarvi and Fagerstedt, 1995). The amount of soluble sugars in dry cereals is usually low, starch is the reserve carbohydrate. It is well known that the metabolism of starch is of primary importance for seed tolerance in reference to anaerobic conditions. The metabolism of sucrose, in the developing seedling, is also required in the fermentative pathway in the growing embryo

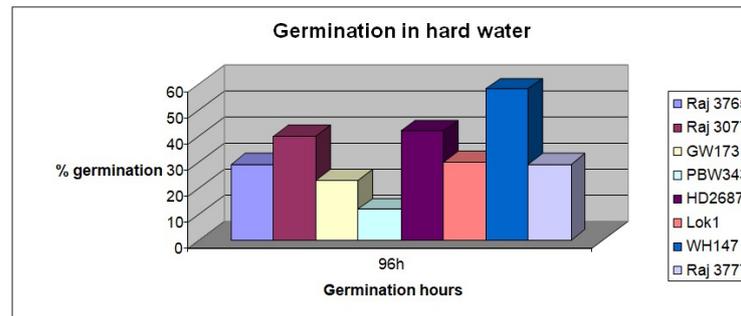


Fig. 20. Germination percentage in hard water

Table 1. Comparative Statement and Results of Germination in Unsoaked and Soaked seeds in Various Systems

S.No.	Systems used in Germination	% Highest Germination in Unsoaked Seeds	% Highest Germination in Soaked Seeds	Varieties with Higher Germination
1.	Germination in soil with tape water	68%	78%	Raj 3077 Raj 3765 GW 173 Raj 3777
2.	Germination in soil with RO water	80%	80%	Raj 3777 WH 147 Raj 3077 PBW 343
3.	Germination in folded cotton	95%	95%	Raj 3777 Raj 3765 HD 2687 PBW 343
4.	Germination in cotton cloth	94%	95%	Raj 3777 Raj 3077 Raj 3765 PBW 343
5.	Germination in paper towel	95%	90%	Raj 3777 GW173 WH 147 Lok-1
6.	Germination in river sand with tape water	70%	49%	WH 147 Raj 3765 Raj 3077 GW 173
7.	Germination in river sand with RO water	80%	49%	Raj 3765 Raj 3077 GW 173 WH 147
8.	Germination in saline water	24%	29%	Raj 3777 Lok-1 PBW 343 WH 147
9.	Germination in hard water	45%	60%	WH 147 HD 2687 Raj 3077 Raj 3777

As observed in the above table there is no difference in the germination of the seeds between the unsoaked and soaked seeds of the different wheat varieties. The germination percentage was found almost the same in both the systems. The first four prominent varieties which found the highest germination percentage are Raj 3777, Raj 3077, Raj 3765, PBW 343 followed by GW 173 and WH 147 in all the systems of germination. Raj 3777 and Lok-1 found to be good in saline situation but the germination percentage was very poor. In the case of hard water, the germination percentage found to be slight better as comparison of saline treatment. The varieties found to be good for germination in hard water are WH 147 and HD 2687 followed by Raj 3077 and Raj 3777. The availability of carbohydrates is essential in leading the ATP production of the glycolytic pathway in plants under different conditions (Perata and Alpi 1993; Armstrong

axis. Germination of wheat and amaranth in reference to antioxidants studied by Yang *et al* 2009, Culminates *et al* 1990, Lintschinger *J et al* 1997. The germination process affects the antioxidants, minerals, vitamins etc (Florain and Arendt 2013). The plasma activated application, the nutritional properties of wheat plantlet in 14 days. It improving protein content, total phenolic contents, photosynthetic pigments, antioxidant activity etc (Junhong Wang *et al* 2023).

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