



**EFFICACY OF *AMARANTHUS TRICOLOR* (RED VARIETY) AND *AMARANTHUS TRICOLOR* (GREEN VARIETY) BY "ANALYSIS OF VARIANCE" – ANOVA FOR SEEDS GERMINATION : A USEFUL GUIDE FOR AGRICULTURAL PRACTITIONER - PART 2**

**Biological Science**

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**ABSTRACT**

Germination' is the emergence of radical and plumule of seed embryo, resulting in the formation of seedling. (Urmila Sarkar , Surendra Sawardekar) A fully developed seed contains an embryo along with food reserves wrapped in a seed coat. (Urmila Sarkar , Surendra Sawardekar) Various parameters lead to proper germination of seed into seedling and later into productive produce. As often, seeds germinate in the dark but different treatment or condition applied also enhance the rate of seed germination.

The research is focused on two leafy vegetables plant species namely *Amaranthus tricolor* (Red variety) and *Amaranthus tricolor* (Green variety) germination of seeds by an application of unheated water and hot water in light and dark condition. The rate of germination under a utilization of qualitative treatments in two different conditions gives efficient results by Analysis of Variance - ANOVA. The research concludes the productivity of specific treatment to be used: A guiding tool during farming practice to be followed by an agricultural practitioner for the above said plant species.

**KEYWORDS**

*Amaranthus tricolor* (Red variety), *Amaranthus tricolor* (Green variety), ANOVA

**INTRODUCTION**

'Germination' is the emergence of radical and plumule of seed embryo, resulting in the formation of seedling. (Urmila Sarkar., Surendra Sawardekar) Each aspect of ecological factor affects the rate of germination which in turn affecting the produce of the plant. During farming practice a quality enriched highly viable seeds leads to cost effectiveness in agriculture. This is ultimately achieved due to high rate of germination of selected seeds. A Successful germination and seedling establishment are crucial steps for maintenance and expansion of plant populations and recovery from perturbations. (de Melo RB., Franco AC. *et.al.*) For any suitable produce climatic conditions needs to be maintained; since these have a direct impact on metabolic activity during plant growth. However, the optimum temperature to most of crops is between 25°C to 40°C. Few plant species can germinate below 25°C to 4°C while above 40°C is extremely above the optimum which will not germinate the seed. (Washa B.) Cold climatic conditions favourable crops seeds germinate at low temperature. Cold stratification is a process that induces the dormancy breaking prior to light emission that promotes germination. (Baskin and Baskin, Carol C. and Jerry M.)

Light or darkness an important factor controls the rate of germination. Although most of the literature in various research do declare that light have no effect on seed germination instead most of plants are reported to germinate earlier and successfully in the dark place compared to the light place but dark place is not declared in any published scientific research as a factor affecting germination. (Neff, M. N., L. Sanderson *et.al.*)

In the field of agriculture and farming germination has greater impact on the rate of successivity of market produce to gain profits in huge amounts. (Urmila Sarkar., Surendra Sawardekar). Leafy vegetables farming in-turn is one of the major crops selected by farmers in the field of agriculture practice as it has greater advantage since within a minimum period of growth periodical cycle a harvested product is available in due course for customers in the market. (Urmila Sarkar., Surendra Sawardekar).

*The Analysis of Variance was carried at 0.05 level of significance.*

**Table 1.1**

Treatment	Amaranthus tricolour (Red Amaranthus)			Amaranthus tricolour (Green Amaranthus)			Treatment	Amaranthus tricolour (Red Amaranthus)			Amaranthus tricolour (Green Amaranthus)		
	21.56	11.42	7.89	73.75	73.49	47.22		5.12	17.24	12.5	41.66	29.34	47.69
Unheated water in dark condition							hot water in dark condition						
Unheated water in light condition	6.25	13.33	7.69	52.38	42.52	31.42	hot water in light condition	4.34	1.96	5	28	32.25	20

**Table 2.1**

The research study carried focuses on guiding a selective tool to an agricultural practitioner for the increase of produce. The statistical report by 'Analysis of Variance'- ANOVA reveals an efficient choice for its analytical utilization in various research studies to achieve more precise and best results. This research accomplish selective specific technique to be used for *Amaranthus tricolor* (Red variety) and *Amaranthus tricolor* (Green variety) seeds germination.

**MATERIALS AND METHODS**

Seeds of *Amaranthus tricolor* (Red variety) and *Amaranthus tricolor* (Green variety) bought from local nursery were soaked in a unheated water for 15 minutes and another set soaked in a hot water for 15 minutes. Seeds after soaking were transferred in a set of tray containing a platform of various sections of wet blotting paper prepared for the study of two parameters such as;

- Germination of seeds in a dark and direct sunlight by using unheated water.
- Germination of seeds in a dark and direct sunlight by heating water known as hot water.

Random numbers of seeds were allowed in every section and a set of triplets for each were utilized both for dark and light condition. The moisture was maintained by fulfilling the requirement with normal unheated water treatment and hot water treatment to concerned sets. The seeds were kept for 6 days for germination for both dark and light condition and the observations was noted. Special treatment of mechanical or any inorganic and organic matter was prohibited during complete research study. (Urmila Sarkar., Surendra Sawardekar).

**RESULTS AND DISCUSSION**

The average value of seed germination by a treatment of unheated water in dark and light condition is shown in **Table 1.1**; while, the one by a treatment of hot water in dark and light condition is shown in **Table 2.1**

Further; the "Analysis Of Variance" of **Table 1.1** is explored by using single factor viz. 'ONE WAY ANOVA' in **Table 1.2** and that of **Table 2.1** is revealed in **Table 2.2**.

Table 1.2 ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	5985.124	5	1197.0247	7.546088628	0.01440697	4.387374
Within Groups	951.771	6	158.6285			
Total	6936.895	11				
Table 2.2 ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	1989.9132	5	397.98264	3.814113955	0.066937425	4.387374187
Within Groups	626.0683	6	104.3447167			
Total	2615.9815	11				

The above results of *Table 1.1* for unheated water treatment in dark and light condition shows that the F calculated value (**F**) = **7.5460** greater than the F-table value (**F crit.**) = **4.3873** (*Table 1.2*) at  $df=11$ ; between the sample and within the sample in a group.

While; the sample for hot water treatment in dark and light condition of *Table 2.1* shows the F calculated value (**F**) = **3.8141** lesser than the F-table Value (**F- crit**) = **4.3873** (*Table 2.2*) at  $df=11$ ; between the sample and within the sample in a group.

### CONCLUSION

The ONE WAY ANOVA carried out at 0.05 level of significance for the unheated water in dark and light conditions reveals that the Alternate hypothesis is accepted *i.e.* (**H<sub>1</sub>**) for the germination of seeds. (**Result as produced from table 1.2**)

While that of the Hot water treatment in dark and light condition shows that a Null Hypothesis is accepted *i.e.* (**H<sub>0</sub>**) for germination of seeds. (**Result as produced from table 2.2**)

Hence the treatment by unheated water in both the condition for a leafy vegetable plant species such as *Amaranthus tricolor* (Red variety) and *Amaranthus tricolor* (Green variety) was observed significant for increasing the germination rate of seeds. While; Use of hot water treatment in dark and light condition was found to be insignificant for increasing the germination rate of seeds.

Hence, it is advisable and recommendable for Agricultural practitioner to selectively use this methodology in-order to increase the rate of germination so as to achieve more amount of produce. This technique efficiently follows the pathway of selection without relying on any seed boosters for germination rather utilizing the natural way for practicing farming in the field. Also it "Affirms" the treatment of unheated water in dark and light condition as a specific tool for both these plant species – Thus creating a guide tool for an Agricultural Practitioner.

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