INTRODUCTION
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'AapoJyoti Rusomrutam, Brham, Bhooh, Bhruvaswaha'
"Yajruved"

Life evolved in water and primitive life forms were aquatic, Parker (1968). There was subsequent migration to land and as such therefore water has still an active role in life of organisms, water remains the essential medium in which biochemical processes take place. The major constituent of plant cell is water. An average protoplasm contains, 85-90% water. Lipid rich cell organalles like chloroplasts, mitochondria contain 50% water. Protoplasm displays the sign of life only when provided with water. It dries out, it does not necessarily die but in which vital process are suspended. Water is a structural Component of carbohydrates, protein and nucleicacid. Biological macro molecules can not exist in their complicated secondary structures without the support of hydrogen bonding within their water matrix. Water is decisive for the occurrence of a single enzymatic reaction as it is for the global zonation of world vegetation. Since the protoplasm is a colloidal system water has a great role in maintaining the aqueous phase of protoplasm. In plants water is a solvent in which gases, minerals and other solutes enter into the cells and move from cell to cell and organ to organ.

Water is a reactant or reagent in many important processes such as hydrolysis of starch to sugar. It is an ingradient of photosynthesis and a product of respiration, cell division and subsequent vacuolation depends upon freely available pure water to act as a hydraulic force. Water has much higher surface tension and viscosity than most other liquids, because of the high internal adhesive forces among their molecules. This also provides
the tensile strength required by the cohesion theory of the ascent of sap. The high specific heat and high heat of vaporization make water a good climatic thermostat, which regulates the temperature of organisms.

The response of plants to the severities of their environments have occupied the attention of many long before the beginning of the science of biology Levitt (1941). In the recent years biologists have adopted the term "stress" for any environmental factor potentially unfavourable to the living organism and stress ability of the plant to survive the unfavourable factor and even to grow and survive in its presence. Biologically stress may be defined as any environmental factor capable of inducing potential injurious strain in living organism. There are a number of different kinds of stresses, developmentally programmed, environmentally imposed and caused by germination of seed. Stress is set up within seeds in response to environment conditions which counteract processes that would result into invisible germination stress. Therefore, tends to delay germination temporarily or even to suppress it permanently in seeds which are ready to germinate.

Growth and survival of plants everywhere probably depend more on the availability of water than on any other factors of the environment. The best development of plants occur in areas of adequate recurrent rainfall, while poor development is associated with scanty rainfall or lack of uniform distribution throughout the year.

Pollock and Roos (1972) remarked that stress depends not only on the genetical constitution but also on the physiological condition of a seed; clearly extreme high and low, of all environmental factors would cause biological stress water, temperature, light, ionising radiation stress not simply through
physical damage but by upsetting the biochemical including hormonal balance.

Germination is a series of processes which transform a seed from in an almost inert to the most active growing entity. The first manifestation of growth normally the protrusion of the radicle signals completion or beginning of germination. But germination is distinct from growth and the conditions which limit the two may be different. Germination phase is of prime importance in growth cycle of plants. Germination process consists of two phases, radicle emergence and seedlings growth. Bewly and Black (1978) during the first phase water absorption play a key role, while in the second phase mobilization of reserve from storage structure of seed and transport to the embryoaxis.

The worldwide interest in water relation of plants is accumulated by increasing sensitivity to the seriousness of dwindling water supplies. In many regions of world about one third of the earth's land area has a rain deficit. In these regions drought is of such regular prolonged occurrence that annual evaporation exceeds total annual precipitation (Larcher, 1983). Besides scanty rainfall large area of the world under higher saline also calling water stress as discussed in the following paragraph.

The terms "salt" or "ions stress" as used here, therefore, refer only to an excess. This stress must be measured in energy units, chemical potential, activity or electrical conductivity.

Although the effects of salts are due to its ions, a distinction will be made between a salt stress and Ion-stress. If the salt concentration is high enough to lower the water potential appreciably (0.5-1.0 Bar) the stress is called a salt stress. If the salt concentration is not high enough to lower the water potential appreciable the stress will be called an Ion-stress.
Most of the saltstress in nature are due to Na-salts, particularly "NaCl". There is a direct and inseparable relation between the salt and water stress. When the plants are subjected to an artificially induced evaporative loss of water, this is commonly called "desiccation stress".

But often when water availability is even in adequate quantity, the quantity of water leaves much to be desired. Millions of hectares of lands are saline due to salts condition this providing stress. This also regards soil & plant water drought.

India is basically an agricultural country where agriculture is a gamble in the monsoon. The vagaries of the monsoon are well known. Naturally the failure of the monsoon is disastrous to the life and economy of the country. Therefore it is important to cultivate crop plants which can be adapted to this inhospitable agroclimatic conditions. Scanty and erratic rainfall is the main cause of increasing expansion of existing arid and semiarid regions. Where leaching of salts by ground water does not occur. Warm whether and illdistributed rains are known to intensify the salt injury 9.5 millions of kilohectares (Massouda 1974) of land through out the world is too saline. It reduces economic crop-yield and more and more reduces nonproductive soil every year. Nonsaline soil and nonsaline water become more intensively and extensively exploited (Poiljakoff, Mayber and Gala (1975). Salt affected irrigated area is 50% irrigated and total irrigated area is 2.3 to 2.4 million of square kilometers.

Sharma and Gupta (1986) reported that India where of 130.55 million hectares of land all under cultivated its estimated that about 12.0 million of hectares of land have been affected by salinity and alkalinity condition such as Indo-Gangatic and alluvial plains covering 4.0 million hectares, medium and deep black
soil 4.0 million hectors. Arid-semiarid 1.0, and Coastal 3.0 million, hectors total 12.0 millions hectors soil salt affected soil. Saline soil hazard is common in (Uttar pradesh, Madhya pradesh, Rajasthan, Gujarat states) West north central and coastal area of India.

The first on saline / alkaline effect of stress by carried reported by progressive deterioration of land in the command of the west Jumana cannal promoted by the government of Punjab for the first time in (1856) to draw the attention of the then governor general to the seriousness of the problem of "Reh" and "Usar" tracts. Second report was in (1876) from David Roberts. In (1877) and (1886) Reh committee focussed the attention on many important points related to canal irrigation, drainage and spread of alkaly in soil.

In (1891) J.A Voekker was the first to review on India-agrorian conditions on Dr Voekker's recommendation, Dr J.W.Leather's was the first scientific work on soil salinity in this country who published his several research findings on the reclamation on "Reh" or "Ushrlands". (1893 - 1897)

The state of gujarat lies between 20° north latitude. 24° north latitude.A large parts of state lies under arid and semi arid conditions and also has coastal region. More than 0.714 hectares of land is saline, saline alkali or alkali (The State of India's environment report 1982).

Salinity in soil or water presents a stress condition for crop plants that is increasing importance in agriculture. Natural saline condition is wide spread, phenomenon of earth and evolution of living organism has resulted in natural species that show special adaptive mechanism to grow and exist in saline environment. Even then the majority of plants are relativly salt sensitive. A salinity problem is regarded as arising when
concentration of NaCl, Na₂Co₃, Na₂So₄ or salts of Magnesium are present in excess.

Salinity and osmotic stress affect the seed germination and suppress the growth of many cropplants (Giorgi et al 1967 Greenway 1973).

The plants that cannot grow in the presence of high concentration of Na-salts are called glycophytes. True halophytes are those plants that occur naturally only on soil or in water too salty for the average plants. They have been subdivided into the extreme euhalophytes and the moderate oligohalophytes (Takada 1954).

The presence of salt in the ambient medium causes "Physiological drought" to plants. The mechanism of salt inhibition is not fully understood. According to Prisco and "O"leary (1970 a) the inhibition is due to inhibition of water absorption and mobilization of metabolites. (Ramnna and Das (1978) Prisco et al (1981).

Strogonov and his co-workers (1970) summarised the research work done in the Soviet Union on "structure and function of plant cell under saline Conditions", comprehensive review of plant responded to salinity, suggested, "Energy expenditure during osmotic adjustment to salinity is one of the main factors in reducing growth." (Greenway 1973).

Data given by Chapman (1966) indicate a variation in tolerance, towards salinity by both wild and cultivated species and this variation depends upon the locality.

The ability of a plant to withstand the disturbances caused by salt-change in the environment by osmotic adjustment without much effect on plant growth and yield is termed as "salt tolerance".

Bernstein and Hayward (1958) discussed the varying tolerance of different plants species and the effect of salt on the water
relation of plants (Flower et al 1977) Greenway and Munns (1980) explained the salt tolerance mechanism in halophytes and non-halophytes.

It is not entirely clear how water stress reduces growth of the plants. Stalyer (1967) had analysed the changes occurring in a transpiring plant with respect to the water potential of soil over a period of several days. In the absence of added soil water, both plant and soil water potential decrease over a period of several days. Until water potential of the plant is equal to the water potential of the soil, and at this point the plant ceases to absorb water, because there is no longer a gradient in water potential. From the soil to the roots. At this point permanent wilting occurs. According to Koller (1972) water stress operates chiefly through increased water potential (w.p.) and reduced supply of nutrients for growth.

The rate of growth of plant cells and efficiency of their physiological process are highest when the cells are at maximum turgidity. Water deficit refers to situations where turgid cells and tissues are less than fully water causing some degree of metabolic disturbance.

The capacity of the plants to withstand the periods of dryness is called "drought resistance" it is a complex phenomenon condition by many internal (i.e. Physiological, biochemical, genetical etc.) and external, or environmental factors. According to Levitt (1958) there are the three categories of plants drought mechanisms—drought avoidance and drought tolerance. Plants resist drought by tolerating loss of water and dehydration of cells or Protoplasm, and this is dependent on properties of protoplasm, like osmotic—pressure, bound water and viscosity. Secondly, the plants avoid drought by absorbing more water or by restricting water loss by developing special morphological or anatomical
characteristics like extensive root system, thick cuticle, sunken stomata, reduction in cell-size etc.

Drought resistance is a dynamic process which changes in the different phases of growth. Some phases are more critical than others and these critical phases may again depend upon ambient, Chinoy et al. (1969). As yet, the detailed information on the mechanisms of resistance are rather obscure, but it is predicted to involve changes in viscosity of the cytoplasm during drought hardening and the protection of membrane properties by the release of simple sugars, Polyhydroxyal alcohols and Proteins.

Many workers have utilized osmotic stress in an attempt to select genetic strains that will be tolerant to drought. A stress that is capable of inducing a loss of water in the liquid state is called osmotic stress. According to Kaufman and Ecard (1971) Polyethylene glycol (PEG or Carbowex) of high molecular weight (6000) when added to nutrient medium caused changes similar to those observed under drying soil.

Various osmotica such as sucrose, NaCl, Mannitol and Polyethylene glycol of high molecular weight 6000(PEG) are used for restricting water supply to the germinating seeds Janes (1966) and Lawlor (1970). Among various osmotic PEG of high molecular weight are widely used, because they are inert for plants as far as their absorption & incorporation into metabolism and toxicity are concerned. Parmar and Moore (1968) used PEG, NaCl, and mannitol and observed that all the solution retarded germination of corn being greatest in PEG and least in NaCl. But a few investigations are carried out to study the effect of various osmotica on metabolic aspects of seedlings.

Effects of water stress on germination have often involved imbibing seeds in solution of osmotically active solutes of known water potential.
The plants can also be subjected to an artificially induced evaporative loss of water and this is commonly called a desiccation stress. Desiccation causes water stress much as would be in the soil when there is no or restricted availability of water due to erratic or scanty rains. It is accomplished by desiccating the seedlings in dessicators containing sulphuric acid or calcium chloride Kufman (1968) and Chinoy (1969) processes here water dehydrates from seedlings.

The desiccation of plants has been less thoroughly investigated than the acquisition and conservation of water, mainly because it is less important agriculturally and in addition, it is intrinsically a most difficult subject for research since it involves a simlutaneous study of the whole plant. Namely visually such as physiology, cell-structure, and many biochemical pathways. However, it has been established that serious loss of cell water is accompanied by disruption of all major metabolic pathways Parker (1968), (especially carbohydrates and nitrogen metabolism) and denaturation of macro molecules (protein and nucleic acids) presumably due to changes in the amount of water bound to hydrophilic surfaces. In addition it has been suggested that the shrinking and swelling of cell contents can cause an irrevercible damage to cell membrane.

It is well known, that mobilization of reserves form storage organs to growing axis plays a vital role in seedlings growth therefore the present work analyses the stress physiology of early germination of pea and Amaranthus.

For experimental convenience the whole experiment was divided into three parts:-

I Effect of sodium chloride (NaCl) salinity on germination growth and biochemical changes of
(A) *Pisum sativum* var. *Boneville*

(B) *Amaranthus tricolor* var. *Co*. This plant is known locally as "Tandaljo".

II Effect of polyethylene glycol (PEG) osmotic stress on germination growth and biochemical changes of A (Seeds) and (B) seeds

III Desiccation treatments during germination and biochemical changes of above desiccating seeds.

Pea (*Pisum sativum var Boneville*) is a cool-season crop. The native country of cultivated pea is uncertain but the species seems to have existed in west Asia before it was cultivated and after that was spread all over world. In our country pea is field crop cultivated all over India pea is used as pulses. Pea is protein rich plant so its study become very interesting.

*Amaranthus tricolor* var. *Co* local name is "Tandaljo". This is a monsoon crop. The leaves are used as green vegetables and also good fodder as full of natural nutrients, salts and vitamins. Red Tandaljo has medicinal values.

In view of this utility and consumption by human as pulse or leafy vegetables respectively, they were selected for the present study.