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Review

Salt Stress Threshold in Millets: Perspective on Cultivation on Marginal Lands for Biomass

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Abstract: Millets hold an immense assurance for food safety and nourishment amid ever-rising agricultural expenses and climate alterations. They are healthful, have supplementary wellbeing profit and need remarkably fewer effort overheads for crop growing. These characters draw attention to millets as a plant of preference for the humankind in the course of emergent alarm about environmental changes. Millets have the prospect to provide biomass and thus bioenergy, reduced carbon emission, carbon footprint and sustainable modern agriculture. As the rate of expansion in budding countries is increasing day by day, the scarcity of energy is a big panic and there is a mounting turn in the direction and rehearsal of waste and biomass as an energy source. Globally, at least 20% of total irrigated land has been injured by salt and 1.5 million hectares is taken away of cultivation every year. Thus, in future, we will have a requirement of efficient crops and utilisation of marginal lands for agriculture. Millet is an answer to the efficient crop. Plants are subjected to various environmental pressures (high/low temperature, heavy metal, salinity, pesticides, etc.) as well as biotic stresses (virus, bacteria, fungi, etc.) and millets are not an exception to it. Millets are categorised as glycophytes and can tolerate average salt threshold of about 6 (EC_e) (dS/m) with some variation from specie to specie. Increase in the salt concentrations can lead to retarded growth and development, thus need for mitigants arise to reduce such stresses. Some mitigants to overcome the stress levels include proline, polyamine and betaines, Na_2SeO_3, H_2S, KNO_3, $Mg(NO_3)_2$, etc.

Keywords: Sustainable development; proline; salt tolerance; biomass; food security

1 Introduction

Salt stress is the gravest factor preventing the yield of crops, having undesirable consequences on the crop, its growth rate, strength and health [1]. Saline conditions influence various irrigated areas, mostly due to the use of brackish irrigate. Internationally, greater than 45 million hectares (at least twenty per cent of total irrigated area) of irrigated land has been injured by saline conditions and 1.5 million hectares is taken away of cultivation every year [1]. The soil is assumed to be saline or influenced by salinity if it has an electrical conductivity of saturation soil extort of larger than 4 dS/m at 25°C where 4 dS $m^{-1} \approx 40$ mM NaCl or greater [2]. Surplus salinity results in unbalanced, underdeveloped development, reduced and spotty yields. The degree of this damage is directly proportional to the quantity of salinity. Also, this type of stress tends to lessen the amount of oil in oilseed crops, in the same way, drop in yield occurs in plants that are to some extent salt-tolerant, for instance, safflower and sunflower [3,4]. Soil erosion, land degradation, biotic and abiotic factors decrease the available area for cultivation. As per United Nations Food and Agriculture Organization forecasts, in instruct to meetup worldwide food requirement, the quantity of staple cereal crops in the next thirty-two years would be greater than two times (raise by sixty to hundred percent) [5–7]. Thus in future, we will need efficient crops and utilisation of marginal lands for cultivation. Marginal and insignificant soils are fit for millets. Thus, the utilization of marginal soils and areas are desirable for bioenergy, biofuel, food, fodder, etc.

Millets are a group of variable grasses with many small seeds. These crops have a benefit of being proficient propagates in the stress conditions (scant rainfall, little soil nutrients, stress, etc.), anywhere if there is a slight possibility of growth for other crops [8]. Millets stay classified with maize and sorghum in grass sub-family panicoideae [9] whereas disagreements exist about the classification of family millet, with some evidence giving the family name Gramineae and others classifying it in family Poaceae [10,11]. About 9 millets are mostly cultivated. In a sequence of universal produce, mostly extensive cultivated millets are sorghum (*Sorghum bicolor* (L.) Moench), pearl millet *(Pennisetum glaucum* (L.) R. Br.), foxtail millet *(Setaria italica* (L.) P. Beauvois), proso millet *(Panicum miliaceum* L.*)* and finger millet *(Eleusine coracana* Gaertn.) [12]. Additional millets are little millet (*Panicum sumatrense* Roth. ex Roem. & Schultz), Indian barnyard millet (*Echinochloa frumentacea* Link), kodo millet (*Paspalum scrobiculatum* L.), Japanese barnyard millet (*Echinochloa utilis* Ohwi & Yabuno), tef (*Eragrostis tef* (Zucc.) Trotter) and fonio (*Digitaria* spp.).

In this review, we explore the benefits of millets with respect to sustainable development and effect of saline stress, salt tolerance capacity and mitigation of salt stress. Further, we will have a look on the relevance of millets to climate change, food security and livelihood.

2 Agroclimatic Conditions and Agronomical Benefits of Millets

Millets are grown frequently in developing countries [13] especially in semiarid humid areas of Asia and Africa. In these areas, millets are cultivated for both food and animal feed. Millets are significantly little granular crops which are mostly grown in marginal soils where other crops fail to propagate [14]. They are grown in severe ecological situations, particularly in insufficient wetness and in soil with a deprived nutrient that is otherwise not matched for the leading cultivated crops. Millets are rich in proteins, lipids, vitamins, minerals, dietary fibre, essential amino acids, essential fatty acids, antioxidants, polyphenols, tannin, phytic acid, phytate and oxalic acid [15]. Millets have been contributing to human health via their hypoglycaemic, anti-tumorigenic, atherosclerogenic and anti-microbial properties. The estimated protein content of millet grains is 8–15% (dry weight). Pearl millet is having the maximum protein content, i.e., 14.5% [16]. The lipid content of millets ranges from 1.43 to 6 gm/100 gm [17]. Al Juhaimi et al. [18] stated the approximate ash content of millets was 1.74% (dry weight basis). Millets are rich in vitamins that are required for normal physiological functions of the human body. Many vitamins especially vitamin-B6 and folic acid are present in millets [19]. Millets are considered to be a rich source of Vitamin E, which is an antioxidant and guards fat in membranes around cells. Millets are a good source of phenolics, flavonoids, tannins, etc. Thus help in cardiovascular diseases, cancer and diabetes. The condensed tannins have antioxidant, anti-viral, anti-inflammatory and anti-bacterial properties [20]. Moreover, being gluten-free millets are an excellent substitution to wheat. Millets are immensely consumed as snacks, bread, puddings, beverages and hold significant cultural positions. Besides providing food security to the millions, these are the means of livelihood for many especially for the people of Africa and Asia. Millets are used as feed and fodder too. Pearl millet feed is highly digestible in a vegetable state and does not contain hydrocyanic acid. Foxtail millet is used as animal feed in western countries especially for caged and wild birds. Finger millet straw is one of the most preferred feedstuffs for cattle in South Asia [21].

3 Biomass and Bioenergy from Millets

We have a continuous rise in global energy expenditure since the past few years. One of the reasons for this is a speedy expansion of population, production and industrial extension. This leads to more utilization of non-renewable fuels, such type of fuels have an obvious impact on the surrounding environment and whole ultimately. The effects of environmental change with greenhouse gases formed by the use of fossil fuels are noticeable throughout the planet [22]. So, the utilization of energy sources which can be used again and again (renewable) seems to have several returns. The only way out of this is biomass. Renewable fuels have accessibility and cause less pollution. The global production of biomass (calculated approximately) is 146 billion metric tons *per annum*. Biomass has the budding scope of providing a sustainable supply of energy and also meeting greenhouse gas reduction targets [23].

Millets have potential to provide biomass and thus bioenergy for sustainable development and reduced carbon emission. *Panicum virgatum* L. (switchgrass) and other millets turn out to be a representative species for bioethanol and biodiesel production [24–26]. The undersoil biomatter of this plant is 4–5 folds superior to corn as it can contribute 2.2 Mg C/ha/yr into soils [27,28]. Switchgrass has outstanding prospective for bioethanol production by fermentation and gas and electricity generation by gasification process. The U. S. Department of Energy selected switchgrass as the herbaceous model species for biomass energy. Characteristics like constant high biomass yield, least agricultural inputs and relatively easy to grow from seed make it a brilliant bioenergy crop [29].

Foxtail millet is cultivated widely for food and feed in Asia and Africa and has future for utilization as a C_4 bioenergy crop. Zhang et al. [30] provided insight of foxtail millet (*Setaria italica* (L.) P. Beauvois) related to its biofuel potential and reported it as a model grass for other renewable fuel grasses, together with switchgrass and pearl millet. Genome sequence studies have shown that this plant is strongly correlated to numerous bioenergy crops at the genome level like switchgrass (*Panicum virgatum* L.), napiergrass (*Pennisetum purpureum* Schum.) and thus can serve as a potential bioenergy crop.

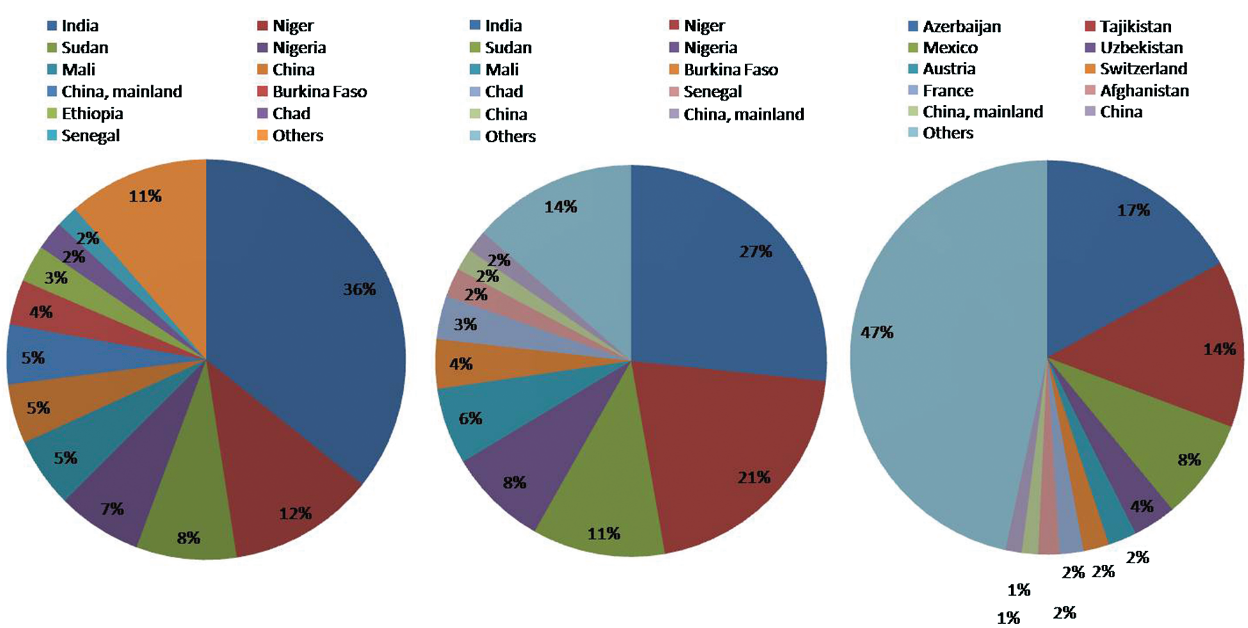
The proximate analysis of pearl millet biomass revealed that superior constituents are present for biofuel production in the crop. The chemical composition of pearl millet is also better to that of the other major cereals [31]. Pearl millet contains cellulose (41.6 ± 0.01%) and hemicelluloses (22.32 ± 0.65%) polymers which are necessary for biofuel production. Sweet pearl millet provides a better alternative for biofuel production than other crops as it can be used for ethanol production because it produces a high concentration of readily fermentable sugar (0.03 to 0.06 litre/kg biomass) [32].

The biofuel production capability mostly depends upon the feedstock superiority, quantity and climatic factors. For growing feedstock, which is required for biofuel manufacturing about every country is restricted by two factors, i.e., land availability and scarce water resources [33]. Developing nations use forty-seven per cent of overall energy from biomass [34]. Owing to the rapid pace of growth, the deficiency of energy is becoming an immense fear. Thus we need to explore more and more for a better future.

4 Relevance of Millets to Climate Change, Food Security, Livelihood and Future Sustainability Development

Two essential sustainability questions of the present farming are the decreasing carbon footprint and increasing energy use. Understand the suggestion of energy and carbon utilization, dept. for environment food, rural affairs [35] informed about temperature raise of 3–4°C and it is certain that agricultural production will be seriously affected, thus in future abandoned and underutilized crop resources are extremely fundamental for sustainable long-lasting agriculture [36] and millets fit into this criterion [37]. Millets are well suitable to little rainfall situations, proficiently survive extensive dry spells, improve quickly after deferred rain, root organization well-organized in soil moisture withdrawal, negligible pest and disease problems, sustainable and modest crop under little management situation in marginal land. Millets have biochemical, morpho-physiological and molecular features which contribute to enhanced tolerance to abiotic stresses than other major cereals. Principally, the quick lifecycle of millets aids in getting away from stress as they need three and a half months to finish their life cycle. The advantageous C4 photosynthetic feature is seen in millets [38]. Foxtail millet is somewhat drought tolerant crop among cereals. Compared to others it needs 257 g of H_2O to manufacture 1 g of dry biomass, where 470 and 510 g is required by maize and wheat correspondingly [39,40]. The noteworthy connection among agronomic characters like panicle and grain weight, plant height, thousand-grain weight and physiologic factors with (DRI) drought-resistant index in drought circumstance is found [41]. Foxtail, as well as finger millets, are prospective crops for saline soils [42]. Millets are nutritionally very rich food, reasonably low-priced, therefore much available to poor, extended storability of yield, the extended shelf life of seeds, quality feed for animals. Thus millets are highly prized for livestock production in areas with less rainfall, have a cardinal place in local food systems, profits generating prospect for marginalized part of society as well as for women by value-adding interventions. Millets have better nutritional quality and valuable food properties, nutritionally millets are rich in protein, amino acids, vitamin A, minerals and fibre [43,44]. They can tackle the unseen appetite of the deprived people, nurture the lactating mothers, due to little glycemic index they can contribute neutraceutical profit to people having diabetes [45]. Thus millets are cardinally related to sustainable development and these characteristics of millets make-out them next-generation crops with the appeal for studies to look at the climate-resilient qualities.

All the major cereal crops like wheat, rice and maize have global warming potential of around 4 tons CO_2 eq/ha, 3.4 tons CO_2 eq/ha and 3.4 tons CO_2 eq/ha respectively. These crops also have a high carbon equivalent emission of 1000, 956 and 935 kg C/ha for wheat, rice and maize, respectively. Even with their higher emission amounts, they are commonly cultivated as primary sources of nutrition for the global population. However, millets and sorghum have comparatively lesser carbon footprints [46]. This is other reasons for the cultivation of millets to reduce carbon footprint globally. Millets are coarse cereals and can be grown as a substitute for wheat and rice. According to FAO, the total production of millets in the world is 31019370 tonnes and the total area under cultivation is 33560087 ha [47] (Fig. 1).



(a) (b) (c)

Figure 1: (A) Country-wise production (% of 31019370 tonnes in total), (B) area harvested (% of 33560087 ha in total), (C) yield (hectogram per hectare: hg/ha) of millets

5 Millets, Stress and Threshold Salt Application Required for Stress

Plants are subjected to various abiotic stresses (temperature, drought, heavy metal, salinity, pesticides, etc.) as well as biotic stresses (virus, bacteria, fungi, etc.), and millets are not an exception to it. Such conditions unpleasantly affect their progress and development and prompt a sequence of changes in morphological, physiological, biochemical and molecular aspects. Abiotic pressures can persuade varied reactions in plant life which include reformations of transportation and the metabolic route which leads to growth inhibition [48]. Ion difference and hyperosmotic pressure is the key outcome of abiotic stress and the instant effect of these crucial changes in the enhanced gathering of ROS (reactive oxygen species) that are injurious to cells at high intensities. ROS like superoxide, hydroxyl radicals, hydrogen peroxide and singlet oxygen, cause injury to cellular structures and biomolecules like DNA, proteins, carbohydrates, lipids and eventually end with cell death [49–53]. ROS are extremely reactive, deadly and can cause mutations [54]. Thus one-sidedness among ROS and antioxidants defences results in oxidative stress and when a cell is in the situation of oxidative stress, its outcomes is lethal lipid per-oxidation, DNA damage, enzyme inhibition, oxidation of proteins and inauguration of deliberate cell death or programmed (PCD) or apoptosis [55,56]. In plants chloroplasts, mitochondria and peroxisomes are cardinal sites where ROS are produced mainly. Regardless of the disparaging nature, reactive oxygen species are well-thought-out to exist as the second messengers in signalling and cellular process, provide tolerance to stress [57]. The balance between ROS and scavenging activity antioxidant decides that whether ROS work as a detrimental or signalling agent, the evenness in the activity of these two is very mandatory to retain, with the aim of battle any oxidative stress. The scavenging antioxidant security system includes non-enzymatic and enzymatic antioxidants [58]. The enzymatic scavenger resistance scheme includes catalase (CAT), guaiacol peroxidase (GPX), superoxide dismutase (SOD), glutathione reductase (GR) however glutathione (GSH), ascorbate (ASA), carotenoids, proline, tocopherols and phenolics function as probable non-enzymatic scavengers inside the cell [59]. Every stress has an unfavourable impact on plants. This injurious effect is detected on the entire plant or some parts, leading to the death of plant or drop in productivity. Further, all the cardinal processes like germination, development, pigments system, photosynthesis, water relation, nutrient imbalance and yield are affected.

The number of genes is switched on and off by transcription factors, ensuing the improved intensities of some proteins and metabolites, which are answerable for granting defence against these stresses [50,51,60] These varied pressures and stresses frequently trigger signalling paths and responses, for instance, stress proteins, upregulating of scavenging anti-oxidants and gathering of friendly solutes [61]. Such genetic produces are categorized into 3 main sets.

(1) Firstly those substances that unswervingly guard cells against stresses, like heat stress proteins (HSPs) or chaperones, LEA proteins (late embryogenesis abundant proteins), osmoprotectants, antifreeze proteins, detoxification enzymes and free-radical scavengers [62,63].

(2) Those that are associated in enormous signalling sequences and in controlling transcription of CDPK (calcium-dependent protein kinase) [64], MAPK (Mitogen-activated protein kinase) and SOS kinase [65], phospholipases, etc. [66].

(3) Lastly, those linked in ion uptake, water uptake, transporters like aquaporins and ion transporters [67].

The minimum salt application that begins to destroy growth fluctuates noticeably within plant variety. Traditional the majority of agricultural crop species are categorised as glycophytes, having threshold resistances in a range of 1 to 10 dS/m (deci-siemens per metre), expressed as the electrical conductivity (EC) of saturated-soil extracts taken from the root zone. At EC over 10 dS/m the development of most resistant plant species, for instance, barley, cotton, sugarbeet, rye and wheat drop off with rising saline application. Several tolerate species flourish at soil salt concentration of 10 dS/m or higher are grouped in halophytes. Several halophytic plants have a budding scope as crop plants however very little or no data is on hand to guess growth as a function of soil salinity [68]. Millets are not resistant to high salt concentrations and thus are grouped into glycophytes. Similarly, salt tolerance can be expressed in mMol/L, glycophytes are cruelly repressed or destroyed by an application of 100–200 mmol/L NaCl, on the other hand, halophytes can withstand salt beyond 300 mmol/L. Halophytes stand enormous extraordinary intensities of salt amounts. For instance, in the presence of 700 mmol/L NaCl *Atriplex vesicaria* Heward ex Benth. can yield good yield. At the same time, *Salicornia europaea* L. constantly stays vigorous in 1020 mmol/L NaCl. Thus whereas glycophytes are salt sensitive and halophytes are tolerant still there are many plants which are very salt-delicate, for example, fruit trees such as avocado and citrus, these plants are restrained by few millimoles per litre concentrations of NaCl [65].

Rasool et al. [69] studied the effect of various amounts of NaCl (50–200 mM) on *Setaria italica* (L.) P. Beauvois and *Panicum miliaceum* L. and found that salt stress decreased the tolerance index (TI) of both shoots and roots, the biomass, relative water content (RWC) and photosynthetic pigments (PP) in a dose-dependent manner with respect to control. The salt treatments increased the membrane damage as evidenced by electrolyte leakage (EL) and thiobarbituric acid reactive species (TBARS). Similarly, Shah et al. [70] reported that salt stress influenced a significant modification in the level of osmolyte accumulation such as proline, glycine betaine, and antioxidant enzymes. A significant decrease of seed germination percentage, root and shoot length, photosynthetic pigments like chlorophyll a, chlorophyll b and proteins at higher concentration of NaCl added was recorded. From this, it was found that the millet crops can be sustained in optimum salinity (100 mM) condition. It was also concluded that enzymatic and non-enzymatic defence systems play a key role in generating tolerance against salt stress.

Fan et al. [71] in growth and physiological characteristics of switchgrass *(Panicum virgatum* L.) seedlings exposed to 0, 50, 100, 150 and 200 mmol/L of NaCl solutions. With the increasing concentration of the NaCl, the seedling growth was inhibited. The plant height decreased, leaves became smaller, photosynthetic leaf area and net photosynthetic rate reduced and dry matter accumulation decreased significantly and presenting the general traits of glycophyte, the salt tolerance threshold for *P. virgatum* L. was 178.6 mmol/L when taking 50% drop in biomass as the standard. El-Keblawy [72] investigated germination percentage and germination rate to salinity level in *Panicum turgidum* Forssk. Germination was significantly reduced and slower at the higher concentrations and was completely inhibited at 300 and 400 Mm. The results of the present study showed that the seed germination of *Panicum turgidum* Forssk. was greatly reduced by increasing the salt concentration and completely inhibited at 300 and 400 mM NaCl and KCl.

Seffino [73] evaluate the response of two cultivars (Klein Verde and Bambatsi) of *Panicum coloratum* L. to salinity. The salinity of 100 and 200 mmol/L NaCl delayed germination and significantly reduced germination percentages in both cultivars. Seeds that did not germinate within 16 days in saline solutions had lost viability, as very few germinated when they were transferred to water after this period. Sreenivasulu et al. [74] in differential response of antioxidant compounds to salinity stress in salt-tolerant and salt-sensitive seedlings of foxtail millet (*Setaria italica* (L.) P. Beauvois) found that seed germination and seedling growth are normally limited by increasing concentration of NaCl. Accordingly, 5-day-old seedlings of the tolerant and the sensitive foxtail millet cultivar are grown upon high amounts of NaCl (up to 250 mM) showed differences in their growth pattern (root and shoot length). Seedlings of the tolerant cultivar were able to grow normally even at 200 mM, whereas germination of seedlings of the sensitive cultivar was strictly inhibited already at 150 mM NaCl. Kafi et al. [75] investigated relative salt tolerance of south Khorasan millets ie proso millet (*Panicum miliaceum* L.), foxtail millet (*Setaria italica* (L.) P. Beauvois) and pearl millet (*Pennisetum glaucum* (L.) R. Br.) and found that the yield and other yield-related parameters of millets decreased by salinity stress, this reduction was more prominent only at a high level of salinity (9.5 dS/m). Zehtabian et al. [76] studies on *Panicum antidotale* Retz. Salinity stress was selected in the form of four salinity treatments, including zero (authentic), 40, 120 and

200 millimolar. Salt solutions of NaCl (60%), Na_2S0_4 (30%) and $CaCl_2$ (15%) were used. The effect of 20 days of dry treatment and 200 millimolar salinity was observed in decreasing dry matter production more than the other treatments. Further, we can describe the salt resistance capacity of a crop by plotting its relative yield as a continuous function of soil salinity in (ECe) (dS/m). Tab. 1 shows the salt tolerance capacity of some plants whereas Tab. 2 shows some mitigants used to combat stress.

Table 1: Threshold salt tolerance of some agriculture crops

Name	Botanical name	Relative yield taken	Salt Threshold (EC_e) (dS/m)	References
Barley	*Hordeum vulgare* L.	Grain yield	8.0	[77]
Canola	*Brassica napus* L.	Seed yield	11.0	[78]
Rice	*Oryza sativa* L.	Grain yield	3.00	[79]
Rye	*Secale cereale* L.	Grain yield	11.4	[80]
Sorghum	*Sorghum bicolor* (L.) Moench	Grain yield	6.8	[81]
Soybean	*Glycine max* (L.) Merr.	Seed yield	5	[82]
Wheat	*Triticum aestivum* L.	Grain yield	6.0	[83]
Carrot	*Daucus carota* L.	Storage root	1.0	[84]
Potato	*Solanum tuberosum* L.	Tuber yield	1.7	[85]
Proso millet.	*Panicum miliaceum* L.	Grain yield	5.5	[86]
Foxtail millet	*Setaria italica* (L.) P. Beauvois)	Grain yield	6	[87]
Foxtail millet	*Setaria italica* (L.) P. Beauvois)	Dry matter	6	[88]
Corn	*Zea mays* L.	Shoot DW	1.8	[88]
Common Bean	*Phaseolus vulgaris* L.	Seed yield	1.0	[89]
Sweet potato	*Ipomoea batatas* (L.) Lam.	Fleshy root	1.5	[90]

Table 2: Some mitigants used to overcome stress in plants

Species	Type of stress	Mitigants	Conc. of mitigant	Conc. of salt	Reference
***Setaria italica* (L.) P. Beauvois) and *Panicum miliaceum* L.**	NaCl	Se	1 µM	50, 100, 150, 200 mM	[69,70]
***Setaria italica* (L.) P. Beauvois)**	Cd	H_2S	50 mM	5 mM	[91]
***Pennisetum typhoides* (Burm.f.) Stapf & C. E. Hubb.**	As	$[PO_4]^{3-}$	100 µM	10, 25, 50, 100 and 200 µM	[92]
***Pennisetum typhoides* (Burm.f.) Stapf & C. E. Hubb.**	NaCl	NO_3^-	2 & 10 mM	25, 50, 100 mM	[93]
***Fragaria* x *ananassa* Duch.**	NaCl	KNO_3	10 mM	40 mM	[94]
***Fragaria* x *ananassa* Duch.**	NaCl	$Mg(NO_3)_2$	10 mM	40 mM	[94]
***Fragaria* x *ananassa* Duch.**	NaCl	$Ca(NO_3)_2$	10 mM	40 mM	[94]
***Fragaria* x *ananassa* Duch.**	NaCl	NO donor sodium nitroprusside & H_2O_2	100 µM & 10 mM	100 mM	[95]

(Continued)

Table 2 (continued).

Species	Type of stress	Mitigants	Conc. of mitigant	Conc. of salt	Reference
***Caralluma tuberculata* N. E. Brown**	NaCl	Ascorbic acid salicylic acid	100&200 µM for both	300 mM	[96]
Lactuca sativa* L. var. *crispa	NaCl	Epibrassinolide	1, 2 and 3 µM	50, 100 mM	[97]
***Zea mays* L .**	NaCl	Na_2SeO_3	1, 5 and 25 µM	100 mM	[98]
***Zea mays* L.**	NaCl	Proline	0.5–2 mM	75 mM	[99]
***Nicotiana tabacum* L.**	NaCl	Proline	20 mM	200 mM	[100]
***Nicotiana tabacum* L.**	NaCl	Betaeins	20 mM	200 Mm	[100]
***Solanum tuberosum* L.**	NaCl	Polyamine and betaeins	–	50, 100, 150 mM	[101]
***Cucumis melo* L.**	NaCl	Proline	0.2 mM	100 mM	[102]
***Helianthus annuus* L.**	NaCl	Proline	2.5, 5.0 and 7.5 mM	0.23, 3.13, 6.25 dS/m,	[103]
***Nicotiana tabacum* L.**	NaCl	Proline	20 mM	200 mM	[104]
***Oryza. sativa* L.**	NaCl	Proline	10 mM	100 mM	[105]
***Vigna radiata* (L.) R. Wilczek**	NaCl	Proline	15 mM	300 mM	[106]

6 Conclusion

From the outlook of this review, we concluded that millet serves as an excellent grass for bioenergy, biomass, food Security and sustainable development. Possibly, a hale and hearty environment can be produced with food security and also our future generation will feel more safe and secure. Further millets have a scope for renewable energy generation as demanded by countries like India. Abiotic restrains like salinity is the foremost preventive factor for development and productivity of millets. Moreover, the growing worldwide population is forcing researchers to develop new and proficient plans for boosting crop production to guarantee food security in unfavourable circumstances. So far, we have various outstanding studies in millets like the significance of mitigants, threshold tolerance in millets under salt stress etc. Investigation of the stress tolerance mechanisms and genetic manipulation of millets will aid further in attaining sustainable development efforts to search out enhanced crop performance on marginal and in-significant lands. Considering the significance of mitigants in free radical scavengers at a biochemical and physiological level in salinity stress, additional search regarding role and mechanism of mitigants as protectant may perhaps add a lot to solve such adverse conditions of millets.

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