SUMMARY AND CONCLUSIONS

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Chenopadium album L. is a common weed mainly used as leafy vegetable. Mostly it is grown in gardens, in fields and on bare waste grounds. It is commonly known as Fat hen and Goose foot. It is world wide in distribution. Mainly it is cultivated for consumption in India and South America. It prefers all types of soils like sandy, loamy, very acidic, very alkaline and neutral but it can't grow in shade.

Leaves of *C. album* are rich source of proteins, fats, vitamins, carbohydrates and essential nutrients like Ca, Fe, and Mg. It contains high percentage of calcium hence it is used as leafy vegetable. Leaves are antihelmintic, laxative, antiphogistic, antirheumatic, contraceptive and odontalgic. The leaves are applied as a poultice to bug bite, sunstroke, rheumatic joints and swollen feet.

C. album contains oxalic acid which in large quantities can cause lock-up of some of nutrients in the food. There are reports that the people may cause rheumatism, arthritis, kidney stone or hyperacidity should take special precaution if this used in their diet. Large quantities and raw leaves only can cause problems because it contains saponins which are toxic. However they are broken down in the cooking process and they are poorly absorbed by the body.

Seeds of *C. album* are edible and baked into bread. They are also used in salad as they contain high amount of carbohydrates and proteins. The plant is also used in the preparation of green dye and soap.

In the present investigation the effect of NaCl salinity, distillery effluent, vermiwash and senescence on organic and inorganic status of *C. album* has been studied.

Seed germination in *C. album:*

Seed germination in *C. album* was studied in the present investigation and we found the decrease in seed germination percentage of *C. album* with increase in NaCl salinity upto 40% distillery effluent treatment shows the seed germination percentage increased then it is decreased with increase in distillery effluent concentration. Seed germination of *C. album* was increased with increasing concentration of vermiwash but at higher concentration there was slight inhibition in

seed germination. Germination percentage was higher than control. Hence diluted vermiwash is beneficial for seed germination in *C. album*.

Growth Analysis in *C.album*:

In the present investigation plant growth of *C. album* was increased at lower level of salinity and then decreased with increasing in NaCl concentrations. Kumar *et.al.* (2005) observed that height of *Brassica juncea* was decreased with increasing salinity from this results it appears that *C. album* can tolerate lower level of NaCl salinity. Growth of *C. album* is also affected with higher concentration of distillery effluent but at 40% concentration of distillery effluent treatment was beneficial for plant growth. Hence proper diluted spent wash can be used as liquid fertilizer as it contains organic matter and micronutrients. Plant growth was increased with 10% concentration of vermiwash spray. According to Sivasubra-munm and Ganesh Kumar (1998-1999) vermiwash spray enhanced the plant growth of Marigold.

Organic constituents in *C. album* :

The total chlorophylls were increased at lower levels of NaCl salinity. However the chlorophylls were decreased at higher NaCl salinity. In distillery effluent treatment the Chl-a, Chl.-b and total chlorophyll contents were increased upto 40% concentration and then sharply declined at higher concentrations. Behera and Misra (1991) observed that chlorophyll contents were declined with increasing concentration of distillery effluent. Our results are also on similar lines. Hence distillery effluent is beneficial for plant growth with proper dilution. In vermiwash treatment chlorophyll a, b and total chlorophylls were increased at 10% and at higher consantrations of vermiwash foliar spray chlorophylls were decreased.

In the present investigation we found decrease in chlorophyll contents as leaf becomes senescent. Chlorophyll contents were higher in young and premature leaves as compare to other stages of leaf. In 1971 Dyer and Osborne reported that leaves of plant approaching to senescence, the synthesis of nucleic acid and protein becomes progressively less and total levels fall. Quantitative changes in the pigments composition are also found in senescing leaves. Hence chlorophyll contents were sharply declined in senescent leaves.

Carotenoids, accessary pigments in photosynthesis which were increased upto 8 EC NaCl treatment and then decreases at higher salinity. In distillery effluent treatment carotenoids were higher in 40% concentration as compare to other conentrations and control. In foliar treatment of vermiwash gives good results for carotenoids & chlorophylls upto 10% concentration. According to Siddhamol (2008) vermiwash is diluted with water (10%) and sprayed on plants which acts as a good tonic for plants and as a pesticide.

Carotenoid contents in the leaves of *C. album* were affected by leaf age. Carotenoids were sharply declined from onset of senescence stage to senescent leaves in *C. Album.*

Accumulation of polyphenols observed in the leaves of *C. album* with increasing concentration of NaCl salinity. In distilley effluent treatment polyphenol contents were declined upto 40% and again increased at higher concentration. The effect of vermiwash treatment on polyphenol contents were studied in *C. album* and found that polyphenols were declined with increasing concentration of vermiwash. Polyphenols were also declined due to leaf senescence in *C. album.* Most of these phenolics are intermediates and derivates of shikimate and phenyl propanoid pathways. (Cheng and Breen, 1991).

Carbohydrates are the potential source of energy. Their breakdown produces the energy that utilized in many of the synthetic reactions of the cell. In the present investigation we found that the concentration of total sugars and reducing sugars was increased significantly at lower levels of NaCl salinity regimes. However it was decreased with increasing NaCl salinity. Distillery effluent treatment was also affected the carbohydrate contents in *C. album.* Total sugars were increased upto 20% and then declined at higher concentration of distillery effluent. The concentration of reducing sugars and total sugars were declined in the senescent leaves of *C. album.*.

We also found that starch was accumulated at lower NaCl salinity stress and it was adversly affected at higher salinity. In distillery effluent treatment plant showed accumulation of starch at lower concentration but sharply declined at higher concentration. From these results, it is concluded that carbohydrates metabolism was disturbed by these adverse condition of salinity and distillery effluent.

Starch accumulation was increased in mature leaves and it is suddenly decreased in senescent leaves due to catabolic activities of the cell.

In the present investigation effect of senescence on oxalic acid content was studied in *C. album.* From results it is found that oxalate contents are increased in premature to mature leaves and then declined as the effect of leaf senescence. Oxalic acid has an antinutritional component that could reduce the Ca bioavalability in alimentary ration. According to Osmond (1967) oxalate contents declined as Ca absorption increased in *Atriplex inflata* and *A. vesicarla.*

Inorganic contents in *C. album*:

The present investigation was extended to study the effect of NaCl salinity on mineral nutrition of *C. album.* It has been found that Na was accumulated in the leaves of *C. album* due to NaCl salinity. Such an increased sodium concentration under saline conditions can be considered as an adaptive feature of the plant to adverse conditions of salinity. Potassium content also decreased upto 8 EC NaCl treatment and then slightly increases at 12 EC but less than control. According to Hu and Schmidhalter (2005) the salinity may cause nutrient imbalance in plants due to competition of Na^+ and Cl^- with other nutrients, such as K. Calcium content which may be markedly decline due to salt stress. This observation indicates an adverse effect of salinity on calcium uptake and distribution in *C. album.* The Mg^{++} level increases with increase in NaCl salinity, at lower concentration that shows good correlation with increased chlorophylls due to NaCl salinity. The uptake of iron was significantly affected by NaCl salinity.

Sodium concentration in *C. album* leaves was affected by increasing concentration of distillery effluent. We also found that Potassium contents were declined with increasing concentration of distillery effluent. In distillery effluent treatment there was good mobilization of potassium. Potassium and Nitrogen are highly phloem, mobile elements and their reutilization lead to rapid decline in their level in vegetative parts thereby earlier senescence (Morscher 1995).

The uptake of Ca in the leaves of *C. album* was affected by distillery effluent. Ca was accumulated at lower concentration of distillery effluent but declined at higher concentration. Mg^{++} contents in *C. album* were declined with

increasing concentration of distillery effluent. According to Singh (1982) the inhibition of photosynthetic activity in legumes was due to reduction in chlorophyll contents as a result of osmotic effect of high effluent concentration which reduce the uptake of Mg^{++} and other mineral ions that leads to inhibition of photosynthesis.

As a result of distillery effluent treatment iron was accumulated in the *C. album* leaves except 40% concentration where we observed healthy growth of plant. In 1997 Somshekar and Siddaramaih reported that application of heavy metal rich industrial effluent cause accumulation of the metals in the soil.

Vermiwash treatment gives good growth results and found that amount of sodium increased and remain fairly high in all concentrations. Potassium content was higher only in 10% vermiwash concentration. Ca^{++} was accumulated as the result of increased concentrations of vermiwash, this may be due to less mobile nature of calcium, Mg^{++} levels were also increased with increasing concentration of vermiwash. Hence vermiwash acts as good biofertilizer for plant growth, development and productivity. The level of iron was increased at 10% concentration of vermiwash. According Sindhumol (2008) 10% vermiwash sprayed on plants showed best growth of plant. Our results are also on the similar lines.

Leaf senescence affects the mineral nutrition of *C. album*. Sodium was accumulated in senescent leaves this may be due to sluggish sodium mobility in *C. album*. Potassium content was higher in mature leaves of *C. album* but K was declined with leaf aging as it is very mobile. We found that Ca was accumulated from young to senescent leaf stages due to its less mobile nature. Magnessium concentration was declined in senescent leaves, Mg is the main component of chlorophyll and it was markedly affected by leaf aging. Iron was accumulated in senescent leaves of *C. album*. Woughman and Bellamy (1981) reported that in perennial species iron was increased in the senescent leaves.

Enzyme studies in *C. album* :

A) Nitrate Reductase (NR)

The nitrate reductase (NR) activity was inhibited as the effect of NaCl salinity. It was accompanied by an increase in nitrate concentration, the decrease in the rate of enzyme NR activity.

In distillery effluent treatment we found that nitrate reductase activity decreased with increasing concentration of effluent. However NR activity seen to be stimulated at 40% concentration of distillery effluent. Due to increasing concentration of vermiwash treatment NR activity was markedly affected i.e. it was inhibited.

Leaf aging also affected the Nitrate Reductase activity, it was decreased due to leaf senescence. Our results are similar with the results of Joshi (1988) who reported that NR activity was higher in young leaves of mango, guava and custard apple than in senescent leaves of above plants.

B) Enzyme catalase:

Due to NaCl salinity catalase activity was affected. It was decreased with increasing NaCl salinity. In (2004) Manikanandan and Venkatesan reported that the catalase activity was increased upto optimum level due to salinity treatments and thereafter decreased in *Aegioceros cornicalatum.*

Catalase activity was increased at mature stage of leaf as compare to senescent leaf. It was decreased due to leaf aging. Patra *et.al.* (1978) noticed a decrease in catalase activity during senescence of several species. Our results are also on similar lines.

Pistelli *et.al.* of (1992) also reported that in *Beta vulgaris* leaves, catalase activity decreased during the leaf senescence.