SUMMARY AND CONCLUSIONS

The various soil conditions determines the types of vegetations in the world. Among various types of soils, problem soils is a most concerning group which includes acidic soils, saline soil and alkaline soils. In many regions of the world, the development of acid soils is a natural result of the weathering process. There are several records of the extent of acid soils in the world. According to Van Wembeke (1976), acid soils occupy 1,455 Mha (11%) of the world's land while Haug (1983) recorded 30-40% world's arable soils and upto 70% of potentially arable land are acidic. According to Von Uexkull and Mutert,(1995) the maximum acidic soil noticed in America. It records about 41% (1616 Mha) of acidic land and ranks first in world while Asia as second largest area records 26% (1044 Mha). Globally most of the forests and woodlands are having acid soils (66.3% or 2.261 Mha), In India Mandal, (1997) recorded the total geographical area of India is 329 Mha, out of which net cultivated area is nearly 145 Mha having about 100 Mha acidic soil. Even in Maharashtra, acidic soil was reported in various districts including Kolhapur, Ratnagiri, Thane, Bhandara and Chandrapur with pH 4.5-5.5 (1.7%) and 5.5-6.5 (16.7%).

The number of factors influencing soil acidification are nitrification, extensive uses of inorganic nitrogen fertilizers, poor drainage system, atmospheric deposition, microbial respiration etc. Among these amount of $H+$ ion activity in soil solution is a major cause of soil acidity. According to Ellis and Mellor (1995), Al ion play an important role in acidic soil by releasing $H+$ ions due to hydrolysis. According to Foy (1984), in acidic soil the major problem is aluminium toxicity. Thus aluminium toxicity is one of the major growth limiting factors that affects plants in most of the acidic soils which is detrimental to plants, limiting growth and productivity. According to Kochian *et al.,* (2004), about 60% of the tropic and subtropics acidic soils shows negative impact on staple food crops like rice and maize. However the responses of oil seed crops like groundnut under such condition is not clear.

Groundnut represents one of the major oil seed legumes which occupy a significant place in Indian National Economy. Hence it is worth while to study the effect of different concentrations (10,50 and 100 ppm) of Al on germination performance, seedling growth and some physiological changes during 24 to 120 hrs of groundnut seed germination. For present investigation two varieties of groundnut SB-11 and W-55 were selected. The seed samples were collected from Agricultural Research Station, Karad.

Some of the significant findings of the present investigation can be summarized as follows :-

Germination represent a dynamic period in the life cycle of the crop plants that makes the transition from a metabolically quiescent to an active and growing entity. The initial decrease in germination percentage in both cultivars was recovered as germination hours increased especially with lower doses of Al concentrations than higher concentration. This data indicate the ability of both groundnut cultivars to germinate and grow under toxic effects of Aluminum.

The aluminium treatment reduced root growth in both groundnut cultivars but stimulates shoot growth in cv. SB-11 than cv. W-55. the inhibition in root growth is more significant than shoot growth. Similarly the browning of root tips is noticed in both cultivars of groundnut.

Water is essential for rehydration of seeds as the initial step towards germination. The noticeable reduction in moisture percentage due to 50 ppm Al concentration at 120 hrs in both cultivars has no effect on germination performance. However increase in moisture percentage with all Al treatments after 48 hrs, stimulate seed germination in both cultivars, especially cv. SB-11 shows better performance to Al toxicity.

A qualitative test for determining Al tolerance with the use of hematoxylin staining method described by various workers. The distinct color was noticed with 10 and 100 ppm aluminium treatments than 50 ppm in cv. W-55. This shows the Al tolerant nature of cv. SB-11 than cv. W-55.

Groundnut is generally cultivated for it's oil. A very little effect of Al treatments was noticed on oil content in both cultivars of groundnut. The maximum reduction in oil content was recorded at 96 hrs of seed germination in both cultivars due to higher (100 ppm) Al treatments.

Carbohydrates are the most abundant class of biomolecules in plants. The increase in reducing sugars upto 72 hrs with all Al treatment noticed in cv. SB-11 which sharply decreases later on. The opposite trend was noticed in cv. W-55. Similarly the stimulation in non reducing sugars after 72 hrs of seed germination due to all Al treatments was reported in both groundnut cultivars. This increase in sugar provides respiratory fuel for germinating groundnut seeds. Starch is a major carbohydrate reserve biomolecule. The marginal reduction in starch content due to all

Al treatments in both groundnut cultivars was noticed. It is maximum at 72 hrs of groundnut seed germination.

In oily seeds, the role of enzyme lipase is a prerequisite for lipid metabolism. The stimulation of enzyme activity due to all Al treatments in both groundnut cultivar was evident between 48 to 72 hrs of seed germination by higher Al treatments (50 and 100 ppm).

The activity of antioxidant enzyme peroxidase protect plants from cellular damage from physiological stress developed due to Al treatments. The initial reduction in enzyme activity upto 48 hrs of seed germination was noticed in both cultivars of groundnut. But there after stimulation of enzyme peroxidase activity was recorded by all concentrations of Al treatments in cv. SB-11. However in cv. W-55, the only elevation of enzyme activity by 50 ppm Al treatment was noticed at 96 hrs.

Groundnut is important oil seed crop required high demand of both macro and micro elements for the growth and development. However the response of Al treatment is different for the uptake of these elements in cotyledons and embryo axis.

Nitrogen is the most required element of groundnut. The stimulation of 'N' uptake in cv. SB-11 and cv. W-55 was noticed with higher Al concentration (100 ppm). But significant decrease in 'N' content in cotyledons of cv. W-55 due to all Al treatment employed may be due to translocation of this element in embryo axis.

The Al treatment has no significant effect on 'P' uptake in cotyledon and embryo axis of both the studied groundnut cultivars. The slight decrease in 'P' content was noticed in cotyledons of both cultivars by 10 ppm Al treatment.

It is evident from our results that only higher Al treatment (100 ppm) enhanced 'K' uptake especially in cotyledons of both groundnut cultivars may be helpful for catalyzing many metabolic reactions for developing groundnut seeds.

Both the cultivars differ in 'Ca' uptake due to Al treatment was noticed. The reduction in 'Ca' uptake both in cotyledon and embryo axis was noticed in W-55 while opposite trend was noticed by SB-11.

The 'Mg' content was reduced due to higher Al treatment in cotyledon and embryo axis of cv. SB-11, while slight alteration in Mg uptake was noticed in W-55 may be because of inhibition of Al by inhibiting activities of enzymes which mediated uptake of nutrients and active transport.

In plant metabolism 'Fe' performs several functions which includes reduction of tikka and rust disease in groundnut. The enhancement of 'Fe' in the embryo axis of both cultivars due to 50 ppm Al may be an adaptive feature for groundnut metabolism.

The effect of various concentration of Al on 'Mn' uptake in both cultivars of groundnut was not significant. The marginal increase in both cotyledon and embryo axis with higher Al treatment may be helpful for catalyzing many metabolic processes at certain germination stage.

The decreasing uptake of zinc with increasing concentration of Al was noticed in embryo axis of cv. SB-11 and cotyledons of cv. W-55, that could be attributed to the reduction of cellular respiration in plants by Al causing an inhibition in uptake of this micronutrients.

Both cultivars of groundnut differ in their response of 'Mo' uptake with Al treatment. The increase in 'Mo' in cotyledons by higher Al treatment may be correlated with increasing nitrogen demand by elevating nitrogen fixation activity of growing groundnut seeds.