SUMMARY AND CONCLUSIONS

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Salt-affected soils exist in all the continents of the world. Based on the FAO/UNESCO soil map about 952 million hectares of land in the world is under varying degrees of deterioration due to excessive accumulation of salts in the soil profiles. There are about 2.5 million hectares of salt-affected soils in North India. Amongst different states, Uttar Pradesh has largest area (1.3 M ha) under salt-affected soils. Out of 1.3 M ha salt-affected soil 0.088 M ha is situated in Varanasi division. Besides Varanasi a number of adjoining districts of eastern U.P. namely Chandauly, Ghazipur, Jaunpur, Azamgarh, Mau, Ballia etc. have big stretches of such salt-affected soils. Unfortunately authentic informations regarding nature, properties, method of reclamation and utility of these salt-affected soils situated in eastern U.P. are almost unavailable, mainly because soil scientists have neglected this aspect of research in the concerned area. As a result big stretches of these problem soils are lying almost barren and serving as village grazing grounds. Preliminary studies have shown that amelioration of salt-affected soils of eastern U.P. is a costly affair, especially when it is done using chemical amendments like gypsum and pyrites. Atleast poor farmers of eastern U.P. are not able to afford additional investment for improvement of soil affected by salinity and alkalinity make them suitable for cultivation of traditional crops like paddy, wheat etc. Therefore, possibility of cultivation of non-traditional crops like aromatic crops on these salt affected soils may be explored.

Keeping these facts in mind the present research programme entitled, "**Biomass Yield of Selected Aromatic Plants on Soil Affected by Salinity and Alkalinity**" was planned to utilize salt affected waste land of eastern U.P. for cultivation of aromatic crops. The main objectives of the present research work were:

1. To categorize soils affected by salinity and alkalinity for cultivation of selected aromatic plants.
2. To find out suitable aromatic plants for soils affected by salinity and alkalinity of proposed area.
3. To find out optimum doses of N, P, K on growth and yield (biomass and oil) of the crops.
4. To test and fix safe and toxic limits of salinity and alkalinity to selected aromatic plants.
5. To see the changes in salinity status of soils polluted by salinity and alkalinity under study before and after the experiment.

Considering above objectives diagnosis of the salt-affected soils and irrigation water was done. Experiments were conducted at the farmers field of village Amuwari Narayanpur (site A) in Azamgarh district during 2003-2004 and 2004-2005 to study the effect of cultivation of aromatic crops alongwith pyrite, farmyard manure, sludge and their combinations on improvement of salt-affected soils.

The field had been under rice-fallow sequence for over five years. Out of field experiment four villages also selected for profile study i.e. Changaipur (site B), Harsinghpur (site C), Mahabatgarh (site D) and Gandhupur (site E).

Soil samples were taken from soil surface and different depths of the soil profiles. On the basis of ECe, pH and ESP/SAR soils under study have been found to be saline-sodic in nature. In all the soil samples sodium has been found to be dominant soluble cation followed by calcium, magnesium and potassium. Chloride has been found to be the dominant anion followed by bicarbonate, carbonate and sulphate. So far as exchangeable cations are concerned, exchangeable Na was the dominant cation followed by Ca and Mg in almost all the soil profiles. The gypsum requirement of the soils under study varied from 4.01 to 4.50 t ha^{-1}. These soils were found to be deficient in organic matter, available nitrogen, phosphorous and micronutrients such as Fe, Mn, Zn, Cu and Mo. Positive correlations were found to exist between pH, ECe, SAR and $CaCO_3$. Reverse correlation were found between salinity and alkalinity (pH, ECe, SAR) and organic carbon, N, P, K, Fe, Mn, Zn, Cu, and Mo.

Effect of organic and inorganic amendments on soil characteristics without transplantation of aromatic crops observed. The pH, ECe and SAR of soil treated by amendments after one month decreased whereas organic carbon, macro and micronutrients status of the soil increased.

Field experiments were conducted to study the effect of aromatic crops on improvement of salt-affected soils alongwith organic and inorganic amendments like farmyard manure, sludge and pyrite for five consecutive harvestings. It was found that the cultivation of aromatic crops with all the amendments and their combinations have beneficial effect on the improvement of salt-affected soils. The pH, ECe, ESP and SAR decreased and, organic carbon, available N, P, K Fe, Zn, Mn, Cu and Mo increased considerably by the application of all the amendments whether organic or inorganic. Maximum improvement in context of physico-chemical

parameters and fertility status of the soil was found in lemongrass with S_6 (FYM @ 3.5 t ha^{-1} + sludge @ 2.5 t ha^{-1} + pyrite @ 40 % GR ha^{-1}) indicating thereby superiority of the lemongrass over citronella jawa and palmarosa. In other words it can be said that all the treatments have favourable effect on the improvement of salt-affected soil but effect of S_6 is better than all the other subplot treatments treatments.

It is interesting to note that aromatic crops (lemon grass, citronella jawa and palmarosa) used as a main plot treatment without any amendments are able to decrease the soil salinity and alkalinity when compared to initial soil. Further, aromatic crops alone increased the fertility status of soil.

Effect of amendments sub plot treatment on the herbage and oil yield was determined. It was found that all the treatments increased the herbage yield and oil yield. Subplot treatments S_6 produced maximum herbage and oil yield in case of all the aromatic crops under study. Amongst main plot treatment (aromatic crops) palmarosa (M_3) recorded highest herbage yield followed by lemon grass (M_1) and citronella jawa (M_2). But in case of oil yield citronella jawa produced maximum oil yield. Content and uptake of N, P, K, Ca, Mg, Fe, Zn and Cu in plants were also determined. It was observed that application of different amendments considerably increased the content and uptake of N, P, K, Ca, Mg, Fe, Zn and Cu by aromatic crops. Maximum increase in the uptake of N, P, K, Ca, Mg, Fe, Zn and Cu was observed with S_6 followed by S_4, S_5, S_2, S_1, and S_3 indicating thereby superiority of S_6 over all the treatments. Thus the effect of pyrite alone or in combination with farmyard manure and digested sludge was found to be very useful in enhancing the status of N, P, K, Ca, Mg, Fe, Zn and Cu of soil and aromatic crops. Based on the findings of the present investigation the following results may be exploited at field scale:

- To cultivate aromatic crops especially lemongrass for improvement of saline-sodic soil as this grass performed better than citronella jawa and palmarosa in improving the salt-affected soils.
- Farmyard manure (FYM) may be used in combination of sludge and pyrite for the improvement of the salt-affected soil. Farmyard manure @ 3.5 tones per hectare alongwith 2.5 tones per hectares sludge and pyrite @ 40 % GR may be profitably used for reclamation of the salt-affected soils of eastern U.P.

Accordingly the farmers of the locality may be advised to grow aromatic crops with or without amendments for reclamation of their salt-affected soils as proved by present study. The central and state governments are advised to promote and given incentives for the cultivation of aromatic crops on farmer's salt-affected waste lands.