In the anticipation of mounting population at even a decreasing rate in coming century, a shrinkage of acreage of normal grown crops due to nutrient sucking cropping pattern and shrinking cultivable land poses tough challenges to the farming community. The world’s arable land resources are finite and there is not much scope for significantly expending the area of land under cultivation. Hence, most of the increase in agricultural production will have to be obtained through increased productivity from the existing agricultural land. The extent of reduction in growth and decrement in productivity, however, depend upon many factors such as kind and content of salt constituents, soil texture, distribution of salts in soil profile, the species of crop plant grown, level of soil-water-crop management and climatic conditions.

Soils in which concentration of salts is very high adversely affect plant growth and crop management. The area of such type of land (sodic soil) is increasing due to continuous use of poor quality of irrigation water, faulty method of irrigation and impeded drainage. These lands either hardly produce any crop or produce a very poor crop. The continuous use of rich RSC (Residual sodium carbonate) water for irrigation develops the higher concentration of exchangeable sodium ion on the exchange complex of the soil rendering it unsuitable for cultivation (Kanwar and Kanwar 1971).
It is estimated that approximately 10 million hectares land of India is degraded due to salts in varying degrees of magnitude. The worst affected districts of U.P. are those located in lower valley of the Ganga-Yamuna and Ganga-Gomti Doaba with extension right up to Jaunpur and Azamgarh Districts. Big stretches of these problem soils are lying absolutely barren. Ballia district is a part of Azamgarh Division situated in eastern most corner of Uttar Pradesh, where farmers are streaming their nerves to fetch the stress situation. This region is homogenous for low productivity and high degree of poverty. About 17661 hectares of presently demarcated barren land and 1248 hectares of banger land (Suitable for the cultivation of salt tolerant crops) lying desolate in the district (Singh et al 2005), which can be exploited properly after reclamation.

With the point of view of profitable trend in comparison to traditional agriculture, introduction of some new plant type having sodicity tolerances and high benefit cost ratio (B/C) may attract the farmers to continue farming. It has been reported that salt tolerant aromatic crops e.g. lemon grass, palmarosa etc. are able to improve the fertility status of soil. Therefore, cultivation of high value aromatic plants may be a very good alternative for such problems for increasing the return to the growers as well as foreign exchange to country. In this way farmers of the district may also increase their income through the cultivation of aromatic plants if they are convinced and assured that aromatic crops can be successfully grown on these salt affected soils.

Lemon grass commonly known as “East Indian Lemongrass” is a perennial and multicut aromatic grass. The prefix ‘lemon’ owes to it’s typical lemon like odour, which is mainly due to the presence of citral, a cyclic monoterpane. Lemon grass is the source of lemon grass oil, a good source of natural citral, which is used as a basic raw material for synthesis of ®-ionone used for synthesis of a number of
useful aromatic compounds and Vitamin-A. Lemongrass oil is thus used as a main substitute for ‘Cod liver oil’. Citral itself is used in perfumery for various grades of soaps detergents, cosmetics and flavour agent for soft drinks. Consumption of lemon grass in Ayurvedic preparation like Balm is also increasing. In aromatherapy it is used as tissue toner. The present domestic requirement is about 150 MT/year and about 70 MT is exported every year. Import/export trends show India to be the largest producer of lemon grass with about 80% of its export. The total world production is estimated to be 1300 MT/year, while the total world demand for the oil is 2500 MT.

The crop provides maximum herb yield from second and third year after planting and thereafter declines. The leaves yield essential oil on steam distillation containing 70-90% Cymbopogon (lemon grass, citronella grass or fever grass) is a genus of about 55 species are indigenous in tropical and semi-tropical areas of Asia and are cultivated in South and Central America, Africa and other tropical countries. The essential oil of Cymbopogon citrates contains Citral α (40%), citral β (32%), nerol (4.18%), geranicol (3.04%), citronellal (2.10%), terpinolene (1.23%), geranyl acetate (0.83%) etc. and all important raw material used in the pharmaceutical, perfumery and cosmetics industries, especially for the synthesis of Vitamin A and ionones. The grass is considered a diuretic, tonic, antiseptic and stimulant. It promotes good digestion, and preparation of lemon grass with pepper is used for relief of menstrual troubles and nausea. It induces perspiration, cools the body and reduces the fever.

It is used to treat diarrhoea, stomach-ache, headaches, fevers, and flu. It is helpful in treating muscular pain, poor circulation, and muscle tone and slack tissue. The antiseptic oil treats athlete’s foot and acne. A tea prepared from lemon grass is used as a sedative for the central nervous system. The residue thrown out
after the extraction of oil is called spent grass. (residue obtained after extracting the oil). Cattle relish it when it is hot or is converted into silage by adding a dilute solution of molasses. It contains 7.4% crude protein, 0.17% Ca and 0.09% P. It is also used for the manufacture of cardboard and paper. Besides a good source of manure and the spent is used as fuel for distillation after drying and also cheap packing material for fragile objects. The oil is also used in other preparations such as bactericidal, as insect repellents and in medicines.

An one-acre farm can produce 14.32 kg of oil per harvest. Lemon grass can be harvested up to 4 times per year making it a total of **57.28 kg** of oil per year. Current market price for lemon grass oil is US$66 per kg. Simultaneously, the one-acre farm can produce **13,088 kg of hydrosol** (floral water) per year. Current market price for hydrosol is US$3.80 per kg. Current prices for bulk lemon grass oil is US$28 per kg. Growth in the health and wellness industry has significantly increased the demand as essential.

Thus, the lemon grass industry in India is having a vast and expanding business potential in view of the wide internal usage of oil and spent grass and the increased export possibilities of oil and ionone. It is thus essential that a combined bid be made by all those who are connected with this industry to boost up the production of lemon grass oil in the country by extending its cultivation in other states on scientific lines, so that the whole internal demand can be met. Then India will be able to compete Guatemala in the international market also.

This plant produces flowers at matured stages of growth (Jaganath et al., 2000). Conversely, flowering has never been observed under cultivation due to rapid harvesting time. The rhizome produces new suckers that extend vertically as tillers to form dense clumps. Lemon grass can tolerate a wide range of soils and
climatic conditions. However, vigorous growth is obtained on well-drained sandy loam soil with high fertility and exposed to sunlight (Sugumaran et al., 2005).

The productions of lemongrass have not been extensively studied especially in Uttar Pradesh. There is also lack of information on best harvesting stage for lemongrass. Since the yield of essential oil and citral content are of importance, it is necessary for farmers to identify the proper harvesting time for lemon-grass so as to obtain high quality essential oil, and lower production cost. Essential oil content is a crucial criterion in determining the quality of lemongrass oil. There are 65 chemical compounds detected in the essential oil of lemongrass. However, only 13 of the compounds have been reported to be present in each maturity stage.

Organic matter is a key component in the build up or maintenance of a high quality soil. Many soil properties such as microbial activity, CEC and aggregation are directly affected by the presence of organic matter. Indirectly, soil organic matter influence the nutrient and water use efficiency, root growth and stress tolerance, and quality of water and air that interact with the soil. The production and emission of greenhouse gases are largely controlled by how soil organic matter is managed.

The integrated use of organic materials and inorganic nitrogenous fertilizers has received considerable attention in the past with a hope of meeting the farmer's economic need as well as maintaining favourable ecological conditions on long-term basis. Current trends in agriculture are centered on reducing the use of inorganic fertilizers by organic manure and the application of biofertilizers such as vermicompost (the products of the degradation of organic matter through interactions between earthworms and microorganisms.) and phosphatic biofertilizers (Gyaneshwar et al., 2002; Darzi et al., 2011). A strategy for
integrated nutrient supply is evolved by using a judicious combination of chemical fertilizers, organic manures and biofertilizers.

The application of organic materials to different cropping systems and their ability to incorporate nitrogen as well as organic matter, may offer opportunities to increase and sustain productivity of cropping system. The integrated nutrient management helps to restore and sustain fertility and crop productivity. It may also help to check the emerging deficiency of nutrients other than N, P and K. Further, it brings economy and efficiency in fertilizers. The integrated nutrient management favourably affects the physical, chemical and biological status of soils.

No doubt lemongrass is the best suited choice of crop to be cultivated in the waste land of the district with a view to utilize human power to catch attention of poverty. In this way the avenue of employment generation will be opened. The waste land will be reclaimed simultaneously for sustainable farming. Popularization of oil extraction at village level will be a boon for farmers to earn extra money. Thus by undertaking the proposed study the uncultivable agricultural land and barren land in the district would be brought back into cultivation of non edible aromatic crops on the place of traditional edible crops should be tried. This practice will not hamper the income of farmers on the one hand and health of consumers on the other hand. An integrated nutrient management and supply system will be an, important feature for the maintenance of soil fertility and proper utilization of uncultivated land for sustainable development of agriculture as well as industrial fate to improve the quality of lemongrass oil. Such type of high economic value aromatic crop will certainly improve soil health of waste land towards suitability for other crops.
Keeping these facts in view the present research work entitled “To Study the Effect of Inorganic and Organic Sources of Nutrients on Yield and Quality of Lemon Grass (Cymbopogon flexuosus L.)” was undertaken following the main objectives as.

1. To study the release pattern of nutrients under the effect of Integrated nutrient management practices.

2. To study the growth and yield attributes of lemon grass.

3. Correlation between the integrated nutrient management treatments suitable for quality based oil.

4. To assess the cost effective treatment for viable growth and quality of the effect of integrated nutrient management practices.

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