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Oil seeds stand next to food and fibre class of commodities, playing an important role in the economy of the country. These are in great demand as food for human-beings, as feed for cattle and raw material for many vegetable ghee-producing industries.

Since independence, we have concentrated efforts only to raise the total production of food grains and have not visualized quality in meeting the requirement of the two most important constituents necessary for good health, i.e. protein and fat. The lack of these two important constituents is responsible for malnutrition and poor health among the people of the country. Vegetable oil is the only supplementary source of fat, after animal or milk fat. The average per capita consumption of fats and oils in India during the past 30 years has remained as low as about 26 grams against a required minimum of 60-70 grams per day (F.A.O., 1967).

The vegetarian food habits of masses in the country gives added importance to vegetable oils. Further, the change in the living standards pattern of economic development, population increase and expanding industrialization have made it inevitable to concentrate on the production of oil seeds like other agricultural commodities.

India is one of the largest oil seeds producing country in the World. Total area occupied by these crop is about 10 percent of total cropped area of the country and it goes to the tune of 15 million hectares. Nevertheless, there has been an increasing shortage of edible oils and as a result of which the country has to resort to
expensive imports at the expense of previous foreign exchange to meet the demand.

To cover up the average annual deficit about 3 million tonnes of oil seeds in the country, it is essential to launch crash campaign of oil seed improvement and production. The apparent solution at sight is to introduce high yielding oil seed varieties with improved agronomic practices which could bring about a real break through in oil seed production. Besides, it will be worthwhile to explore the possibilities of acclimatizing the new oil seed crop from other countries.

Sunflower is such an oil seed crop which contains high percentage of oil. Sunflower, a native of America, had been growing in India for the last many years as an ornamental plant. It is only in the recent years when we started its cultivation as a subsidiary oil seed crop. Contrastingly sunflower had been an important oil seed crop from the turn of this century in U.S.S.R., Canada, Argentina, Rumania, Hungary, Bulgaria, Yugoslavia and several other countries. It appears that this crop may have tremendous scope in our country as reflected by results of field experiments giving 39.69 q/ha seed yield with good management. It is also note-worthy that sunflower can also be grown in different agro-climatic conditions, even in the salt-affected soils and also as a choice crop for low rainfall areas.

The oil content of sunflower varies from 40 - 45 per cent and it can safely be kept under the category of oil seed crop. It contains very high percentage of linoleic acid (52 - 62%), Oleic acid (32-47%), and vitamin A, D and E, the most important
constituents for human health. Due to high linoleic acid content it has got anti-cholesterol properties and as a result of which it is a boon to the heart patients. It is also very useful in reducing the incidence of artheraselerasis, a deadly circulatory disease in man.

The utilization of sunflower is not only limited to the production of oil, but other industrial products are also manufactured from it. The seeds contain 40 - 44 per cent high quality protein. Its' seed-meal and seed-cake may be successfully utilized to supplement poultry and live-stock feed. The stalk of sunflower, which contains high content of carbohydrates, can be preserved as good quality silage. Its' hulls are used as a raw material for furfural production. Sunflower oil is largely utilized for industrial purposes like Vanaspati, soap manufacturing and for dry oil production.

The crop has special attraction for the farmers due to its return oriented nature. This includes lower cost of production, short duration, low moisture-requirement and its photosensitivity. Therefore, it will be easy and beneficial to initiate and encourage the cultivation of sunflower crop in our country.

Amongst the multiplicity factors responsible to fetch out high yields of sunflower, the fertility of soil is of paramount significance. Sunflower crop removes large amount of nutrients from the soil in a relatively brief growth span. A liberal supply of available nutrients is essential for getting higher yield and better quality of sunflower. It is, therefore, essential to carry out research on soil-fertilizer complex for
finding out the nutritional requirement of this crop.

The importance of nitrogen in plant kingdom is well established as it is one of the chief ingredients of proteins, chlorophyll, enzymes and various hormones. Its deficiency retards plant growth and root development, turns foliage yellowish which eventually results in poor yields. Sunflower is an exhausting crop and responds very well to nitrogen fertilization. Balanced and rational use of nitrogen will not only increase sunflower yield but it is also likely to have a positive bearing on quality of oil. Not much work has been done so far on this aspect in India and it will, therefore, be of immense use to work-out the optimum dose of nitrogen required by this crop. For obtaining higher yields, high oil percentage and good oil quality the optimum requirement needs to be worked out under a particular set of soil and climatic conditions.

Sulphur is another structural element which plays an important role in raising the crops. However, the knowledge concerning the sulphur behaviour in soil plant relationship is so scanty that it has been very aptly called the unseeing servant of fertilizer industry and the forgotten step-child of agronomists and plant nutritionists. Tisdale (1966) stated that sulphur studies were the subject of our much attention. This might be due to the initial presence of this element in the soil or a considerable amount placed into the soil either by rains and atmosphere particularly in industrialized area or through traditional application of fertilizers like superphosphate and ammonium sulphate. Conditions are, however, now changed and sulphur deficiency has become a problem for following reasons (i) Changes
in the pattern of fuel consumption which are restricting the atmospheric supplies. (ii) High analysis fertilizers, containing little or no sulphur are being applied in the soil, (iii) Intensive cultivation and heavy removal of sulphur by the crops depleting soil reserves, (iv) High doses of N, P, and K applications demand the greater amount of sulphur for balanced nutrition.

Sulphur influences plant growth in two ways, firstly by acting as a nutrient and secondly by improving the soil conditions. The essentiality of this element in plants is shown by the fact that sulphur is a constituent of many amino-acids, eg. cystine, methionine, glutathione etc, which are the building unit of proteins. It is also a chief constituent of thiamin and biotin, plant harmones, which have a greater role in plant growth regulators. Sulphur is very closely associated with the nitrogen metabolism in plants which is disturbed in its absence, resulting in the cessation of the development of plant chlorophyll and root nodules with little or no yield. It is also required by plants for synthesizing the essential oils. Thus visualising the important role of sulphur in this oil seed crop, it is of no less importance to plan further investigation for its optimum dose to be worked out.

Among the micro-nutrients essential for normal plant growth, boron is one of the most indispensable trace element as it is involved in the metabolism of protein, synthesis of pectin, maintaining the correct water relationship in the plants, and in the translocation of sugars. It has also beneficial effect on flowering and fruiting processes. The deficiency of boron may cause stunted or distorted growth, discolouration and abnormalities in fruits, failure in reproduction, death of growing tips.
followed by the death of plants partly or even completely. The net result is a reduction in the yield and quality of the crop.

Sunflower may be used as an indicator plant for boron as it is highly sensitive for the deficiency and excess of this element. A very little work has been done so far in this direction on sunflower crop in our country. It will be therefore, worthwhile to undertake studies on boron nutrition in relation to the cultivation of sunflower crop.

The increase in crop yield due to application of fertilizers is known but very meagre information is available regarding the change in plant composition. It is, therefore, important to study the composition of foliage at various stages of crop growth. A knowledge of nutrient concentration in various parts at successive stages of plant development is thus indispensable for a better understanding of nutritional problems of the plants. The concentrations found within the plants reflect what the plant has obtained from the soil in relation of its growth up to that particular stage. The concentration in the plant of a particular nutrient is often increased by applying the nutrient fertilizers. One nutrient may increase or decrease the concentration of the other nutrients. There also exists a correlation between the nutrient content of the plant and its yield and quality. The concentration, at which highest yield is obtained and further increase in concentration has no or little response on yield, may be discarded to same fertilizer by establishing the threshold value of a nutrient.

The availability and removal of nutrients from soil vary with the varieties of crops. Therefore, to grow a particular
variety in any locality, the best way to supply these nutrients in adequate amount and in suitable proportions is to find out its nutritional requirements. The Ramson-record variety, which is comparatively a new one, shows a great promise in the north plains of the country. An impetus in the yielding ability of this variety may further be expected if optimum quantity of different nutrients is worked out and recommended to the cultivators.

The cation exchange phenomenon is next to the photosynthesis in the domain of agriculture. The property of cation exchange of root systems had been first as reported by Deveaux in 1916. The cation exchange capacity of roots has a direct bearing on crop yields. The roots with the higher cation exchange capacity take more nutrients than the roots with the lower capacity. Dhawan and Mahajan (1968) reported that the plant roots of higher yielding varieties gave higher values of cation exchange capacity and consequently could withstand higher doses of fertilizer application. Therefore, it is very essential to study the effect of varying doses of fertilizers on the values of the cation exchange capacity of sunflower crop at different stages of its growth and to find-out inter-relationships between this property and crop yield.

Low seed setting and thus cavity formation is a bottleneck in obtaining higher yields of sunflower in northern India, which results in lowering the crop yield. It may be possibly to overcome this problem by proper fertilizer management practices. In this connection it is expected that the varying doses of nitrogen, sulphur, and boron will help ascertaining the correct proportion of these nutrients which directly affect the yield
potential of the crop.

In view of the above discussion, the present investigation "Nutritional studies in Sunflower" was undertaken with the following objectives.

(1) To study the effect of nitrogen, sulphur and boron fertilization on filling of seed, filling of head, total yield and quality of oil and protein.

(2) To ascertain the threshold value of the above nutrients.

(3) To study the correlation between the nutritional status and C.E.C. of roots.

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