



CORPUS PUBLISHERS

Archives of Agriculture Research and Technology (AART)

Volume 2 Issue 2, 2021

Article Information

Received date : June 21, 2021

Published date: July 21, 2021

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Keywords

Inorganic; Fertilizer; Growth; Nitrogen; Micro-nutrients; Yield; Crop production

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Review Article

Impact of Inorganic Fertilizers on Growth, Development, and Yield of Sunflower

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Abstract

Sunflower (*Helianthus annuus*) is an annual herb with a rough, hairy stem, 1-4.5 meters high, thick and coarse, rough leaves, arranged in spirals, about 7.5-30 cm long. The attractive flowers in wild specimens are about 7.5-15 cm across and in cultivated plants sometimes about 30 cm or more. It is grown to consume oil from the seed. This species of sunflower is used in some industry applications as wild bird feed, as animal feed (as a meal or as a silage plant), and as an ornamental garden. The plant was first domesticated in the USA. The sunflower name is derived from the shape of the sun-like moral head. During the 16th century the American sunflower seeds were brought into Europe, which along with the sunflower oil became a popular cooking ingredient in the world, after 3000 B.C., many sunflower applications, including ornamental plants, drugs, food, fodder, textile dyes, body paints, decorations, etc. have been produced. The species of sunflower are allelopathic in nature and this plant looks forward to a bright future. But farmers have to manage soil fertility levels to cultivate sunflower with an integrated approach which blends organic and inorganic methods in order to grow sunflower crops successfully. Fixing inorganic approaches to nutrient imbalances does not only contribute to sustainable high crop yields, but also eliminates the need for wasteful marginal lands. Fertilizers are organic or inorganic chemicals which help plants grow and increase soil fertility. Organic (manure) fertilizers have a low percentage of nutrient material. Inorganic or mineral fertilizer nutrients constitute inorganic salts, which are extracted through physical or chemical processes. N, P, K are the three most important plant nutrients. Inorganic fertilizer components such as N, P, and K are essential nutrients for plant development and productivity. A well-balanced fertilization of each was crucial in providing the nutrients needed for maximum sunflower growth. Nitrogen and potassium levels influenced plant height, biological yield, seed yield, and seed oil content. Application of nitrogen and phosphorus also aided growth and output. The amount of NPK fertilizer employed influenced plant growth, sunflower grain production and maximum grain yield.

Introduction

Sunflower (*Helianthus annuus L.*) which originated in South Africa, is among the world's quickest-growing and a most vital vegetable crop. In the United States and Mexico, it is the fourth most popular behind groundnut, soybean, and rapeseed. Sunflower (*Helianthus annuus L.*) is a mild plant that grows well in a variety of climates and soils. It is grown on 15.12 million hectares around the world, an annual output of 22.03 million tons and productivity of 1216 kg per hectare, respectively [1]. Sunflower is one of India's most important oilseed crops with productivity of 753 kg ha⁻¹ in total. Sunflower acreage is concentrated in the northern districts of Bijapur, Gulbarga, Raichur, and Dharwad, accounting for nearly 85 percent of total State acreage. In India, sunflower cultivation is gradually growing, particularly during the rabi and summer season. Karnataka is the country's leading producer of sunflowers. It covers more than half of the entire crop area and produces 43% of the overall crop production. The overall output Andhra Pradesh is the state with the highest production of sunflowers. Andhra Pradesh accounts for roughly one fourth of the total area and 34% of total output. Maharashtra ranks third in both sunflower area and production. Sunflower has a great promise as an oil seed crop because its broad adaptability, high yield potential, shorter duration and profitability make it also popular among farmers.

Because of its flexibility and high yield, sunflower has a lot of potential as an oil seed crop. Around 50% of the edible oil produced by this crop is consumed, 20 % being non-edible and remaining is used for industrial purposes [2]. Consider the potential, the shorter time and profitable. Adaptability to various agro-climatic areas and soil types in the wild. Therefore, this crop is crucial in the preparation of contingency crops. Sunflower oil has the potential to help the country overcome its food oil shortage [3]. Due to many reasons, our country is facing severe shortage of edible oil. Due to demographic pressures, higher quality of life and increasing demand from oil consuming companies, there is a significant demand for edible oil imports. (Figure 1).

Objectives

- To check the effect of inorganic fertilizers on the growth, development, and sunflower yield.
- To determine the optimum dose of inorganic fertilizers for sunflower

What are inorganic fertilizers?

In order to improve crop production, farmers use fertilizers and chemical substances that raise crop output daily. The fertilizers provide the necessary nutrients for nitrogen, potassium and phosphorus needed by plants [4]. Inorganic fertilizer is made of minerals or manufactured products, also known as synthetic fertilizers. For example. synthetic nitrogen fertilizers are

generally manufactured from oil or gas (Figure 2).



Figure 1: Sunflower (*Helianthus annuus L.*)

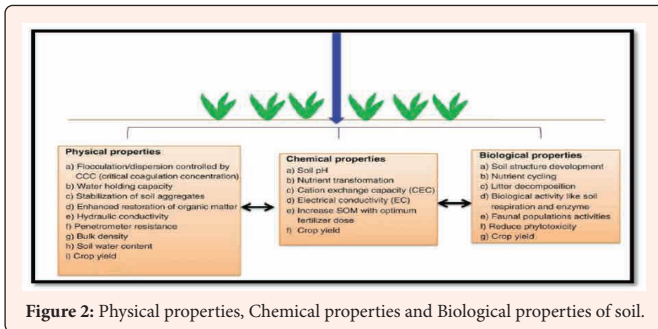


Figure 2: Physical properties, Chemical properties and Biological properties of soil.

Due to soil erosion, nutrition depletion, and toxic buildup, soil fertility in India is steadily decreasing. Alternative sources for meeting crop nutrient requirements include organic manure and biofertilizers. Among the most effective fertilizers for crops are Azotobacter, Azospirillum, Phosphonate, and Rhizobacteria [5]. Bio fertilizers are living microorganisms that symbiotically and symbiotically provide nutrients to plants. Reclaimed soil plant nutrients (especially nitrogen, phosphorus, and potassium) are essential for crop production. To help achieve optimum crop yields, they must be applied in the right amounts and at the right times. Incorrect application of plant nutrients, on the other hand, can cause a slew of agricultural and environmental problems. Furthermore, nutrient availability and plant uptake are extremely difficult in fresh reclaimed soil [6]. Nutrients must be supplied in sufficient and balanced amounts for optimal plant growth. Although soils contain natural reserves of plant nutrients, most of these reserves are unavailable to plants, and only a small part of these reserves is available to plants.

A portion of it is released each year due to biological or chemical processes. This rate of release is insufficient to compensate for nutrient losses due to agricultural production while also meeting crop needs. As a result, fertilizers are developed to replace the nutrients already in the soil.

When it comes to fertilizers management, follow the four rules

Use the appropriate fertilizer in the appropriate quantity at the appropriate time and in the appropriate location. Soil control is the first of the four RS. Soil tests evaluate the present soil nutrient condition and the sufficiency of soil nutrients in cultivation. The correct sum is zero if the soil has enough nutrients. If the results of the laboratory indicate that additional fertilizers are possible, a rate recommendation will be made. It is a fair person. Agriculture as well as the growing process and current environmental conditions determine the best time and location, The soil contains most of the nutrients required by plants. Plant growth will decrease with the scarcity of all these nutrients.

In ecosystem, nutrients from soil to plant are recycled to fulfil plant requirements. On the other hand, in farming crops more nutrients than natural vegetation is needed.

Crops often lose a considerable amount of nutrients when harvested. For optimal crop growth and profitability, It may be necessary to handle inorganic fertilizer, animal manure, green manures and legumes. The article focuses about inorganic fertilizers which are widely used for plant growth. Unbalanced nutrient use is one of the leading causes of low sunflower yield. The most important factor in growing and sustaining crop productivity is only by providing them important macro and micronutrients in proper quantity. Nitrogen and boron are the most frequent nutrition in plants. The world's most pressing problem, which is causing sunflower production to decline. Different amounts of fertilizer have substantially influenced all growth and return components, including plant height, stem diameter, head diameter, achene and biological output. Both the oil and the protein. The use of different quantities of NPK fertilizers had a significant effect on sunflower material.

Conventions, conversions and terms and conditions

Fertilizer is marked N-P-K as the oxides of the elemental phosphorus (P) and potassium types (N), phosphate (P₂O₅), respectively NPK. Nutrients can be represented in any way in some situations.

Phosphorus
 $P \times 2.3 = P_2O_5$
 $P_2O_5 \times 0.44 = P$

Potassium
 $K \times 1.2 = K_2O$
 $K_2O \times 0.83 = K$

Role of Inorganic Fertilizers in Sunflower

In addition to C, H and O. Mineral nutrients must be cultivated in the plants. Minerals are dissolved, Minerals consumed from their roots in soil whaler by plants. For the growth of plants, there are 13 known components.

Nutrients are classified into two categories.

Macro-nutrients

Macro nutrients are divided into two categories: main nutrients and supplementary nutrients. Main nutrients are first to find limited yield as crops, typically in kilograms per hectare, are used in large quantities. It has Nitrogen, Phosphorus and Potassium.

Supplementary nutrients contain Calcium, Magnesium and Sulphur, because they are generally present in sufficient quantities in the soil, extra fertilizer is not necessarily required.

Micronutrients

Trace elements present in lower quantities are iron, copper, manganese, zinc, boron, molybdenum and chlorine, typically in grammars per hectare as compared to a macronutrient.

Sunflower nutrition

Precise sampling and testing of soil are important to assess nutrient availability and the fertilizer application during the entire crop rotation (Figures 3 & 4).



Figure 3: Fertilizers.



Figure 4: Sunflower nutrition and timing of fertilizer applications.

Knowing how much phosphorus and potassium in soil are available will enable you to apply the appropriate balance for a crop or avoid fertilizer application, reduction of costs and environmental protection, if nutrient concentrations are high. Sunflower seeds are susceptible to fertilizers so that the amount of planting is limited by the crop.

Application of Fertilizer

Nitrogen

Sunflowers is plant with a deep root system hence nutrient can be accessed at a depth inside the soil profile. Excessive plant growth, increased disease, postponed maturity, and a lowering of content of seed oil and values, containing oleic acid and decreased protein, can lead to higher levels of nitrogen. Crop yields will be reduced by little quantities of N. Experiments has shown that N will affect the final number of seed shortly before the flora begins, while further applications from flowering to anthesis will affect the weight of individual seeds. The optimum dose of nitrogen is 16 kg/ha. The nitrogen doses always should be applied in split doses, 6 kg should be applied in top dress after 30 days after sowing and rest nitrogen fertilizer should apply with irrigation. In this way soil pH will be maintained up to 6.5 to 8 (Figure 5).



Figure 5: Nitrogen (N) deficiency may result in retarded growth and leaves with a pale green color.

Where practical, new sunflower fields should be sampled at least 4 feet to find out whether deeper N should be considered in the recommendation for N fertility. Approximately 30 pounds N of 2 to 4 acre should be considered but N recommendation should not be subtracted. The soil Nitrate test for 2 to 4 feet is more than 30 pounds N per acre, then the additional N of the total N Recommendation should be removed [7]. If deeper sampling of the soil is not possible, the non-limiting region of N should be a complete range based on the N calculator or the N guideline tables, and the remaining field should be approximately half of the N calculator.

Phosphorus and Potassium

Phosphorus and potassium migrate slowly through the soil in fertilizers and use these nutrients to produce it, rather than on a single crop. Depending on the conservation of the rotational requirements of the soil. If the soil is no longer sufficient for P or K, it is improbable that the root will receive new application to cultivate in time. To keep the ground in the proper manner, it is important to substitute any nutrient needed for harvested plants from the field. The soils should be tested every 3 or 5 years to find if amount of P and K are constant. The use of 40-60kg of P_2O_5 therefore usually replaces soil absorption and maintains soil levels in sunflowers at low phosphorus levels. The optimum dose of phosphorous for sunflower is 24 Kg/ha as a basal dose because it is immobile in nature and there is very less chance of erosion or loss of phosphorous fertilizer. Potassium-rich sunflowers return much of the time to the soil, but the soil is held at 40 kg to 60 Kg K_2O . According to the researcher's optimum dose of potassium is 12 kg/ha. Potash is also worked as an enzyme and able to increase resistance against disease attack on the plants.

Role of Molybdenum in Sunflower

Molybdenum (Mo) is especially important element for sunflower plants. Mostly Mo will be found in that soil which are having more Ph or alkaline in nature. It is deficient in acidic soil due to low Ph. Mo is a traceable element in plants growth and moderately very essential catalyst for two important enzymes like Nitrogenase and Nitrate reductase which is helping to fixing nitrogen and nitrogen reductase. Foliar application of Mo is much required for sunflower crop, the required dose is approximately 50gm/acre. It is minor element so required in very less amount for crops like Sunflower and Legumes. But in soil it will vary from (0.1% to 17.0 mg/kg [8]). Mostly the availability of Mo in soil for plants is depends upon soil Ph. In Acidic soil there is less availability of Mo and in Alkaline soil it is present in more amount. Mo always helps for plant by increasing biomass production due to its more mobile nature with the plants.

Conclusion

Inorganic fertilizers play an essential role in sunflower development, yield and oil content, as sunflower fertilization, even slow release, may produce high yields and is suggested to sunflower farmers as a good exercise. For plant growth and yield, Components like N, P and K and Mo are crucial to inorganic fertilizers. The amount of N P K and Mo fertilizer applied had an impact on plant development, and the highest grain yield and proper and accurate N P K and Mo application generated maximum seed yield of sunflower. Inorganic fertilizers influence the growth and production of sunflowers.

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