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IMPACTS OF NPK FERTILIZER ON STRAWBERRY PLANT

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ABSTRACT

Strawberry (Fragaria x ananassa), a perennial herbaceous plant, renowned for its delectable taste and rich nutritional profile, holds a prominent position in global fruit markets. As an emerging subtropical and temperate crop, understanding its macronutrient requirements, particularly nitrogen (N), phosphorus (P), and potassium (K), is vital for optimizing growth and yield. However, excessive fertilizer use, particularly inorganic fertilizers, poses environmental and economic challenges, necessitating sustainable nutrient management practices. This study investigates the influence of N, P, and K on strawberry growth and productivity, aiming to determine optimal nutrient levels for maximizing yield while minimizing environmental impact and production costs.

INTRODUCTION

Strawberry (Fragaria x ananassa) is a perennial herbaceous plant belongs to Rosaceae family which is thought to be originated in France and North America. It is one of the world's most delicious and refreshing fruits which has achieved a leading role in the world fruit market as fresh and processed fruit. It has long been considered to have significant health advantages, owing to its high content of useful phytochemicals and essential nutrients, which seem tohave relevant biological activity in human health. It is an emerging, subtropical and temperate fruit crop of the world. The need for photosynthesis and rapid growth of strawberry plants is reported to require a high acquisition of macronutrients. Knowledge of crop requirement is important in developing profitable crop with better quality. In plant growth and development, N, P, and K are essential macronutrients. Playing a particular role in various physiological and morphological aspects as essential molecules associated with various fundamental metabolic processes. Nitrogen (N) is known as the nutritional most limiting nutrient to plant growth and development and its availability determines crop yield and quality. Phosphorus is an important nutrient and plays an important role in reproduction, vigor and general health of all plants. It is often referred as an energy source because during the photosynthesis it helps to store and transfer energy in plants. Potassium increases crop yield and improves quality. It is required for numerous plant growth processes such as enzyme activation and stomatal activity. Fertilizers are essential factors in determining the yield, quality and nutritional content of horticultural crops. For most of horticultural crops, researchers have helped to

elucidate optimal NPK applications and other micronutrients. These studies have tended to concentrate mostly on crop yield. Since efficient use of fertilizers plays a major role in crop production and yield. Furthermore high fertility levels not only put a heavy financial burden to the basic system of production, but also heavy use of chemical fertilizers as a source of nutrients show less fertilizer use efficiency. Only limited amount of food elements can be absorbed from chemical fertilizers by the plants. The acidic and alkaline elements of the remaining chemical fertilizers react with soil which disturbs pH and makes the land infertile. Many of these fertilizers are acidic or basic in nature, hence long-term use of these fertilizers disturbs the pH of the soil which reduces the beneficial soil organisms thus degrades ecosystem and accelerate the process of soil erosion, and limit the availability of nutrients. Furthermore, K and P are costly nutrients and being used in huge quantity.

INFLUENCE OF NITROGEN ON STRAWBERRY

Studies with strawberry have shown the diversity of responses to changing N rates and time of application. In Mexico, N fertilization is often in excess of 597 kg/ha during the strawberry production cycle, which is two and a half times as much as the local recommendation. Strawberry fruit weight and number increased with N rates up to 53 lb/acre, but no further yield increase was observed with higher N rates. A similar response was described in Canada by, where there were no effects on ‘Tribute’ strawberry yields and fruit size with the application of either 50 or 100 kg/ha of N. Other studies have shown little impact of preplant N rates on strawberry early and total yields. Other crop responses can also be affected by N fertilization rates. For instance, showed that a N rate of 225 kg/ha improved fruit firmness during 21 d of storage, compared to lower N rates, such as 150 kg/ha. Higher N rates increased fruit acidity and reduced sugar content.

INFLUENCE OF PHOSPHORUS ON STRAWBERRY

Phosphorus increase root growth, grain, fiber and forage yield, enhances early plant maturity and stalk strength, and promotes resistance to root rot disease and winter kill . Phosphorus plays an important role in functions of enzymes required for the vital processes and growth. Phosphorus, an important nutrient for propagation, vigour and general health of all plants, is often referred to as the ‘energizer’ because it helps store and transfer energy within plants during photosynthesis process. Considering the above mentioned facts the present study has been planned and designed to determine the optimum level of phosphorus for maximizing the growth and yield of strawberry.

INFLUENCE OF POTASSIUM ON STRAWBERRY

Potassium is an essential mineral element for strawberries, which require large amounts. It has essential functions within the plant in the production and transfer of proteins and sugars, in regulating

water movement within the plant, and in improving plant tolerance to diseases and pests. However, potassium affects significantly growth, production and quality parameters of strawberry plant. During the strawberry fruiting period, potassium requirements increase to meet fruit needs, which contains a large proportion of potassium. Potassium is thus considered a determinant of strawberry quality parameters such as sugar content, vitamin C content and fruit acidity. These parameters tend to increase with the potassium fertilization dose. Indeed, a higher potassium concentration in the nutrient solution improved strawberry fruit quality. In addition, potassium plays an essential role in the transfer of assimilates to fruit. Reduced assimilate transport limits strawberry productivity and quality and is often a consequence of potassium deficiency.

EFFECT OF INORGANIC FERTILIZER ON QUALITY OF STRAWBERRY

Among the various factors like N, P, K which contributes toward the growth, yield and quality of strawberry, nutrition is the most important and it has direct bearing on crop production (Umar et al.,2008). Integrated nutrient management includes the use of inorganic and organic sources of nutrients to ensure balanced nutrient proportions by enhancing nutrient response efficiency and maximizing crop productivity of desired quality. It also helps to minimize the exiting gap between nutrient removal through continuous use of chemical fertilizers and supply through slow release of fertilizers. It is widely reported that the extensive use of chemical fertilizers adversely affects soil health and results in decreased crop productivity and quality. They become recently, positive alternatives to chemical fertilizers because they help bring down the costs of chemical fertilizers especially N and P and improve soil fertility by maintaining the physical properties of the soil.

Inorganic nitrogen sources are commonly used to manage depletion in soil fertility and sustainable crop production, but their cost and additional constraints discourage small growers from using them. The availability of nitrogen from inorganic sources during early crop growth is higher than the plant demand and leads to potential nitrogen losses. In addition, excessive use of inorganic fertilizer (IF) on fruits which are all eaten with peel could be harmful to human health.

CONCLUSION

Strawberry cultivation demands careful management of nitrogen, phosphorus, and potassium to optimize growth, yield, and fruit quality. Excessive fertilizer application, particularly of inorganic sources, not only incurs high production costs but also poses environmental risks, including soil degradation and nutrient runoff. Therefore, adopting balanced nutrient management practices is imperative to ensure sustainable crop production while minimizing ecological harm and maintaining

human health. By elucidating optimal nutrient levels and application strategies, this study contributes to promoting environmentally friendly and economically viable strawberry cultivation practices.

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