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INFLUENCE OF INORGANIC FERTILIZER (POTASH AND PHOSPHORUS) APPLICATION ON YIELD AND YIELD CONTRIBUTING FACTORS OF OKRA IN PAKISTAN

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Abstract

Okra (Abelmoschus esculentus) is the most regular and rage vegetable. The production of okra in the field is highly dependent on the application of the inorganic fertilizer. Still, inorganic fertilizer overuse can cause the acidification of soil and disturbance of soil structure that can influence plant growth. The purpose of this study was to find out the effective combination rate of inorganic fertilizer toward okra growth and yield performance. This study was conducted in field and it was revealed that application of fertilizers like potash and phosphorus in combination with nitrogen had enhanced the yield and strengthens the yield contributing factor. The combination of inorganic fertilizer NPK was proven to be the most effective in okra production. The increase in shoot biomass, improvement of root development, fruit length, fruit diameter, plant height, and yield increase were observed by the application of potash and phosphorus. The maximum yield was observed at the application of nitrogen, potash and phosphorus. The study will help to identify the economic worth of fertilizer on the yield and yield contributing characteristics of okra.

Key words: *Fertilizer influence, Fertilizer and yield, Growth parameter, Growth and yield, Inorganic fertilizer, Okra yield*

INTRODUCTION

Fertilizers performs a key role among the cultural crop production practices. Over application of inorganic chemical fertilizers without adequate knowledge leads to the degradation of soil structure especially increased soil acidity. Furthermore, availability of high concentrated rapidly available nutrient content in inorganic fertilizers and which released for the plant uptake instantly, comparatively cost is high and cause nutrient imbalance and soil acidity (1).

Fertilizer application has a key role among the crop production. The soil structure degradation may happen without proper knowledge of application of inorganic fertilizer. The inappropriate application of the fertilizer can increase soil acidity or alkalinity. The rapid availability of nutrient content in inorganic fertilizer with instant uptake is comparatively costly and cause nutrient imbalance (1).

Okra *(abelmoshus esculantus* L.) is a grown for its pod in tropical and sub-tropical countries of the world. The immature pod of the crop is used as vegetable. As the production of the okra is less as compared to the demand of the crop. Different fertilizer is used to increase the yield of okra crop. These fertilizers are used for rapid growth of plants and better development of the plants.

Okra's nutritional constituents include calcium, protein, oil, and carbohydrates, along with iron, magnesium, and phosphorus. The World Health Organization (WHO) emphasizes its dietary value due to its ability to help combat diseases in humans. Lady finger has been bringing into being the wealthy supply of thiamine, vitamins A and C, calcium and riboflavin. It is also main source of iron and has importance as a medicine in the curing of peptic ulcer (2).

Growth and yield of okra can be increased by use of inorganic fertilizer as it valued in production of okra. The three main constituent of plant nourishment: nitrogen, phosphorus and potassium (N.P.K) for a array of crops and emergent situation are formulated in suitable application and combination in the inorganic fertilizers. Such component of plant nutrients are combined which promote the leaves development, forms proteins and chlorophyll.

Phosphorus is main source for development of roots, reproductive parts and fruits. Potassium (K) has a major role for the development of root, stem and synthesis of protein in various parts of the plants (2, 3).

Okra as vegetables has an importance for vital protecting foods for the safeguarding of fitness and avoidance of ailment. It bears valued food ingredients, which has importance to be productively utilized in constructing and repairing the body (4).

The majority of the year, India has access to okra, also known as okra or ladies finger, and output can be tailored to meet demand (5). Around the world, okra is a widely consumed vegetable in tropical and subtropical areas. The largest okra producer in the world is India (6).

MATERIALS AND METHODS

The study was conceded out to assess the production of okra for different fertilizer level. The experiment was conducted at vegetable research sub-station Bahawalpur, Pakistan. The region has warm climate and in Kharif season of sowing remain warm due to low rainfall. The material used for the experiment included the seed of okra, hoe, spade, different fertilizer doses, potash, nitrogen and phosphorus used in Pakistan. The fertilizer was spreader manually with irrigation. The ridges were made with the help of tractor mounted rigger.

EXPERIMENTAL DESIGN

The okra seed were planted according to the randomized complete design with spacing 15 cm*15cm and two seeds were put in each hole and later were thinned to one per hole. The thinning was completed after germination. The row to row distance was 75 cm. Randomized complete block design with five treatments was replicated thrice.

TREATMENT

The four treatments were applied with control of no potash and phosphorus fertilizer.

T1> 1 bag urea/acre

T2>1 bag urea + 1 bag SOP/acre

T3>1 bag urea+1 bag SOP+1 Bag DAP/acre

T4>1 bag urea + 1 bag SOP+2 Bag of urea/acre

The organic percentage and PH was similar for experimental plots.

DATA COLLECTION

The growth parameters like the plant height, root length and fruit length were measured with the help of ruler. Chlorophyll content was measured with the help of SPAD-502 meter. Fruit length was measured with the help of vernier caliper. Fresh shoot weight and yield was calculated with the help of electric balance.

TRIAL MANAGEMENT

The trial was managed by hoeing of crop for weed control and irrigation was applied equally for all treatments. All types of four treatments were applied on per acre calculation of fertilizer rate. The potash and phosphorus rates of fertilizers were applied at the sowing of crop and nitrogen fertilizer was at fix rate.

MEASUREMENT OF CHLOROPHYLL CONTENT

The calculation of chlorophyll content was made by SPAD-502 meter which was hand handled device. The device is widely used due to rapid, accurate and non destructive measurement of leaf. It measured the content by means of absorbance or transmittance measurements. The chlorophyll content was measured by clamping over leafy tissues simply and index chlorophyll content reading was recorded.

INSECT AND PEST MANAGEMENT

The trial was observed regularly for different insects like, heliothis, eggfruit caterpillar, fruit fly, aphid and silvery whitefly. The observation were also taken for different diseases like bacterial spot, bacterial wilt, mosaic, sclerotium base rot, sudden wilt, powdery mildew and sclerotinia rot. The appropriate chemical was used for controlling the symptomatic disease and pest.

STATISTICAL ANALYSIS

The recorded data was used for the statistical analysis using Analysis of variance (ANOVA). In order to determine the significant difference for the treatment and blocks the one way ANOVA in software version 8.1 was used.

RESULTS AND DISCUSSION

The experiment was subjected to the analysis of variance statistics. The analysis revealed the following results.

THE EFFECT OF DIFFERENT FERTILIZER ON CHLOROPHYLL CONTENTS

The results in the Fig. 1(a) showed that the chlorophyll contents did not vary significantly with respect to the application of fertilizer. It showed that different doses of the fertilizer at okra plants did not affect the chlorophyll content significantly.

FRESH SHOOT WEIGHT AND FERTILIZER APPLICATION (GM)

The mature shoot weight was calculated. Data recorded regarding fresh shoot weight as showed in Fig. 1 (b) was significantly different for application of potash and phosphorous application. The minimum value of fresh shoot weight was showed by the control application of fertilizer as shown in Fig. 2. In the first treatment no application of potash and phosphorous was applied. In other treatments (T2, T3 and T4) with application of potash and phosphorus showed increase in shoot weight.

The application of Potash and phosphorus increased the fresh shoot weight. The increase of stem diameter was effect of the more plant growth and more synthesis rate that correlated with the chlorophyll content. The hundred percent NPK applications has produced the maximum diameter of the stem which showed the better utilization of the NPK by the plants. The results are in accordance with the findings of Sharma *et al.,* (2010) in pointed gourd and Sadat (2000) in okra (11, 10).

FRUIT LENGTH (CM)

The mature fruit length was recorded for each replication. As the graph given below showed that the application of fertilizer affects the fruit length. In control condition the minimum fruit length was observed. The application of the SOP and DAP increased the fruit length. In combination of both fertilize maximum fruit length was observed. The further increase of phosphorus application did not increase the fruit length further as depicted in T4 as shown in Fig. 1 (c).

Shelke *et al.,* (2019) reported the maximum fruit length in combination of different fertilizer (12). The application of fertilizer significantly improved the fruit length of okra compared to the control conditions. These results are consistent with the findings of Shelke *et al.,* (2019).

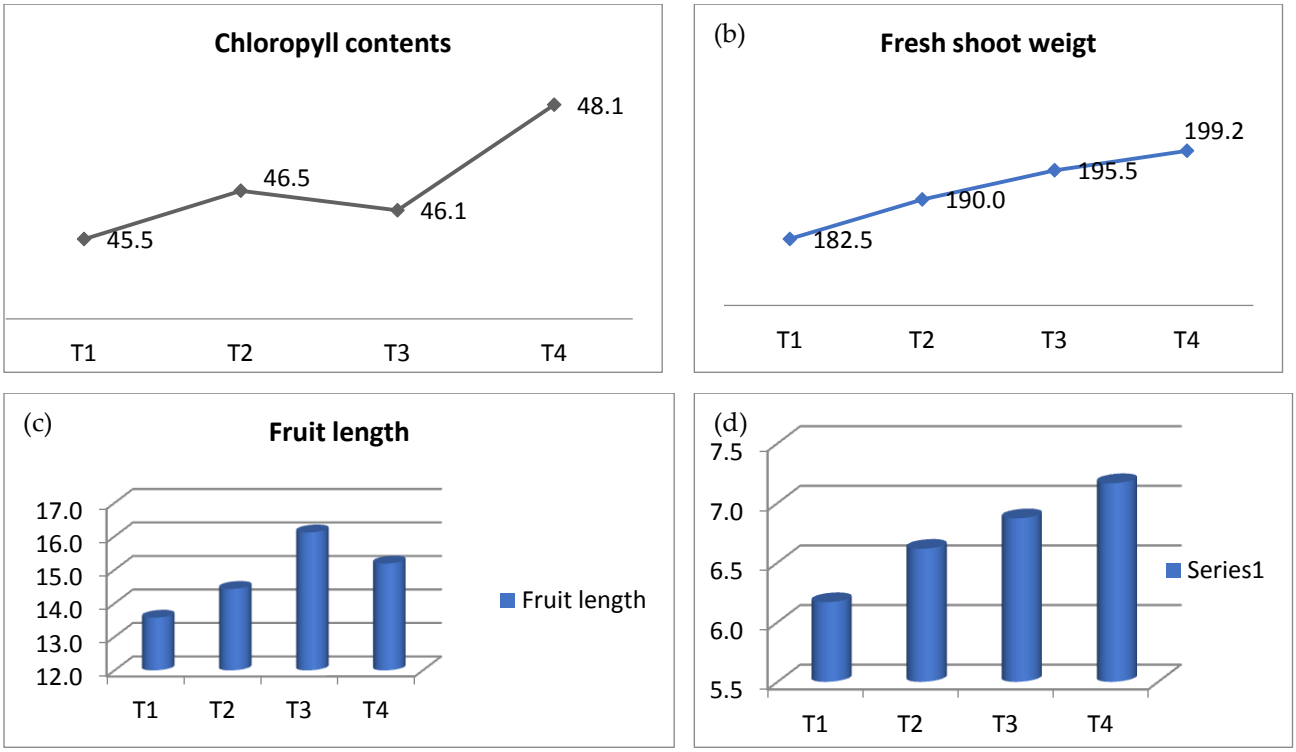

Fig. 1 (a). Chlorophyll content of okra plants verses different fertilizer. **(b). F**resh shoot weight of okra plants verses different fertilizer. **(c).** Fruit length of okra plants verses different fertilizer. **(d).** Fruit diameter of okra plants verses different fertilizer

FRUIT DIAMETER (CM)

The diameter of the mature fruit was recorded. The application of fertilizer increased the fruit diameter as shown in graph below. The application of the potash and phosphorus increased the diameter of okra fruit. As the dose of phosphorus was increased it also increased the fruit diameter. The application of the nitrogen, potash and phosphorus had a direct effect on fruit diameter which may contribute to the high yield as shown in Fig. 1 (d).

PLANT HEIGHT (CM)

Plant height of plant was measured with the help of meter rod at emergence of last pod at terminal point of plant. The recorded data revealed that minimum height was shown at control .The application of nitrogen, potash and phosphorus increased the plant height as shown in graph below. The highest plant height was observed in T4 and gradually decreased in T3, T2 and T1 as shown in Fig. 2 (a) given below. The recent study was also supported as higher dose of N might have enhanced cell division and formation of more tissues resulting in luxuriant vegetative growth and thereby increased plant height Sultana (2002) and Saxena & Rao (2018) found highest plant height with the application of fertilizer (8, 9).

ROOT LENGTH (CM)

Root length of mature plant was measured by uprooting the plant. The data recorded in this experiment showed that root development was positively affected by the application of fertilizer. The poor root length was observed in T1 and as the application of fertilizer was increased it improved the root length. The highest root length was observed in T4 as shown in Fig. 2 (b).

Sapkota *et al.,* (2021) found the similar results that for getting better root length of okra crop and good production of okra the amalgamation of organic and inorganic fertilizer in alternative combination is very important (13). It was also found in that study, the combination of NPK with chicken manure in different combination was one of the factors which contribute the better growth and higher root length. The more production of polysaccharides by the microorganism in soil produced from the chicken manure has improved the soil structure and it was useful source for the better growth of the roots.

YIELD OF OKRA (GM)

Per plant yield of okra plant was recorded for this experiment. The yield was recorded for mature pods developed in seventy days from sowing. The study revealed that application of NPK has direct effect on yield. The data recorded depicted that that T1 produced the low yield as compared to other T2, T3 and T4 as shown in Fig. 2 (c). The yield increased with higher level of potash and phosphorus. The yield and yield contributing factor were directly affected by the application of the fertilizer higher doses. Phosphorus deficiency results in poor root development, poor pod setting and subsequently reduces yield was an agreement with the present study (5).

The results indicate that both N and P application had remarkable influence on pod yield per plant. Naik and Singh *et al.,* (1999) observed highest yield of okra with N + P at the highest rates and their study supported the present results (6).

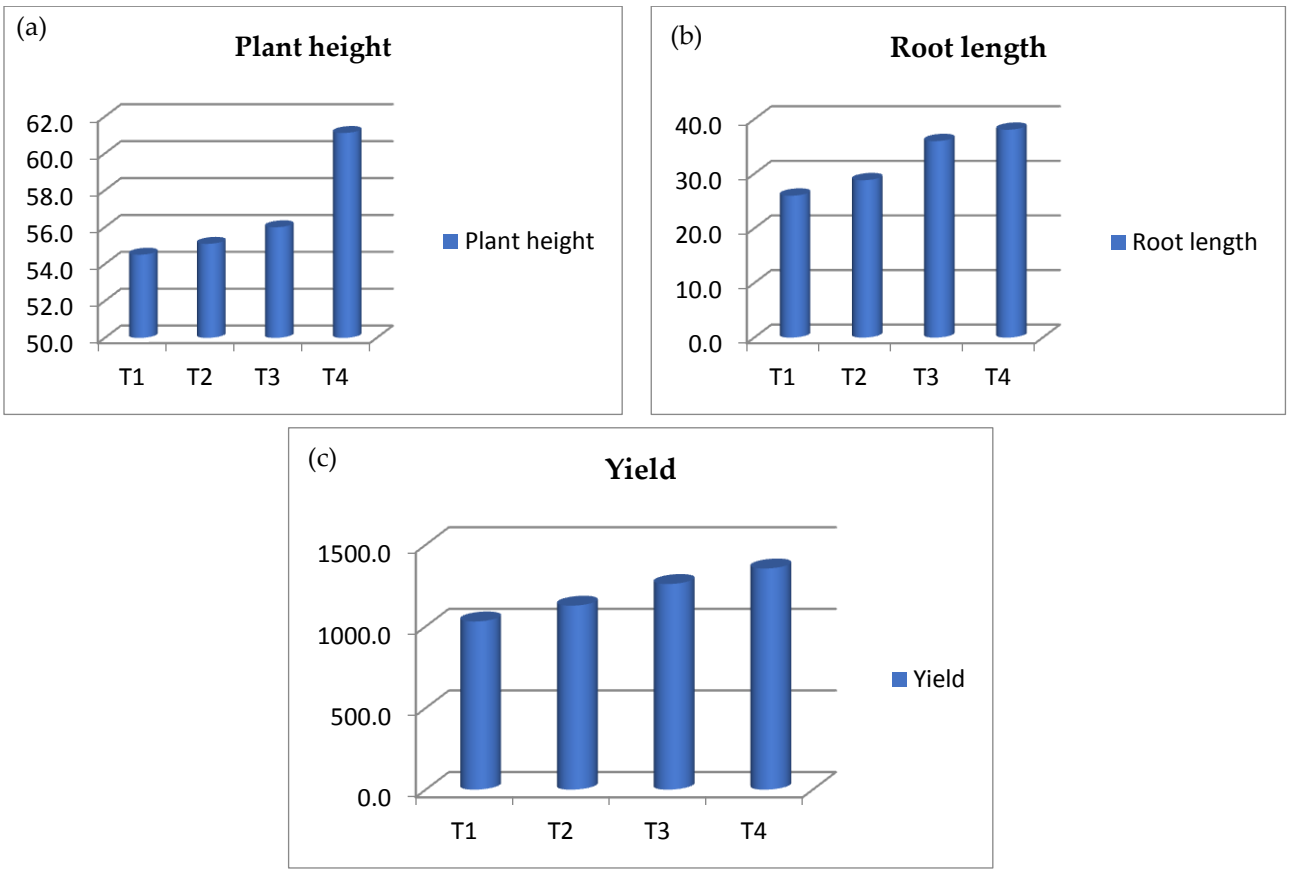

Fig. 2 (a). Plant height of okra plants verses different fertilizer. **(b).** Root length of okra plants verses different fertilizer. **(c).** Yield of okra plants verses different fertilizer

CONCLUSION

The study revealed that application of inorganic fertilizer has capacity to increase the yield of okra directly. It also strengthens the factor affecting the yield of the okra.

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