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EVALUATION OF NPK FERTILIZERS ON THE DAYS TO SPROUTING AND GROWTH OF PHALSA (*GREWIA ASIATICA* L.)

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خلاصہ

نائٹروجن، فاسفورس اور پوٹاشیم شامل میکرو غذائی اجزاء میں شامل کیے جاتے ہیں اور پھل کی تمام اقسام کی فصل کے لئے انتہائی اہم عنصر مانے جاتے ہیں۔ توازن کھاد کا استعمال اچھی فصل کی نشو نما اور معیاری پھل کے لئے بہت اہم ہے موجودہ تحقیق میں NPK کی مختلف شرح کی چھان بین کی گئی ہے خاص طور پر انکرت کے دنوں میں اور مجموعی طور پر فالسہ کی فصل جو کہ ڈسٹرکٹ لسبیلہ کی آب وہوا میں 2016-17 تک تحقیق کا حصہ بنی۔ مندرجہ ذیل پیرامیٹر کے مطابق T1-Control ، T2= 200g NPK Plant، $^{-1}$ T3=400g NPK Plant^{-1} اور T4-600g NPK Plant^{-1} چار تجرباتی ڈیزائن بنائے گئے۔ جسکے مطابق T4 ڈیزائن انکرت دنوں میں 54.1% اور فصل کی پیداوار 30.5% رہی، جبکہ بہار میں 36.5% اور بہار کے بعد خاص طور پر پھل کے دنوں میں 13.2% کم ہوئی T1 ڈیزائن کے مطابق بھی، تاہم T1 اور T3 غیر اہم رہے ایک دوسرے کیے جبکہ انکرت دنوں میں T1 کے موازنے کے مطابق مزید زیادہ دکھنے میں شامل کیے گئے۔ موجودہ تحقیق سے یہ نتیجہ افذ کیا گیا ہے کہ معیاری کھاد کا درست استعمال پودے کی نشو نما کے لئے نہایت اہم ہے۔

Abstract

Soil and plant macro nutrients including nitrogen, phosphorus and potassium considered key nutrients for all kinds of the fruit crops, and proper fertilizer management is key factor for better crop growth and fruit yield. Current field experiment was laid out,to investigate the influence of various rates of NPK fertilizer on the sprouting days and overall growth of phalsa (*Grewia asiatica* L.).c.v Mera" under Lasbela climate conditions at Wayaro experimental farm Uthal during year 2016-2017. The field study was conducted in randomized complete block design (RCBD) included four treatments such as T1 (without fertilizer or 0 NPK), T2 (200 g plant^{-1}), T3 (300 g plant^{-1}) and T4 (400 g plant^{-1}) with four replications. The results were indicated that T4 was increased days taken to sprouting (54.1%) and fruit yield plant^{-1}(30.5%), while, days taken to flowering (36.5%) and days taken to fruit setting after flowering (13.2%) were decreased over the T1 (control) treatment. However, T2 and T3 were non-significant with each other but enhanced days taken to sprouting and fruit yield plant^{-1} as compared to T1. Conclusion of present study are that plant nutrition and balance fertilizer application according to plant needs and proper stage is most important factor for plant better growth and fruit yield under field experiments.

Keywords: Pruning, Phalsa, Fertilizers, Growth, Yield.

Introduction

Phalsa (*Grewia asiatica* L.) is horticultural small fruit and cultivated in the sub-tropical regions of the world. It is originated from India and also cultivated in southern parts of Pakistan and India, and consumed as ripe fruit and for drinking purpose during summer seasons in tropical areas (Salunkhe and Desai, 1984). It has lot of medicinal and nutritional benefits for health (Morton, 1987), specially, in respiratory and cardiac disorders, and fever relief as well as blood ailments. Pakistan is an agriculture-based country and Balochistan zone is contributing an imperative function in its economy by giving essential stuff for human and animal nutrition in the form of fruits, vegetables, cereals and fodders etc. In Pakistan fruit industry has made significant progress during the last four decades. Lot of essential elements which are beneficial for human health comes from phalsa, however, it depends on the proper nutrition for plant growth or balance fertilizers application to phalsa trees from seedling to maturity of the plants (Ali *et al.*, 2001).

Soil and plant macro nutrients included N, P and K considered the macro or primary nutrients for all kinds of the fruit crops and other crops. Plant's uptake N into two major forms such as ammonium (NH_4^+) and nitrate (NO_3^-) under normal condition (Barker and Bryson, 2007). However, NO_3^- -N taken by plants in higher than

NH_4^+ -N, and NO_3^- -N easily mobile for crops, while, it could be declined to NH_4^+ for synthesis of proteins and other organic compounds. It is major or primary nutrient for better crop growth, and is highly displayed to volatile, leached, and denitrification losses (Chrysargyris *et al.,* 2016). P plays an important role in plant metabolic reactions and improved root network system (Bharali *et al.,* 2017), and crops commonly uptake P from soil solution, and P deficiency in crops caused adverse impacts on growth and development (Arshad *et al.,* 2016). It has considered the limiting nutrient for proper root and vegetative growth of crops (Arruda *et al.,* 2017). Among macro nutrients K considered a major element for better crop growth and fruit quality for modern agriculture.

However, excess application of chemical fertilizers could be negative impacts on fruit quality and soil properties. Agricultural and fruit crops yield is depended on the proper application of chemical fertilizers (Sial *et al.,* 2019), continuously high dose application of chemical fertilizer declined the crop and soil quality, especially N fertilizer (Neff *et al.,* 2002). Arid and semiarid areas it is challenge, to achieve targeted food requirement for coming generations would be stressed on the soil and water resources (Sial *et al.,* 2019).

To our knowledge, there are limited research evidences evaluated the influences of different rates of chemical fertilizers (NPK) on sprouting and growth of Phalsa under Baluchistan environment. The major aims of current study are, (1) to evaluate influence of different doses of NPK fertilizers on sprouting of phalsa and (2) to compare the impacts of various rates NPK fertilizer on phalsa growth and economic.

Material and Methods

Description of the experimental site and studied soil

The field experiment was conducted at wayaro, Uthal (26°3'27 N 66°30'12 E with an altitude of 53 meters, located at Baluchistan, during 2016-17 at wayaro experimental farms. Normally, most of the rainfall is received in summer. The annual mean maximum and the minimum temperature remains around 17^0C and 3^0C in January and above 38^0C and 24^0C in June respectively. The soil was sandy loam in texture and the basic properties of the soil are presented in Table 1.

Experimental setup

The field trial was included four treatments with four replications and used randomized complete block design (RCBD). Field experiment was contained four treatments T1 (control, without an amendment), T2 (200 grams of NPK), T3 (400 grams of NPK), and T4 (600 grams of NPK) per plant, and fertilizers were applied after flowering and pruning stages. All the agronomical practices were done according to recommended practices. The total area of the experiment was one acre and plants were three years old.

Soil sampling and analysis

Surface soil samples (0-20 cm) were collected from the field experiment before conducting the experiment and samples were collected. Twelve surface soil samples were collected from one acre and made composite soil sample and shifted to the laboratory, and air-dried, ground and passed through a 2 mm sieved for basic physico-chemical properties of soil. The soil electrical conductivity (EC) and pH were determined with soil and water extract (1:2.5 (w/v)), soil texture using hydrometer (Bouyoucos, 1962), soil organic matter percentage (SOM), available P and K were determined with standardized protocol (Murphy and Riley, 1962; Kundsen *et al.,* 1982).

Statistical analysis

All data were analyzed with the analysis of variance (ANOVA) with using SPSS 22 software, and figures were generated using Origin Pro. 9.0 software. Means of comparison test was performed with Least Significant Differences (LSD), and at $p>0.05$. Pearson Correlation test was analyzed using SPSS 22.

Results and Discussion

Effects of chemical fertilizers doses on days taken to sprouting of phalsa

Different doses of chemical fertilizers (NPK) were significantly ($p>0.05$) effects on days taken to sprouting of phalsa (Figure 1). The days taken to sprouting of phalsa were increased with increase rate of NPK fertilizers, and higher sprouting was recorded in the T4 (25.7) and minimum in the T1 (11.8) treatments. The maximum percentage was increased in the T4 (54.1%) followed by T3 (34.7%) and T2 (25.3%), respectively. Ahmad *et al.,* (2019) documented that sprouting of phalsa was increased with increasing fertilizer rate of P and maximum observed at 150 g plant^{-1} (13.89). In present study, we recorded maximum sprouting of phalsa (25.7) at 600 grams of NPK, this could be due the maximum rate of chemical fertilizers (Ahmad *et al.,* 2019). Khan *et al.,* (2017) evaluated that proper fertilizer management improved growth parameters of tomato fruit crops. Nijjar and Rehalia (1977) established that N fertilizer enhanced essential for different metabolic reactions and positive effects of vegetative growth (Sial *et al.,* 2019). Similarly, Wali *et al.,* (2005) evaluated that N and K application

enhanced yield and fruit quality of phalsa. The proper nutrients management in the phalsa orchards has positive impacts on plant growth, sprouting and fruit yield and quality and improved economic values for growers (Yadav *et al.*, 2017). Fruit quality and plant health related tobalance fertilizer and timing of fertilizers application to fruit trees of orchards (Ahmad *et al.*, 2019).

Table 1. The basic properties of experimental area.

Items	Value	Unit
Soil textural class	Sandy loam	
Electrical conductivity (EC)	1.32	dS m^{-1}
pH	8.2	
Soil organic matter (SOM)	0.6	%
Available phosphorus (AP)	3.5	(mg kg^{-1})
Available potassium (AK)	7.2	(mg kg^{-1})

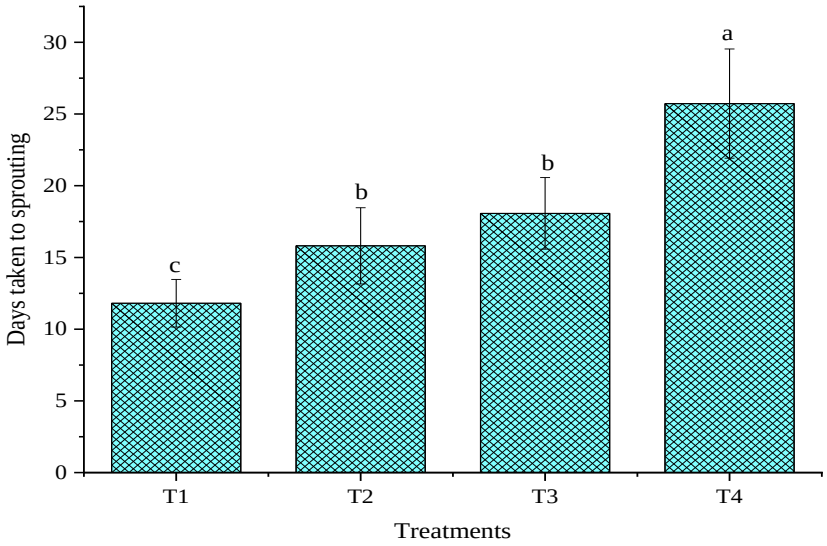

Fig.1. Effects of different fertilizer rates on days taken to sprouting, and control (T1), 200 grams of NPK (T2), 400 grams of NPK (T3) and 600 grams of NPK (T4). Data indicated the mean of four replications, and error bars are standard deviations, and different letters indicated there were significant differences ($p<0.05$).

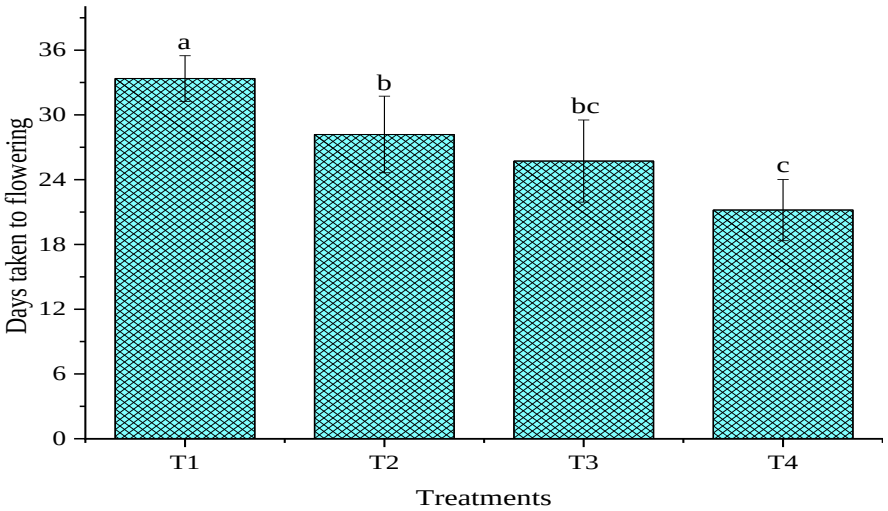

Fig.2. Effects of different fertilizer rates on days taken to flowering of phalsa, and control (T1), 200 grams of NPK (T2), 400 grams of NPK (T3) and 600 grams of NPK (T4). Data indicated the mean of four replications, and error bars are standard deviations, and different letters indicated there were significant differences ($p<0.05$).

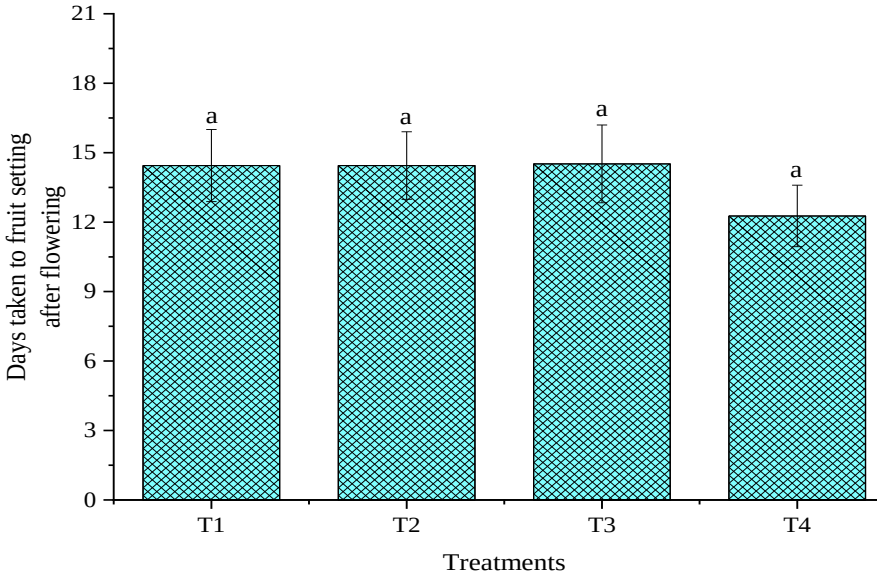

Fig.3. Effects of different fertilizer rates on days taken to fruit setting after flowering of phalsa. Control (T1), 200 grams of NPK (T2), 400 grams of NPK (T3) and 600 grams of NPK (T4). Data indicated the mean of four replications, and error bars are standard deviations, and different letters indicated there were significant differences ($p<0.05$).

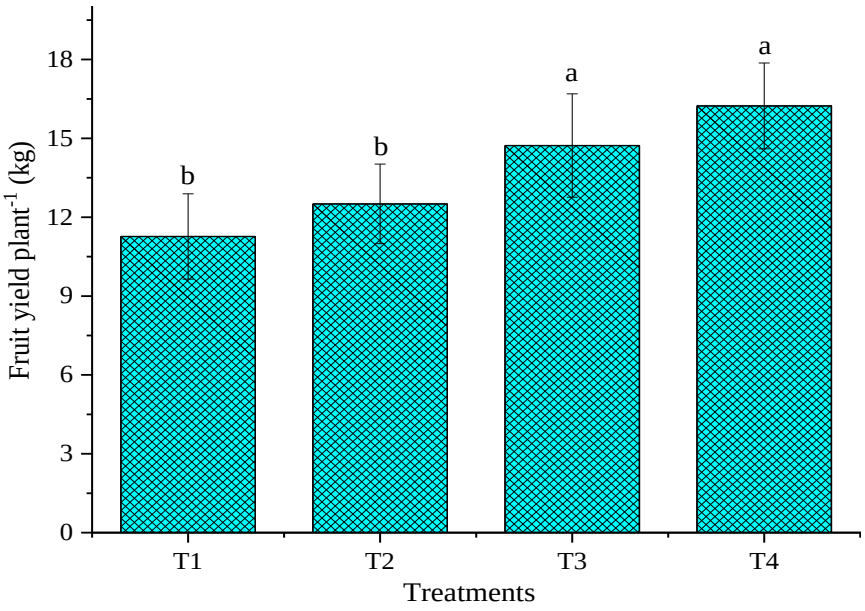

Fig.4. Effects of different fertilizer rates on fruit yield of phalsa, and control (T1), 200 grams of NPK (T2), 400 grams of NPK (T3) and 600 grams of NPK (T4). Data indicated the mean of four replications, and error bars are standard deviations, and different letters indicated there were significant differences ($p<0.05$).

Effects of chemical fertilizers rates on days taken to flowering of phalsa

Data indicates that days taken to flowering of phalsa was improved after various rates of NPK chemical fertilizers (Figure 2). The days taken to flowering were decreased with an increased rate of NPK, maximum days taken were recorded in the T1 (33), in order to < T2 (28), < T3 (26) and T4 (21), respectively. The maximum percentages of the decrease in the days taken to flowering in the T4 (36.5%) followed by T3 (22.9%) and T2 (15.3%) as compared to the T1 (control). Yadav *et al.*, (2017) and Ahmad *et al.*, (2019) evaluated that fertilizer application accelerated the metabolic reactions of plants and enhanced plant vegetative and reproductive growth as well as improved fruit quality. Saravanan *et al.*, (2013) established that NPK fertilizers increased plant ability, help in the cell divisions and improved the photosynthesis in the phalsa. Similar picture was observed in the current study, that increasing rate of NPK fertilizer enhanced phalsa growth and decreased

days taken to flowering. Our findings are agreed with previous study conducted by (Jitendra *et al.,* 2017) documented that increased fertilizer levels decreased the days taken to flowering and fruits were before harvested as compared to control treatment. The orchard fruit shrub plants need proper fertilizer management for better crop canopy, maximum number of flowers and fruiting and quality of fruits (Ali *et al.,* 2001).

Effects of chemical fertilizers rates on days taken to fruit setting after flowering of phalsa

Different rate of NPK fertilizer had significantly ($p<0.05$) effects on days taken of fruit setting after flowering of phalsa (Figure 3). Fruit setting was indirect proportional with NPK rates because maximum days taken of fruit setting recorded in the T1 (14) and minimum in the T4 (12). The NPK rates were non- significant with each other except T4, while T2 and T3 (13. 4 and 13.1) were almost similar effects on days taken of fruit setting after flowering. Our results are in line with previous studies on days taken of fruit setting after flowering of phalsa and rates of chemical fertilizers (Jitendra *et al.,* 2017; Ahmad *et al.,* 2019). The maximum days taken of fruit setting percentages were decreased in the T4 (13.2%), T3 (7.1%), T2 (4.8%), respectively. Similar, pictures were observed under different kinds of orchard fruits and rates of chemical fertilizers under field experiments, such as phalsa (Sing *et al.,* 2013; Kacha *et al.,* 2014), guava (Kher *et al.,*2005), Pomegranate (Goswami *et al.,* 2014) investigated that balance fertilizer application has better option for reduced losses of economic and fruit quality for long-term field experiments. In present study, T2 and T3 almost same effects on days taken of fruit setting after flowering of phalsa.

Influences of chemical fertilizers rates on fruit yield (plant^{-1}) of phalsa

The fruit yield of phalsa was improved by the NPK fertilizers rates as compared to without an amendment (Figure 4). Fruit yields were from 11.3 to 16.3 kg plant^{-1} among all treatments and greater recorded in the T4 and lower in the T1. The fruit yields were increased percentage in the following order T4 (30.6%), T3 (23.5%) and T2 (9.9%), respectively over the T1 treatment. Our findings are agreed with previous studies of phalsa and fertilizer rates (Ali *et al.,* 2001; Yadav *et al.,* 2007; Ahmad *et al.,* 2019). Fruit quality, diameter and weight are positive related with chemical fertilizers rates (Yadav *et al.,* 2007), and proper management of balance fertilizer significant on fruit yield traits as well as physical characteristics of fruits (Verma *et al.,* 2014). These evidences are supporting our study, because increasing rates of NPK fertilizer enhanced fruit yield plant^{-1}.

Conclusions

The present study concluded that the results displayed fertilizers rates were significant effects on days taken to sprouting, days taken to flowering, days have taken to fruit set after flowering, and fruit yields plant^{-1} as compares to the control treatment. However, T4 was better performed among all treatments and enhanced the above parameters and fruit yield over T2 and T3. The maximum percentage was increased of days taken to sprouting (54.1%) and fruit yield (30.5%), while, days taken to flowering (36.5%) and days taken to fruit set after flowering (13.2%) were decreased over the T1 (control) treatment. The conclusions of the present study are that plant nutrition and balance fertilizer application according to plant needs and the proper stage is most the important factor for plant better growth and fruit yield under field experiments.

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