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SOIL AND LEAF TISSUE NUTRITIONAL STATUS OF DATE PALM ORCHARDS IN DISTRICT PANJGUR, BALUCHISTAN

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ABSTRACT

The aim of this study was to evaluate the soil and leaf tissue conditions in date palm farms in the Panjgur area of Balochistan. The study's second purpose was to develop the relationship between soil and plant macronutrients in date palms. The soils in date palm orchards varied, consisting of different types of loam, from clay loam to silty clay loam. Tehsil Gowargo had silty clay loam soil, while Talukas Panjgur and Paroom had clay loam soil. All the soils in the plantations had an electrical conductivity of less than 2 dSm^{-1}. Tehsil Gowargo had the lowest pH, and Tehsil Panjgur had the highest. Panjgur had the highest organic matter content, whereas Gowargo had the lowest. Panjgur had the highest N content (0.050%), while Gowargo had the lowest (0.021%). Panjgur had the highest P content (7.90%), while Gowargo had the lowest (5.32%). Paroom had the highest K content (438%), while Panjgur had the lowest (211%). In the future, researchers should look at production and fertilizer application data from the orchards that were observed to find the highest and lowest levels of nutrients in date palm leaf tissue and figure out how these factors are connected to the levels of nutrients in the leaf tissue.

Key words: Balochistan, Date-palm, Perception,Cultivars, Tissue culture.

INTRODUCTION

The date palm (*Phoenix dactylifera* L.), a fruit tree that is highly valued in the Arab world for its delicious, nutrient-rich fruit, is widely planted. Its long history of cultivation has made it difficult to determine its original background, although El-Shibli and Korelainen (2016) speculate that it originated in the arid oasis regions of northern Africa and southwest Asia. Although the plant is local to tropical regions, it develops in the hard climate of South Punjab, Pakistan. Due to its excellent nutritional value, benefits for the environment, and sustainability, date palm is an economical means for farmers to improve people's food and financial conditions (Al-Shahib and Marshall, 2003; Salomon *et al*., 2021). The rural and urban areas of Pakistan include the main date palm farming regions of Sindh, Khairpur, Sukkur, and Naushahro Feroze. Unfortunately, compared to its potential yield, the actual yield on the farm is poor (Rajput *et al*., 2016). The date palm industry, including all date palm-related operations such as processing, security, and farming, faces numerous obstacles and constraints. The most crucial factor in increasing the production of date palm seeds is the type and nutrition of the soil. Macronutrients are essential building blocks for crop growth. The three major elements that contribute to growth and development are NPK. N contributes to development, crop canopy growth, and absorption of solar radiation (Bekheet *et al*., 2015). While plants require K for growth and reproduction, phosphorus is primarily known for its capacity to absorb solar radiation, convert it into plant-useful compounds (Malhotra *et al*., 2018), and play a crucial role in stimulating root development, bolstering stem strength, boosting flower production, and enhancing tuber and seed output. On the contrary, nitrogen is beneficial for root formation and overall plant growth (Bhuvaneswari *et al*., 2016; Dubey *et al*., 2017). Potassium is involved in a variety of processes, including protein synthesis, ion balance, stomatal and water management, photosynthesis, enzyme activation, and more. It is one of the sixteen elements that are necessary for plant growth and reproduction (Hari *et al*., 2015). Productivity is roughly 50% or less for the additional N, 20% for the P, and roughly 60% for the K (Karma and others, 2015). Several processes, such as volatilization, denitrification,

surface drainage, leaching losses, and ammonia interception in the soil, contribute to the low utilization potential of nitrogen and phosphorus. For potassium, the situation is fairly similar. Briquettes representing the three primary plant nutrients would be a better option. Crop mineralization of naturally bound nutrients is the sole option when fertilizers are unavailable. Organic manures increase crop productivity by delivering nearly all nutrients at balanced levels and minimizing nutrient depletion.

MATERIALS AND METHOD

The 2019 field study, "Nutritional status of date palm orchards in district Panjgur, Baluchistan," set out to determine how fertilizers applied to the soil affected the growth and yield. Date palm is one of the richest in nutrients in dry fruits due to its high content of carbohydrates, minerals, vitamins, and antioxidants. The tree is capable of handling cold, drought, salt, and the hot, dry environment that is common in the desert region. The recommended methods for land preparation of date palm plantations were put into practice. The treatments included the application of NPK as a soil fertilizer.

Leaf sampling:

From each of the three blocks, three mature trees were chosen to plant in the orchards of Panjgur, Gowargo, and Paroom. Following Kolsi-Benzina and Zougari, (2008) guidelines, leaf samples were randomly taken from the middle of the leaf above the fruiting zone to the pinnae of young leaves (less than a year old), making sure that the height of each sample remained constant across all trees. The samples were transported to the same facility for additional processing after being appropriately labeled and stored in plastic bags.

Analytical methods

This section describes analytical methods for the determination of soil texture, pH, conductivity, Kjeldahl nitrogen, and AB-DTPA extractable P and K. Additionally, leaf tissue analysis is discussed about the total N, P, and K contents of date palm plants. Jackson (1962) calculated Kjeldahl's N by first dissolving the contents in sulfuric acid, distilling the result, and then titrating the distillate with acid. First, we added a teaspoon of the digestion combination (10 g potassium sulfate + 1 g copper sulfate + 0.1 g selenium) to a 1 g chunk of air-dried soil, then left everything for one to twelve hours with periodic mixing. In a digestion block, the temperature was gradually raised to 400 ˚C to digest the samples. The digested material was moved to distillation flasks in the second stage. The receiving flask, which held a few drops of distilled water and two to three drops of the Toshiro reagent, was located beneath the lower end of the condenser. 40 milliliters of 40% sodium hydroxide were added to the flask to begin the distillation process, which lasted until about 120 milliliters of solution were gathered in the receiving flask. The contents' color changed from green to purple when we used 0.1N hydrochloric acid to back titrate them. As a blank, a determination made without a soil sample was used.

Leaf tissue analysis

Date palm leaf ground samples were used for the NPK analyses. The analysis of nitrogen was done using Kjeldahl's technique. Kjeldahl's technique involved distilling the substance in sulfuric acid, titrating the distillate with acid, and then repeating the process to determine the nitrogen content (Jones *et al*., 1996). Total P and K were measured in date palm leaf tissue samples by wet digestion with a solution of perchloric and nitric acid (1:5). For P, this was done using a spectrophotometer to see if vanadomolybdo phosphoric acid developed a yellow color (Cottenie, 2005), and for K, this was done using emission spectroscopy with a flame-photometer (Knudsen *et al*., 1982).

Statistical Analysis and Interpretation:

Descriptive Statistics and Statistics 8.0 software was used to study the total nitrogen (N), total phosphorus (P), and total potassium (K) concentrations in date palm orchards in the Panjgur region. Kjeldahl nitrogen, AB-DTDA extractable phosphorus, and potassium were evaluated at two soil depths (0-15 cm and 15-30 cm). The software makes it simple to understand the relationship between soil and plant nutrient levels.

RESULTS

Particle size distribution

Figure 1 shows the particle size distribution of some date palms at Panjgur, Parum, and Govargo at two soil depths (0–15 cm and 15–30 cm). The analysis results show that both the surface and underground of Panjgur are

clayey loam. Paluma's surface and subsurface soil textures range from loam to clay. The subsurface and surface textures of the Gowago soil are silt loam, respectively.

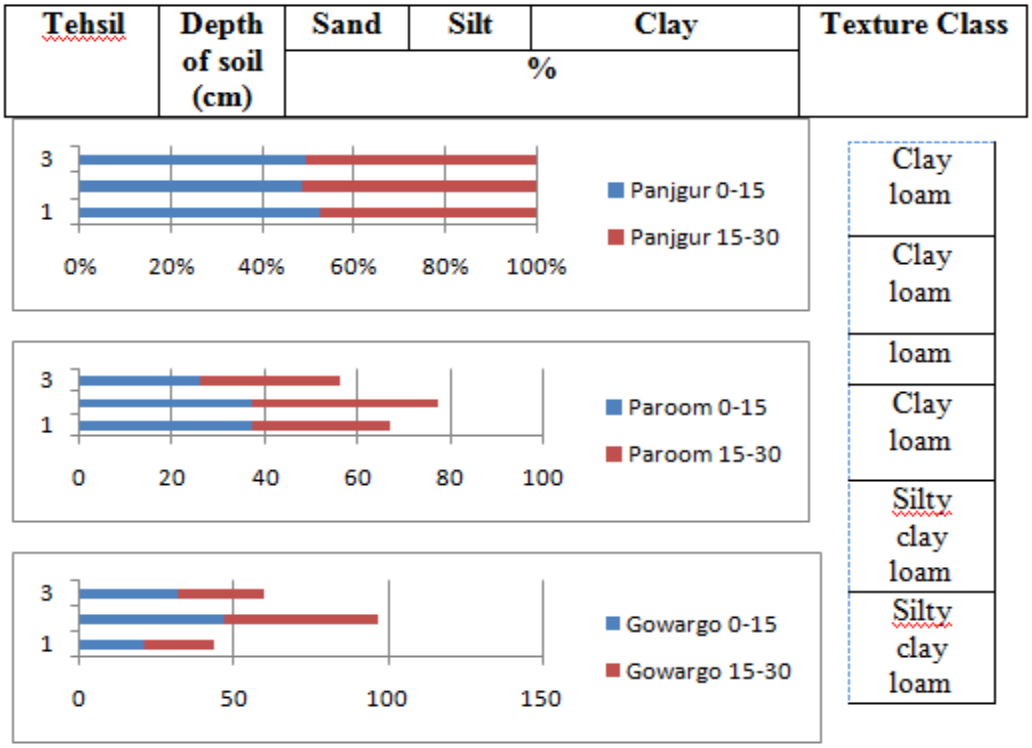

Fig. 1.Particle Size Distribution (%) in Panjgur, Balochistan Date Palm Orchard Soils.

Electrical conductivity

The findings concerning the electrical conductivity of the date palm orchard soils in the Panjgur district showed that none of the orchard soils were saline. All examined orchards in three Taluka had soils with EC values ranging from 0.14-0.99 dS m^{-1}, with Paroom Taluka having somewhat higher values. All of the soil samples that were categorized for EC were determined to be non-saline. None of the samples fit within the highly or slightly salinized categories Fig. 2.

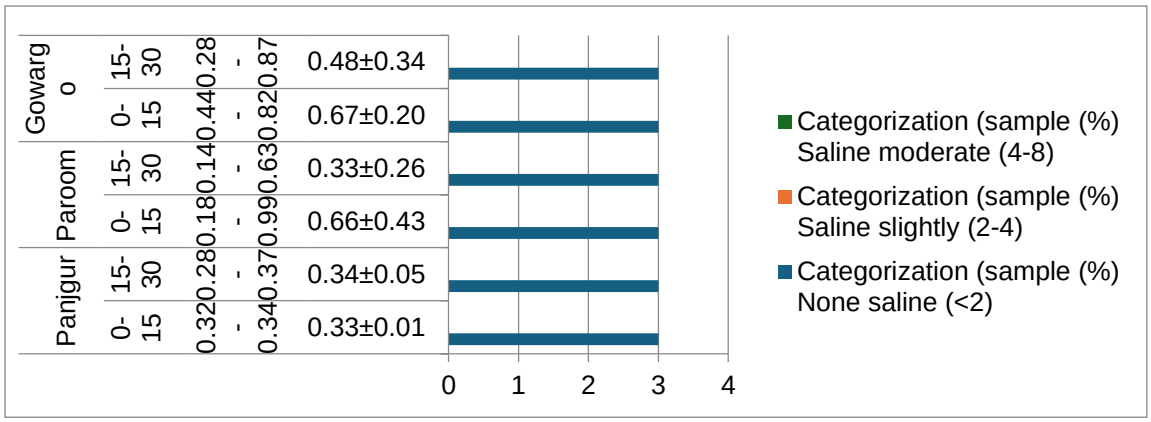

Fig. 2.EC (dS m^{-1}) in the Panjgur District, Balochistan, Date Palm Orchard Soils.

PH

The date palm orchard soils in the Panjgur district tested mildly alkaline to moderately acidic, according to the results. All examined orchards in three Taluka had soil pH values ranging from 7.21 to 7.99, with Panjgur Taluka

having somewhat higher values. The bulk of the samples were moderately alkaline in reactivity, according to the soil sample classification for pH Fig. 3.

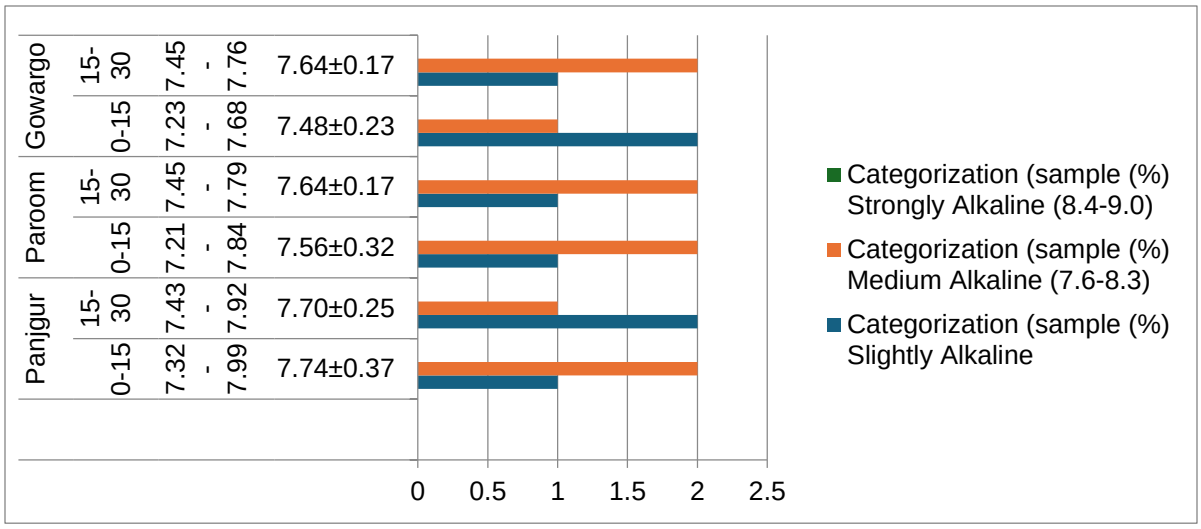

Fig. 3.pH level of date palm soil in Panjgur district of Balochistan.

Organic matter %

According to results (Figure 4) on the beginnings of organic matter in the soil, date palm orchard soils in the Panjgur district had low levels of organic matter. The organic matter percentage ranged from 0.32 to 0.87% in all examined orchards across three Taluka, with Panjgur Taluka exhibiting slightly higher values. According to the classification of soil samples for organic matter (Fig. 4), only a small number of samples had sufficient organic matter content in Panjur's surface soils. The bulk of the soils had poor organic matter contents.

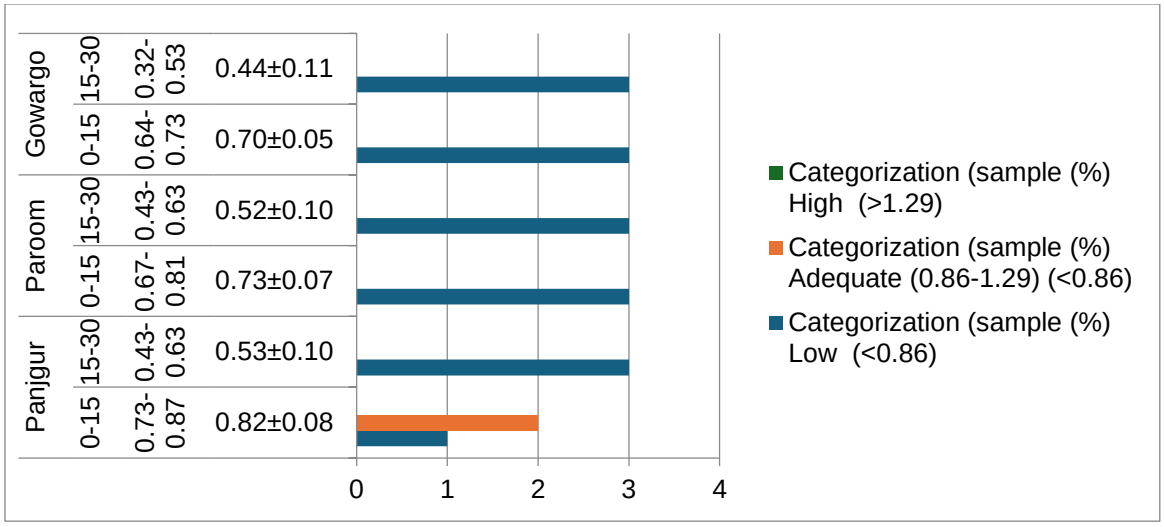

Fig. 4.Organic matter (%) in date palm soil of Panjgur district of Balochistan.

Total N (%)

The results for the N content of the date palm orchard soils in the Panjgur district indicated that the soils are deficient in N. All the orchards in three Talukas tested had N concentrations ranging from 0.020-0.060% in their soils. The bulk of the samples were classified as having low N content, with just a small number of samples having borderline N concentration at surface soils (Fig. 5).

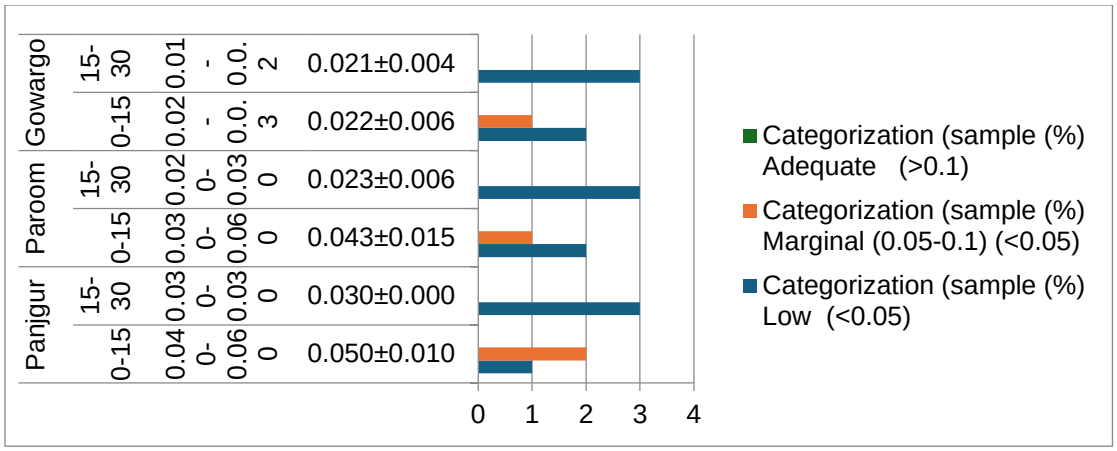

Fig. 5.Nitrogen (%) in Panjgur District, Balochistan Date Palm Orchard Soils.

P ABDTPA (mg/kg)

All examined orchards in three Taluka had soils with a P concentration ranging from 4.88 to 8.64 mg kg-1, with Panjgur Taluka having the highest value. The categorization of samples for P content revealed that the majority of them had a marginally sufficient P content. According to Figure. 6, none of the samples fall into the low P category.

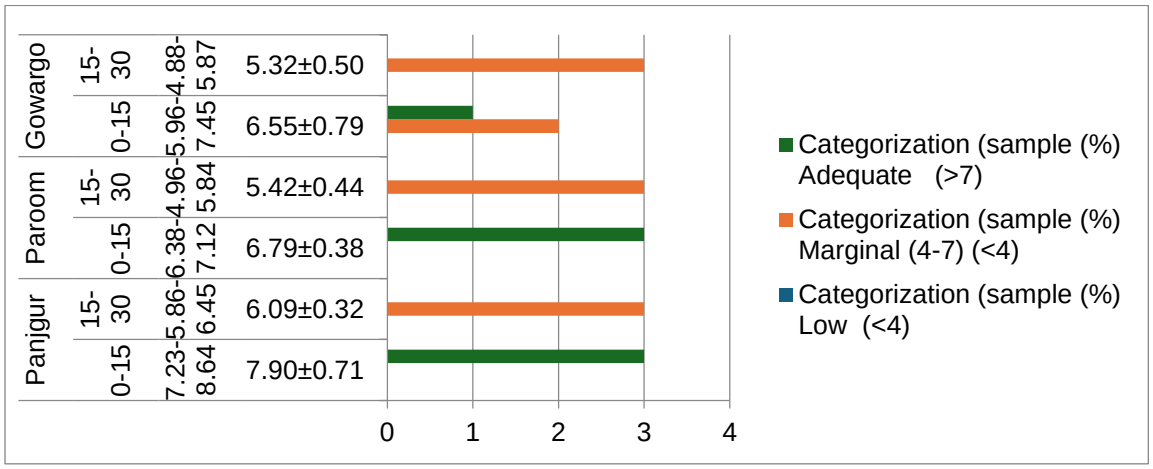

Fig. 6.Shows the amount of phosphorus (P) in date palm orchard soils in Panjgur District, Balochistan, expressed as mg/kg.

K content (%)

The findings indicated that the date palm orchard soils in the Panjgur district had an acceptable K content. The K levels of the soils in the three Talukas' investigated orchards ranged from 123 to 498 mg kg-1. The K content classification indicates that all the samples have a suitable K content. As shown in Figure 7, none of the samples have low or small K contents.

Analyzing the Macronutrient Content of Date Palm

Leaf Tissue N (%)

The total nitrogen concentration in the orchards of Panjgur district varies as shown in Figure 8: The total nitrogen concentration in the orchards of Panjgur district varies from 0.95% to 1.14%; in Parum district it varies from 0.93% to 1.12%; and in Gova B in the Ge region it varies from 0.91% to 1.06%. Paroom, Gowargo, and Panjgur have average nitrogen concentrations of 1.06%, 1.03%, and 1.00%, respectively. Gowargo plants had the lowest nitrogen concentration, while Panjgur leaf tissue samples showed the greatest (Fig. 8).

Leaf tissue P (%)

Figure 9 shows that in Panjgur, Paroom, and Gowargo, the total phosphorus (P) level in date palm leaf tissue ranged from 0.03% to 0.04%, 0.02% to 0.03%, and 0.03% to 0.04%. Between 0.03% and 0.04% was the average P level in Panjgur, Paroom, and Gowargo.

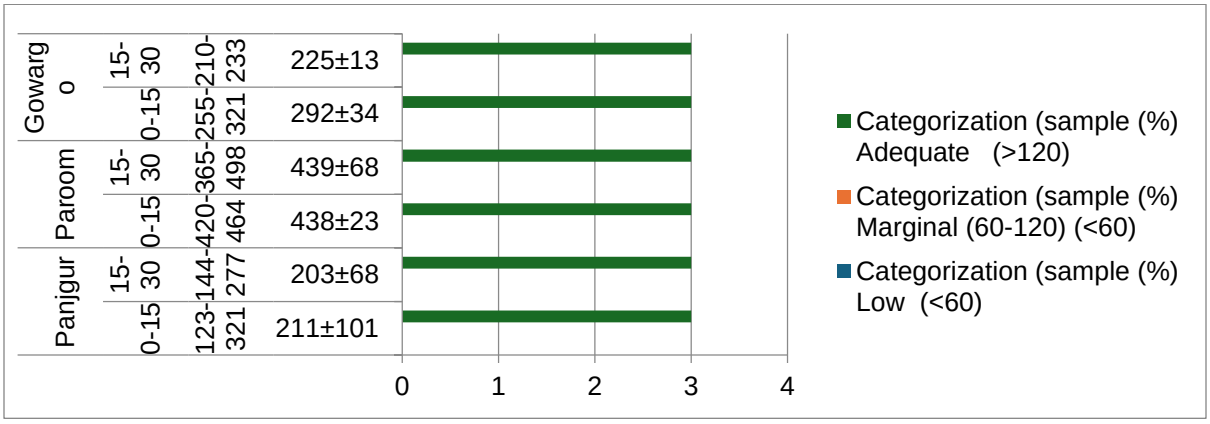

Fig. 7.Shows the amount of potassium (K) in date palm orchard soils in Panjgur District, Balochistan, expressed as mg/kg.

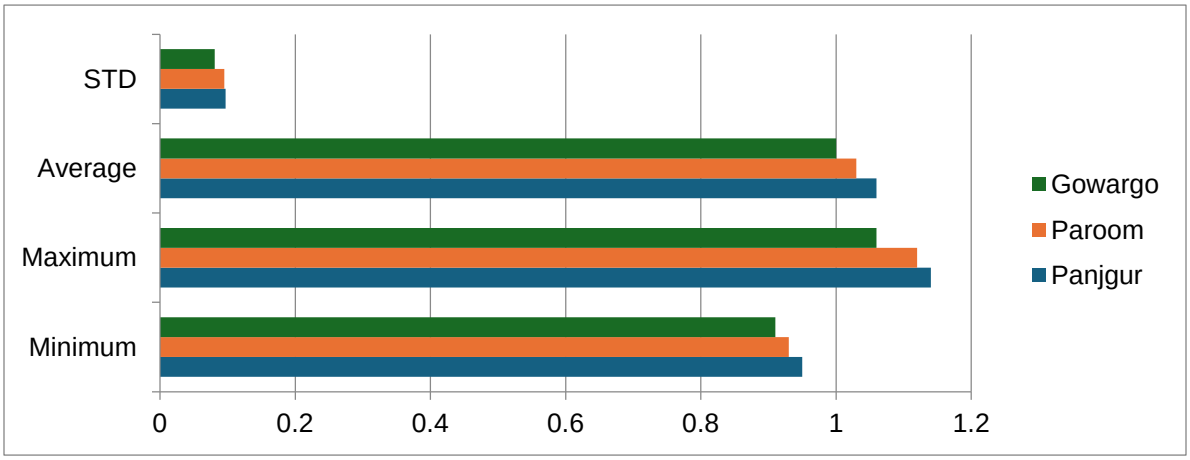

Fig. 8. Date Palm Leaf Tissue Nitrogen (N) Content (%) from Orchards in Panjgur District, Balochistan.

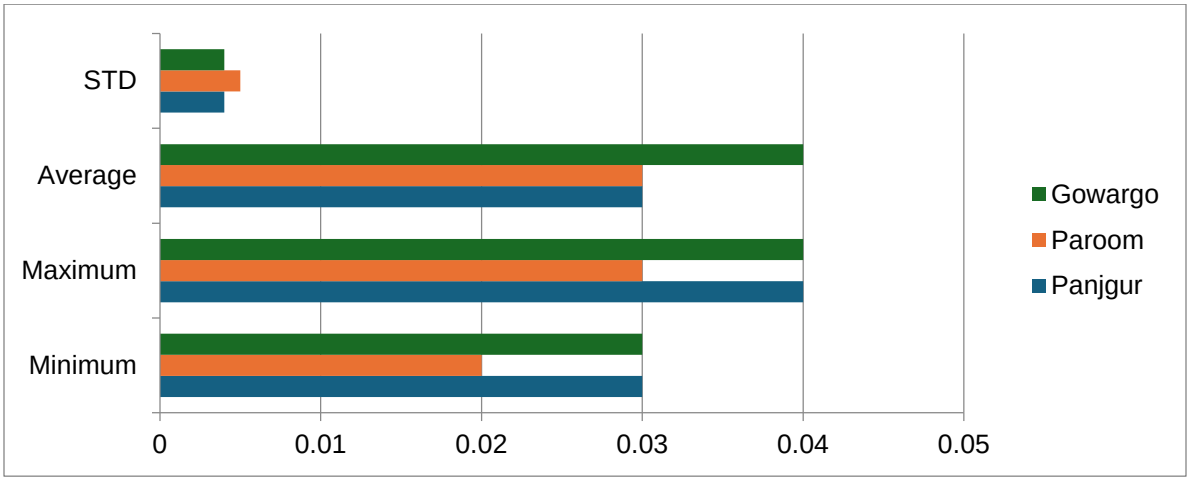

Fig. 9.Phosphorus (P) Content (%) in Date Palm Leaf Tissue from Orchards in Panjgur District, Balochistan.

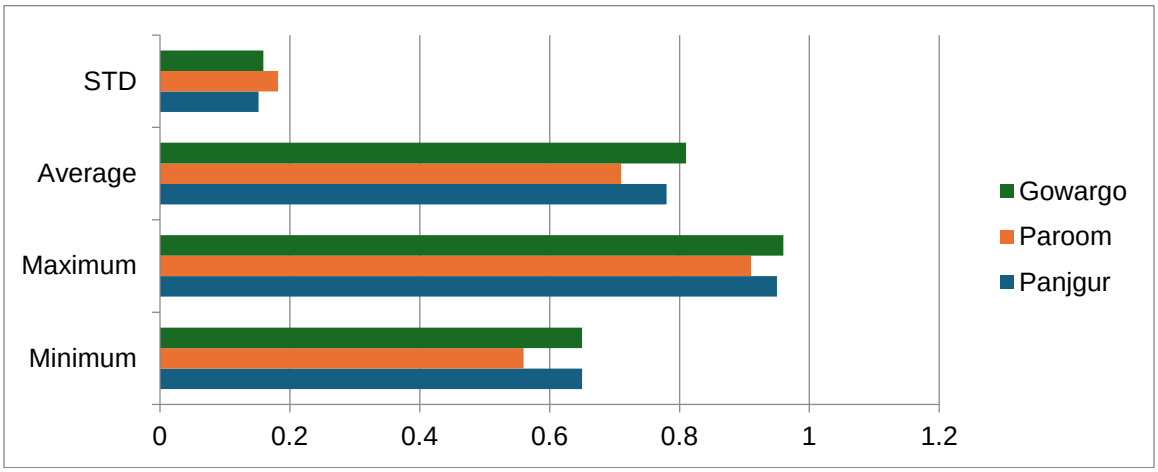

Fig. 10.Leaf tissue K (%) in Panjgur district, Balochistan's date palm orchards.

Leaf tissue K (%)

Figure10 shows that there are differences in total potassium (K) at different concentrations of leaf dates in orchards in the Panjgur region: 0.65% to 0.95% in the Panjgur region, 0.56% to 0.91% in the Parum region, and 0.56% to 0.91% in Goh. In the Vargo region, it is 0.65% to 0.96%. In Panjgur, Palm, and Govalgo, the average potassium content was 0.78%, 0.71%, and 0.81%, respectively.

The connection between plant nutrients and soil

Separate regressions were performed for each nutrient content to examine the relationship between the tissue nutrient (N, P, and K) content of date palm leaves in orchards in the Panjgur region and the P and K content extracted by the method Kjeldahl. The relationship between N and AB-DTPA soil (0–30 cm). Use the correlation coefficient, or "r," to evaluate each nutrient's relationship to soil and leaf tissue. Figure 11 illustrates the positive linear relationship, with K's r value of 0.35, P's r value of 0.43, and N's r value of 0.32.

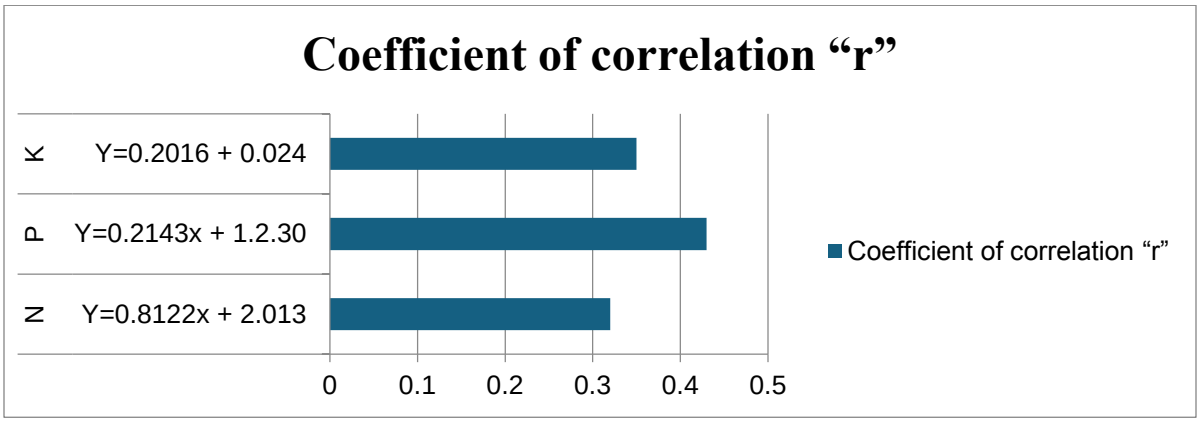

Fig. 11.Regression Equations and Coefficients of Correlation ("r") for Date Palm Orchard Soil and Leaf Tissue Contents in Panjgur District, Balochistan.

DISCUSSION

This study evaluated the concentrations of nitrogen (N), phosphorus (P), and potassium (K) in the soil and leaf tissue of date palm trees in the Panjgur region. Kjeldahl nitrogen extractable phosphorus and potassium contents and AB-DTPA were each regressed on corresponding nutrient levels in leaf tissue to determine the extent of their association. Furthermore, the distribution of particle sizes, electrical conductivity, pH, and organic matter in the soil were also measured. The following section examines the results of this investigation. The total N contents and the N

contents found using Kjeldahl's techniques are nearly identical. Therefore, drawing this conclusion is not worthwhile; instead, access to N pools (NH4 and NO3) is necessary. However, Kjeldahl's findings from this study can provide a ballpark approximation of the N variance within Talukas. The findings indicate that the N content of Gowargo date palm soils was typically low. According to an examination of leaf tissue, Panjgur had the greatest average N content (1.06%), and Gowargo had the lowest (1.00%). In terms of N content, our study's findings are substantially less than those seen in the literature. Even in control plots, which do not receive chemical fertilizer, the N concentrations, as reported by Osman (2009) and Aminifard *et al*. (2015), are significantly higher (2.04 to 2.17%). It's possible that the same plots were fertilized in a previous season. Increasing the amount of nitrogenous fertilizer to a maximum of 120 kg per palm resulted in a significant rise in N content to 2.60%. Additionally, applying 120 kg N per palm led to improvements in growth parameters and palm yields, which also reached their peak. But it's not only about the amount of N used; it's also about the palm's growth stage and quantum. These results were similarly consistent with those published by Bacha and Abo-Hassan (1983) for the Khudari date palm. According to the AB-DTPA extractable P values, the soils of the date palm orchards in three Talukas in the district of Panjgur were either low or on the edge of the low category. Every soil had a borderline P content (4–7 mg kg^{-1}). In the date palm orchards of the Panjgur district, the leaf tissue P (average) contents ranged from 0.03 to 0.04%. Tehsil Gowargo showed the highest amounts of 0.04%, while Panjgur and Paroom showed the lowest contents of 0.03%. The lack of recognized nutritional standard values for date palm orchards demonstrates the volume of studies conducted in this area. As a result, this study's findings were contrasted with those of previous investigations. According to Elamin *et al*. (2017), the phosphorus contents in the leaf tissue of the Khalas date palm were much greater than what we discovered throughout our analysis. Different amounts of potassium (K) and phosphorus (P) were tested, and it was found that the P content rose to 0.2% with higher P and K rates and was at least 0.1% in plots that had not been fertilized. This conclusion fits with the study of Bendaly *et al*. (2016), Salem and Ali,(2020), and other researchers, that even the lowest levels in the control plots were higher than what was found in this study; and that P and K values went up as the application rates went up. The AB-DTPA extractable potassium (K) concentrations were adequate (>120 mg kg^{-1}) for K supply. In Paroom, the average readings ranged from 438 mg kg^{-1} to as low as 140 mg kg^{-1}. Paroom had the lowest leaf tissue K content at 0.71%, while Gowargo had the highest at 0.81%. Al-Qurashi *et al*. (2015), who developed the commercial date garden cultivar in California using the Reglet Noor date palm variety, reported similar findings. On the other hand, the K contents found in this investigation were significantly lower than the data reported by Shaaban *et al*. (2012) and Van der Vorm *et al*. (1992), which suggest that the N, P, and K concentrations of leaf tissue nutrition should range from 0.68 to 1.04%, 0.08 to 0.12%, and 2.1-3.9%, respectively. Upon comparison with these nutrients, the majority of orchards fall into the low nutrition group for each of the three nutrients.

Conclusions

This study establishes a baseline for important nutrients in date palm orchards in Pakistan's Panjgur district in the absence of set standard requirements. It also serves as an initial step toward developing nutritional guidelines for date palm orchards in the Panjgur region of Balochistan. In the future, researchers should look at data on yield and fertilizer application from the orchards that were observed to find the extremes of nutrient deficiency or sufficiency in date palm leaf tissue and see how these factors relate to the levels of nutrients in the leaf tissue.

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