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RESEARCH PAPER

Constraints in soil testing at farmer's level in North Karnataka

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Abstract: Soil, as the fundamental medium for sustaining plant growth, exerts a direct influence on both the quality and quantity of agricultural output. Given the growing global population and the imperative for increased agricultural productivity, the optimization of crop production methods becomes crucial and one promising approach is soil testing.This study focuses on the constraints faced by soil-tested and not-tested farmers in the North Karnataka, India. The study employed purposive multistage sampling technique to select 160 respondents, including 80 soil-tested and 80 not-tested farmers.The study is based on primary data collected through well-structured interviews and Garrett's ranking technique was utilized to examine the constraints faced by soil-tested and not-tested farmers. Results show that among the constraints faced by soil-tested farmers, difficulty in calculating the fertilizer dose based on the nutrient status of the soil was the most prominent problem with mean Garrett score of 70.52, followed by difficulty in comprehending all the information provided in the soil test report, with mean Garrett score of 56.61, unreliability of soil testing results was ranked sixth with mean Garrett score of 35.77. In the case of soil not-tested farmers, lack of awareness about soil testing was the major problem with a mean Garrett score of 63.30, followed by lack of information about the benefits of soil testing with mean Garrett score of 61.05, soil testing laboratories are located far away was ranked sixth with mean Garrett score of 39.11. Taking corrective measures would improve the soil testing rates which would in turn have greater impact on crop productivity in the region.

Key words: Constraints, Garrett Ranking Technique, Soil tested, Soil not-tested

Introduction

In the 21st century, agriculture encountered a multitude of challenges. It must enhance food and fiber production to meet the needs of a growing population while relying on a reduced rural workforce. Additionally, it should provide increased feedstock resources to potentially support a substantial bioenergy market, foster development in numerous agriculture dependent developing nations, embrace more effective and sustainable production techniques and address the impacts of climate change.

Agriculture serves as the backbone of India's economy, with the country's favourable geographical location, encompassing climate, soil quality and topography, providing a conducive environment for diverse crop cultivation. Throughout its history, India has predominantly relied on agriculture as the primary source of livelihood and it continues to play a pivotal role in the nation's overall economic performance. The significance of agriculture in India's national economy cannot be overstated, considering its substantial contribution to the Gross Domestic Product (GDP), its support for the industrial sector, its role in sustaining the livelihoods of the majority of the population and its provision of essential wage goods. It is fair to assert that a revolutionary transformation in our economy can be primarily instigated through an agricultural revolution. Soil, as the fundamental medium for sustaining plant growth, exerts a direct influence on both the quality and quantity of agricultural output. Given the bulging global population and the imperative for increased agricultural productivity, the optimization of crop production methods becomes crucial and one promising approach is soil testing (Das *et al.*, 2014).

Soil is thin layer of earth's crust which contains major components like minerals, organic matter, airand water and acts as medium for plants growth. Soil testing refers to analysis of soil sample to determine nutrient content, composition and other characteristics such as pH and electrical conductivity. A soil test can determine fertility or the expected growth potential of the soil which indicates nutrient deficiencies, potential toxicities from excessive fertility and inhibitions from the presence of non-essential trace minerals. Soil test report gives current nutrient status of soil and required nutrients for particular crop, thus it enhance crop productivity, reduce input costs, minimize environmental impacts and promote sustainable agriculture practices (Singare *et al.*, 2020).

Agricultural productivity remains a crucial factor in ensuring food security, increasing farmers' income and promoting rural development in regions like North Karnataka, where agriculture is the primary livelihood for a majority of households. However, productivity is often hindered by the improper use of inputs, especially fertilizers, due to the lack of scientific soil health management.

Soil testing plays a vital role in determining the nutrient status of the soil and in recommending balanced fertilization. Yet, its adoption at the farmer level remains limited. Identifying and addressing the constraints in soil testing is critical to enhancing productivity in a sustainable manner.

Table 1. Constraints faced by soil tested respondents in the study area (n=80)

Constraints	Per cent Position	Garrett Value	Total Score	Mean	Rank
Difficulty in calculating fertilizer dose on the basis of nutrient status of soil	8.33	77	6,160	70.52	I
Difficulty in understanding all the information given in the report	25.00	63	5,040	56.61	II
Time gap between soil sample taken and issuing reports was high	58.33	46	3,680	50.47	III
Lack of knowledge about method of collecting ideal soil sample	41.67	54	4,320	45.47	IV
Soil testing laboratories are located far away	91.67	23	1,840	40.17	V
Result of soil testing is not reliable	75.00	37	2,960	35.77	VI

Material and methods

Multistage purposive sampling technique was employed for the selection of districts, talukas, villages and sample respondents. In the first stage, based on greater number of soil testing laboratories (Belagavi) compared to other districts of North Karnataka and Agricultural University located in Dharwad district, which has taken up many extension activities on soil test and soil health. Belagavi and Dharwad districts were purposively selected for the study. In the second stage, two talukas namely, Dharwad and Kalaghatagi from Dharwad district; Gokak and Raibag from Belagavi district were purposively selected based on a greater number of respondents undertaken soil testing. In the third stage, from each taluka two villages were purposively selected based on the criteria followed in taluka selection. From each village five soil tested and five soil not tested maize and sugarcane farmers were randomly selected. Thus, total sample size has become 160.

To identify constraints faced by soil tested farmers during soil testing and soil not tested farmers for not soil testing, Garrett ranking technique was used.

The order of the merit given by the respondents was changed into ranks by using the formula,

Per cent position=100* (R_{ij}-0.5) /N_j

Where,

R_{ij} = Rank given for i^{th} factor by j^{th} individual

N_j = Number of factors ranked by j^{th} individual

The percent position of each rank was then converted into scores referring to the table given by Garrett and Woodsworth (1969). For each factor, the scores of individual respondents were added together and divided by the total number of the respondents for whom scores were added. These mean scores for all the factors were arranged in descending order, ranks were given and the most important factors or constraints were identified.

Results and discussion

Constraints faced by soil-tested respondents in the study area are indicated in Table 1. These constraints have been ranked based on their Garrett mean scores, indicating their relative significance to farmers. The most prominent challenge, occupying the top position, was difficulty in calculating the fertilizer dose based on the nutrient status of the soil, underscores the need for simplified guidance and precision in nutrient recommendations. The findings of the similar study conducted by Sultan (2005) underscored major constraints such as expensive recommended fertilizer dosage, limited interaction between extension persons and farmers.

The third significant challenge was time gap between soil sample collection and the issuance of reports reflects a logistical hurdle that warrants attention regarding the timeliness of soil test information, with a mean score of 50.47. Fourth in line was lack of knowledge about the ideal method of collecting soil samples, underscores the necessity for farmer training programs scoring with a mean score of 45.47. The distance of soil testing laboratories from farmers, ranked fifth with a total score of 1,840 and a mean score of 40.17, was a logistical constraint that adds to the challenges faced by respondents. Finally, the perceived unreliability of soil testing resultscalls for measures to enhance the accuracy and credibility of testing procedures, ranking sixth with a mean score of 35.77. Table 2 presents the constraints faced by respondents who have not tested their soil in the study area. These constraints have been ranked based on their mean scores, indicating their relative significance to farmers who have not opted for soil testing. The primary constraint, occupying the top position, was lack of awareness about soil testing, due to the lack of awareness campaigns, with a mean score of 63.30. The second-ranked constraint was lack of information about the benefits of soil testing, due to knowledge dissemination programs to highlight the advantages of soil testing among non-adopters, with mean score of 61.05. The third significant challenge was general lack of interest, with a

Table 2. Constraints faced by soil not tested respondents in the study area (n=80)

Constraints	Per cent Position	Garrett Value	Total Score	Mean	Rank
Lack of awareness	75.00	37	2,960	63.30	I
Lack of information about benefits of soil testing	8.33	77	6,160	61.05	II
Lack of interest	58.33	46	3,680	48.27	III
Do not know how to take soil sample	25.00	63	5,040	45.42	IV
Do not know whom to contact for details on soil testing	41.67	54	4,320	43.79	V
Soil testing laboratories are located far away	91.67	23	1,840	39.11	VI

mean score of 48.27, pointing to the importance of motivational strategies to engage farmers. Fourth in line was inability to take soil samples correctly, with a mean score of 45.42, calling for training programs on proper sampling methods. The challenge of not knowing whom to contact for details on soil testing, ranking fifth with a mean score of 43.79, highlights the need for accessible information sources and contact points. Finally, the distance of soil testing laboratories from these farmers, ranked sixth with a mean score of 39.11, signifies the logistical hurdles for soil testing in the study area.Thefindings align with prior research by Niranjan *et al.* (2018) who also identified awareness and information gaps as barriers to soil testing adoption in agricultural communities.

Conclusion

The study underscores the critical role of soil testing in enhancing agricultural productivity, reducing input costs and promoting sustainable practices. For soil-tested farmers, the foremost challenge lies in the difficulty of calculating fertilizer doses based on soil nutrient status, highlighting the need for simplified guidance. Additionally, challenges in comprehending soil test reports and addressing logistical issues, such as the time gap in receiving reports and the distance to testing laboratories, need attention.

Conversely, non-tested farmers face barriers rooted in awareness gaps, emphasizing the need for extensive awareness campaigns and information dissemination regarding the benefits of soil testing. Lack of interest and knowledge about proper soil sampling methods also emerged as significant constraints. The study suggests that addressing these challenges through targeted training programs, timely report issuance, and improved accessibility to information could potentially boost soil testing rates in North Karnataka. Ultimately, overcoming these constraints is crucial for realizing the full potential of soil testing in advancing sustainable agriculture, mitigating environmental impacts, and supporting the economic backbone of India's agrarian society.

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