*Original Research Article*

# Delineation of Soil fertility status and KVK intervention to improve the productivity of Pepper in TSP villages of Namakkal district under soil health card mission


**Abstract**

Soil is the most important resource needed for agriculture production. The unbalanced fertilizer application associated with more food grains production by high varieties affects the soil quality. Soils of tribal areas especially Kollihills in Namakkal having nutrient deficiency problems were more pronounced in hilly area due to intense cropping especially spices Pepper, coffee, cardamom. Balanced application of plant nutrients is thus the only option to increase soil productivity for maintaining/enhancing the overall soil productivity. Delineation of soil nutrient status is an important practice to plan the nutrient scheduling for pepper crop. Application of soil test based balanced application increased the yield attributes and yield of pepper. An average of Rs. 74,220/ha net profit could be obtained by adopting all scientific package of practices in the farm holdings.



**Key words**: soil nutrients status-delineation-scientific intervention-pepper yield-BC ratio


**Introduction**

Kollihills is a small mountain range located at the tail end of Eastern Ghats in the Namakkal of Tamil Nadu situated between 11.10' and 11.23' North Latitude and 78.17' and 78.28' East Longitude, the mountains are at 1000-1300 m height covering approximately 418.5 $Km^2$. There are 14 villages (Nadus/revenue villages) and 275 hamlets inhabited predominantly (>95 per cent) by scheduled tribes. The total population of Kollihills is 33888 living in 6480 households. Out of the 38678 people 36080 are Tribals and the rest have been declared as scheduled caste. The Malayali Malai Vazh Makkal is the major scheduled tribe's peoples living in this area.

The main occupation is agriculture and cattle rearing. Black Pepper, Hill Banana, Coffee, Pine apple, Tapioca, Paddy, Minor Millets like Foxtail Millet, Finger Millet and Little Millets are

the Major crops cultivated in Kollihills in an area of 1200 ha under rainfed condition. Recently soil fertility getting deteriorated due stunted growth, flower drops, fruit shedding and susceptible to pest and disease attack might be associated with fewer yields. To assess the soil fertility and suggest suitable management practices delineation of soil nutrient status is important. To keeping these points in view, fertility status study was planned

**Materials and Methods**

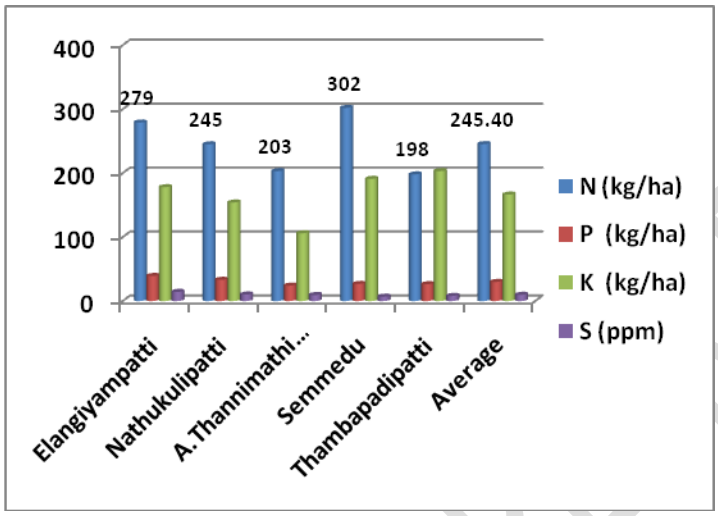
Gundurnadu panchayat was selected in Kollihills and soil samples were collected in Elangiyampatti, Nathukulipatti, A.Thannimathipatti, Semmedu and Thambapadipatti villages. Soil samples were collected, brought to the laboratory air dried, processed and analyzed for physico-chemical, chemical, physical and biological parameters after passing through 2mm sieve. Soil pH and EC were determined in Soil: Water (1: 2.5ratio) extract by potentiometric and conductometric methods respectively (Jackson, 1973). Organic carbon was estimated by chromic acid wet digestion method (Walkley and Black, 1934). Available N in soil was estimated by alkaline permanganate method (Subbiah and Asija, 1956), available P by Colorimetric method (Olsen *et al*., 1954), available K by Neutral Normal Ammonium Acetate method (Stanford and English, 1949), available S by Turbidimetric method (Williams and Steinbergs, 1959).

After the soil testing, importance of soil health was sensitized among farmers and farm women through various group meeting, awareness programme, field visits, regular advisories and distribution soil health cards with suitable recommendations. Then 50 interested farmers were selected and FLD programme with INM practice was implemented.

Among the various spices, pepper cultivated to larger scale for income generation and hence according to the soil fertility status nutrient management practices were suggested through integrated nutrient management concept in an area of 20 ha (50 farmers field). In farmers practice farmers applied cattle manure @ 6 kg/ tree once in 6 months followed by applied Neem cake 250 g/ tree and complex fertilizers @ 100 g/ tree / 6 months interval. In KVK intervention applied FYM/compost @ 10 kg/ tree, Azospirillum @ 50 kg, phosphobacteria @ 50 kg, potash solubilizing

bacteria @ 50 g, & VAM @ 200 g along with 50 % chemical fertilizers in circular basin excavated in 1 feet away from the trunk of the tree. The above said doses recommended to apply twice in equal doses at May - June and September - October months. Also, suggested to apply lime @ 500g / tree once in two years during May-June immediately after the onset of monsoon. After implementation of treatments, growth and yield attributed were monitored through field visits and yield data & its attributes was collected and economics were worked out.

**Results and discussion**




Graph 1 : Concentration of Soil parameters present in different regions

Predominant soil type was red sandy loam in texture and non calcareous in nature. From this soil analysis, analysis report revealed that value of soil reaction (pH) was ranged from 6.67 to 7.27 (Table 1). Climatic condition and topography of the climate played a vital role in decreasing soil pH. None of the soil samples having alkaline pH like plain soil. Farmers in hilly areas doesn't have the tendency to dump more chemical fertilizers even right amount and leaching loss of salts by slopy nature of topography might be the reason behind in non saline nature. Soil electrical conductivity was found to be normal in villages. The value recorded was 0.049 - 0.098 dS $m^{-1}$. The organic carbon content varied from 0.54 to 0.79 %. The highest 0.79 % OC of the hill soil might be due to prevalence of low temperature and accumulation of organic material in the soil compared to plain soil (Navneet Pareek *et al*., 2019). Plain soils in Namakkal district always reported to be OC in low to medium category and farmers who applied right dose of organic

manures had medium category. The same was confirmed by repeated analysis in the Soil and Water Testing .

Available nitrogen content ranged from 198 to 302 kg $ha^{-1}$ in all villages and average N value was found to be low category 245.50 kg $ha^{-1}$. Available phosphorus content recorded high category in all villages and average P content was 29.91 kg $ha^{-1}$. Regarding potassium status recorded low to medium and have Similarity to N status. Available S content recorded low (6.78 pp) to medium (14.32 ppm) category and average S content was 9.76 ppm. Depletion of nutrients especially Nitrogen & Potassium from the running during the heavy pour might be associated with relatively less built up of nutrient in hilly soil.

Yield and its attributes were found to be higher in KVK intervention than farmers practice. More No. of spikes was 209, length of spikes 14.3 cm, no. of berries 89 and yield of dry berries/ tree 1.66 kg observed in plants received all scientific packages of practices (Table 2 & Fig.1). Application of organic manures releases organic acids upon decomposition which mineralize the nutrients and make them available to plants. N fixing ability of bacteria, P solubilizing and mobilizing bacteria materializes and increases the availability the applied as well as native reservoir to the plants during requirement of various growth stage of pepper. Proper nutrient supplementation from all growth stages directly contributed the yield enhancement and hence INM treatments proved its superiority interms of high yield bearing attributes.

From this study it can be clearly stated that farmers got an additional income of Rs.74,220/ha by recording yield increase of 39.59% over check. Farmers sensitized about composting of locally available biodegradable waste, other organic manure preparation in their field itself. Hence cost involved in OM, bio agents were not included in the cost of production. Biofertilizers cost, agro chemicals and labour cost were included in both practices. Hence scientific package of practices recoded higher BC ratio.

Upon field observation and survey carried out among farmers, it can be clearly stated that Quick wilt symptoms, yellowing of pepper vine and berry shedding at pin head stage reduced upto16.8% when farmers adopted suitable scientific management practices especially during since May- June.

## Conclusion

At this juncture, it can be concluded that soil fertility was comparably have less nutrient status and hence suitable management practices were suggested through KVK FLD programme. Farmers applied all the nutrient management practices and got appreciable yield bearing nature of pepper and recorded higher BC than conventional practice. Through this interventions, nearby farmers and villages were started to adopt complete scientific package of practice for pepper cultivation in hilly areas. Farmers experienced better through Tribal sub plan and now days significant changes in farming operations had been observed. They voluntarily buy biofertilizers from KVK and inculcated the habit of application for pepper cultivation largely.

## References


Jackson, M L (1973). Soil Chemical Analysis. Prentice Hall of India Ltd., New Delhi.

Navneet Pareek, K P, Raverkar , M K. Bhatt , Shikhar Kaushik , Subhash Chandra , Gurvinder Singh and Hem C. Joshi.( 2019). ENVIS Bulletin Himalayan Ecology, 27:

Olsen, S R,; Cole, C V,: Watanabe, P S.: and Dean, L A (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. U.S.D.A. Circ. 939.

Stanford, S and English. L (1949). Use of Flame photometer in rapid soil test for K and Ca. *Agron. J.,* 41: 446-447.

Subbiah, B V and Asija, G L (1956). A rapid procedure for estimation of available nitrogen in soils. *Curr. Sci.,* 65: 477-480.

Walkley, A and Black, C A (1934). An examination of Degitijareff method for determining the organic matter and proposed modification of the chromic acid titration method. *Soil Sci.,* 37: 29-38.

Williams, C H and Steinbergs, A (1959). Soil sulphur fractions as chemical indices of available sulphur in some Australian soils. *Aus. J. Agronomical Res.,* 10: 340-352.

**Table 1. Average nutrient status of Kollihills of Namakkal District, TN under Tribal Sub Plan & Soil Health Card Mission**

| Soil parameters | | | Average nutrient of Gundurnadu Panchayat of Kollihills block | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Elangiyampatti N=28 | | Nathukulipatti n=15 | | A. Thannimathipatty N=15 | | Semmedu N=23 | | Thambapadipatti N=19 | | Average (100) | |
| Soil type | Red soil | | Red soil | | Red soil | | Red soil | | Red soil | | | |
| Soil texture | Sandy Loam | | Sandy Loam | | Sandy Loam | | Sandy Loam | | Sandy Loam | | | |
| Lime status | Non calcareous | | Non calcareous | | Non calcareous | | Non calcareous | | Non calcareous | | | |
| pH | 6.98 | Neutral | 6.67 | Neutral | 7.27 | Neutral | 6.86 | Neutral | 7.09 | Neutral | 6.97 | Neutral |
| EC ($dSm^{-1}$) | 0.089 | Non saline | 0.091 | Non saline | 0.049 | Non saline | 0.096 | Non saline | 0.098 | Non saline | 0.080 | Non saline |
| Organic carbon (%) | 0.79 | H | 0.69 | M | 0.56 | M | 0.78 | H | 0.54 | M | 0.67 | M |
| Available nitrogen ($kg\ ha^{-1}$) | 279 | L | 245 | L | 203 | L | 302 | M | 198 | L | 245.40 | L |
| Available Phosphorus ($kg\ ha^{-1}$) | 39.21 | H | 33.2 | H | 24.1 | H | 26.70 | H | 26.32 | H | 29.91 | H |
| Available Potassium ($kg\ ha^{-1}$) | 178 | M | 154 | M | 106 | L | 191 | M | 203 | L | 166.40 | M |
| Available Sulphur ($mg\ kg^{-1}$) | 14.32 | M | 10.23 | M | 9.43 | L | 6.78 | L | 8.02 | L | 9.76 | L |

**Table 2. Effect of KVK intervention on yield attributes and yield of black pepper**

| Treatments | Number of spikes | Length of spikes(cm) | Number of berries/spike | Yield (kg/vine) | Yield (kg/ha) | Cost of cultivation (Rs./ha) | Gross income Rs./ha) | Net income Rs./ha) | BC ratio |
|---|---|---|---|---|---|---|---|---|---|
| **Farmers practice (check)** | 167 | 12.4 | 76 | 1.19 | 1321 | 1,34,560 | 3,05,010 | 2,03,000 | 2.26 |
| **KVK intervention** | 209 | 14.3 | 89 | 1.66 | 1844 | 1,46,900 | 4,24,120 | 2,77,220 | 2.89 |

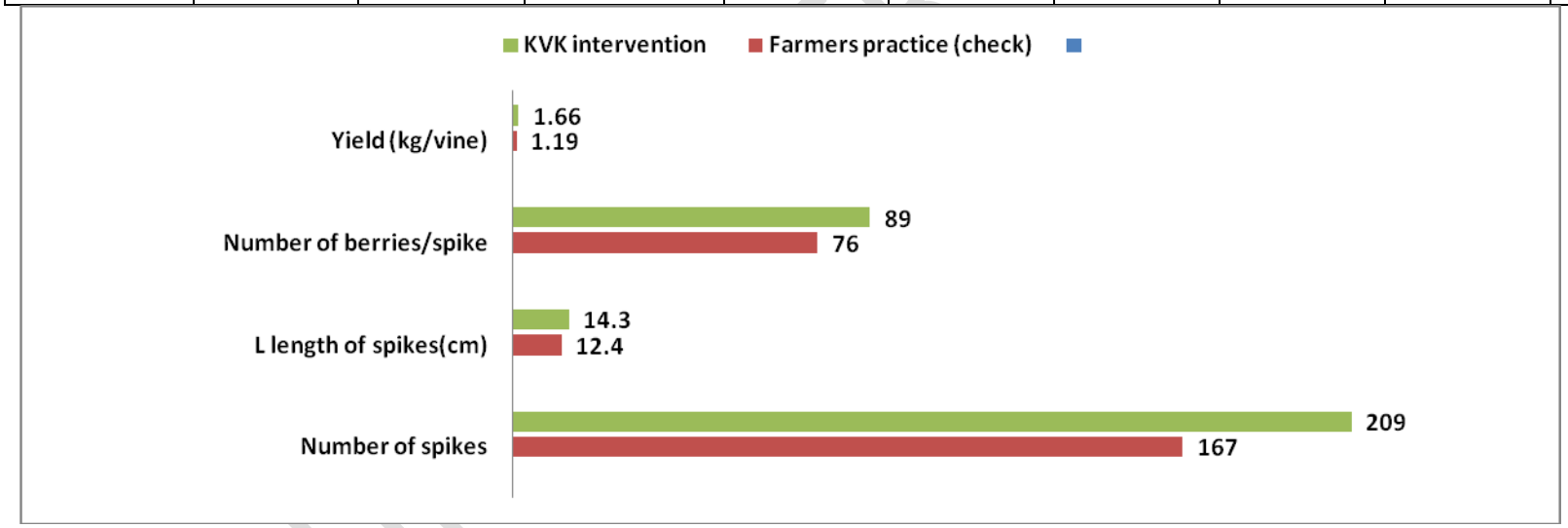



**Fig.1. Yield and its attributes of Black Pepper**