STRATEGIES FOR INTEGRATED SOIL AND PLANT NUTRIENT MANAGEMENT IN PEPPER

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Black pepper known as the king of spices is one of oldest and world most important spice native of the Western Ghats in South India and wetter parts of Sri Lanka, where it is still restricted as a wild plant. Black pepper (*Piper nigrum* L.) is the second most important perennial spice crop grown in Sri Lanka. Total extent of pepper in Sri Lanka is about 31,000 ha and crop is mainly cultivated in wet and intermediate agro ecological zones in mid and low country. The crop is mainly concentrated to small scale farm holdings and makes a significant contribution for their income. Sri Lanka exported 12,218mt of pepper in year 2010.

The nutrient requirement of pepper is fulfilled mainly by chemical fertilizer, organic fertilizers such as green manure (Gliricidia), organic manure and compost prepared in the field in Sri Lanka. Ongoing research related to mycorrhiza also help to increase the nutrient use efficiency in the support tree and green manure further. The growers use mostly complex fertilizers in other growing countries. Sri Lanka was using 14:11:14:2 N,P_2O_5,K_2O,Mg fertilizer mixture at the rate of 500g in first year, 700g in second year and 1,400g in third year onwards in two splits. In long term fertilizer experiments conducted in Central Research Station, Matale has shown 700g of 14:11:14:2 N,P_2O_5,K_2O,Mg mixture is enough to fulfill the nutrient requirement of pepper.

Gliricida sepium (Gliricidia), the most common live support use for pepper has the capacity to produce very high biomass, to tolerate for frequent lopping and the ability to adopt various agro-climatic conditions. The studies were carried out to find out the possible use of Gliricidia green manure to reduce chemical fertilizer use while maintaining acceptable crop yields and sustaining the productivity of the pepper based cropping systems. The number of field experiments were established covering major pepper growing areas in Sri Lanka consisted with two levels of green manure (10 and 15kg (wet)plant^{-1} year^{-1}) and three levels of chemical fertilizer (0, 700 and 1,400g plant^{-1}year^{-1}). Overall yield data collected over 15years suggested that with the application of 10kg fresh Gliricidia green manure in four splits, chemical fertilizer application could be reduce by 50%. Soil analysis indicated significant increase of total soil N, available P, Exchangeable K and Mg content and soil organic C, of the first 30cm layer under all the locations with the application of green manure. However, the response is site specific and under better management in comparatively young soils complete replacement of chemical fertilizer with 10kg of Gliricidia green manure per vine is possible. From the above soil fertility management package gave sustainable yields of an range between 2,500-4,000kgplant^{-1}year^{-1} based on agro climatic zone with 10kg of Gliricidia green manure and 700g of 14:11:14:2 N,P_2O_5,K_2O,Mg mixture per pepper plant per year .

The effect of two types of commonly used organic manures (cattle and poultry) at three different rates (8, 12 and 16kg plant^{-1}year^{-1}) with (200 N, 160 P_2O_5, 200 K_2O and 28 MgO g plant^{-1}year^{-1})and without inorganic fertilizers on growth, yield of black pepper and impact on soil chemical properties was studied. Poultry manure applied treatments showed superior soil N content compared to the cattle manure applied treatments irrespective of application of inorganic fertilizer. Organic manure treated plots showed significantly higher organic matter content (4-5%) compared to the treatments of purely inorganic fertilizer. The application of cattle manure at the rate of 16kg^{-1}vine^{-1}year and poultry manure at the rate of 12kg^{-1}vine^{-1}year in two splits is sufficient to achieve 1,200-1,300kg^{-1}ha^{-1}year in organic cultivation of pepper. The studies of potential use of compost prepared on field, vermi- compost are in progress.

The sustainable management of pepper could be achieved by integrated crop nutrient management. The potential use of Gliricidia green manure, animal wastes (cattle manure and poultry manure), compost, bio fertilizer have evaluated as organic sources of nutrients for sustainable organic cultivation of pepper. The application of Gliricidia green manure at the rate of 10kg^{-1}vine^{-1}year in four splits is sufficient to achieve 1,500kg^{-1}ha^{-1}year berry yield.

In last few years research division of Department of Export Agriculture also initiated a research project with the objectives of developing and introduction technology to inoculate black pepper rooted cuttings at the nursery stage with Arbuscular Mycorrhiza (AM) inoculums, investigate the effect of mycorrhizal associations of black pepper on increasing plant-availability of phosphorus from ERP (Eppawela Rock Phosphate) fertilizer and enhance the beneficial effect of green manure/mulch in field established black pepper and other EAC through mycorrhizal inoculations. The effective spore density of *Glomus mosseae*, (AM), for inoculation of rooted cuttings of Black Pepper (*Piper nigrum* L.) was determined as 75g. The increase of the root length and shoot dry weight of the pepper was recorded after addition into the potting medium of one standard size polythene bag before planting a rooted cutting of black pepper.

Plant nutrients can be supplied from different sources viz. organic manures, crop residues, green manure, bio fertilizers and chemical fertilizers. In pepper cultivations for better utilization of resources from the system (Gliricidia-pepper) and to produce crops with less expenditure, the best approach is integrated nutrient management. Application of green manure or organic amendment not only supplies plant nutrients; it can improve soil structure, soil moisture retention, weed suppress as well as improvement of soil biological activities towards sustainable soil productivity management.