Growth and Yield Response of Hot Pepper (Capsicum annuum L.) to NPSB Blended Fertilizers and Farm Yard Manure: A Review

Adugna Chimdessa¹, Muluneh Bekele² & Chala Obsa³

¹Adugna Chimdessa, ²Muluneh Bekele & ³Chala Obsa
Department of Horticulture, College of Agriculture & Veterinary Science, Ambo University Oromia
Ethiopia

Abstract: Pepper (Capsicum annuum L.) is the world’s most important vegetable after tomato and used as fresh, dried or processed products, as vegetables and as spices or condiments. The major factors that limit vegetable crops production are shortage of cultivars and agronomic practice, poor quality seed, poor irrigation systems, lack of information on soil fertility, diseases, high postharvest loss and poor marketing system. In smallholder farming system, the causes of nutrient deficiency include high plant nutrient uptake, removal of entire crop residues, use of cattle dung as source of fuel energy for cooking, nutrient loss through leaching, P-fixation in acid soil and gaseous loss of N. Of the three primary macro nutrients, plants require N in the largest amounts. N enhances rapid growth, increases leaf size and quality. Phosphorus is the second most important plant nutrient next to N and essential for development of the roots and reproductive organs. Sulphur is secondary macro plant nutrients and involve in protein synthesis. Boron is absorbed by plants as boric acid, which is easily leached in soils. Organic manure is comparatively low in nutrient content, so larger volume is needed to provide enough nutrients for crop growth. Integrated approach for the maintenance of soil productivity with the complementary use of both mineral and organic fertilizers offers a good opportunity to small scale farmers to maintain yields at reasonable and sustainable levels. So as a general, the supply of nutrients improves the exchange capacity of nutrients due to the increase of organic matter content of the soil. It increases soil water retention, slow release of nutrients and contribute to the residual pool of organic nitrogen and phosphorus in the soil. It enhances soil biological activity, which improves nutrient mobilization from organic and chemical sources and decomposition of toxic substances. Thus, the objective of this paper is to review on the effect of NPSB blended fertilizers and farmyard manure fertilizers application on yield and yield related traits of hot pepper.

Keyword: Pepper (Capsicum annuum L.), agronomic practice, NPSB Blended Fertilizers & Farm Yard Manure.
1. Introduction

Pepper (*Capsicum annuum* L.) is the world’s most important vegetable after tomato and used as fresh, dried or processed products, as vegetables and as spices or condiments (Acquaah, 2004). It is commonly grown crop worldwide as hot and sweet pepper. The crop is usually grown as herbaceous annual in temperate areas while it is a perennial shrub in the tropics and in climate-controlled greenhouses. The crop is well known by its phenotypic diversity in plant habit and especially in shapes, sizes, colors, pungency, and other qualities of the fruits. Peppers are third in importance in tropics among cultivated vegetables, primarily grown for their pungency, as good sources of vitamins A and C especially in fresh state (Abu et al., 2011).

Though the introduction of pepper in Ethiopia not certainly known, its cultivation is an ancient practice (MARC, 2004; EEPA, 2003). Pepper is the main parts of the daily diet of most Ethiopian (Dennis, 2013). The fine powdered pungent product is used as flavoring and coloring ingredient in the common traditional sauce “Wots”, while the green pod is consumed as a vegetable with other food items. The average daily consumption of hot pepper by Ethiopian adult is estimated 15g/day, which is higher than tomatoes and most other vegetables (MARC, 2004). The pepper has high market demand year round because dried ripe pods of many capsicum cultivars are utilized to prepare ground and crushed red pepper that increases the acceptance of the insipid basic nutrient foods (EEPA, 2003).

Despite the benefits of pepper and the increasing demand in Ethiopia, the hot pepper production both in green and dry forms is low due to lack of improved varieties, poor cultural practices and the prevalence of fungal and bacterial as well as viral diseases (Fekadu and Dandena, 2006). One of the major problems affecting food production in Africa including Ethiopia is the rapid depletion of nutrients in smallholder farms (Achieng et al., 2010). FAO (2009) report indicated that the estimated production of pepper in Ethiopia was 220,791 tons from 97,712ha in green form and 118,514 tons of dry pepper from an area of 300,000ha. This means that the average production of pepper in the country was 2.26 and 0.395t/ha of green and dry pepper respectively. In Ethiopia, it has been recommended to application of 200kg DAP and 100kg Urea per hectare or 92kg P₂O₅ and 82kgN/ha to produce maximum yield of hot pepper (EARO, 2004).

In the era of modern agriculture (since the Second World War), huge amount of chemical fertilizer, particularly nitrogen sources fertilizer have been used to double or even triple yields of food grains and other crops (Mahajan et al., 2008). In the short term, very good productivity can be seen from the use of chemical fertilizers. However, in the long term, many problems may occur, such as deterioration of soils physical properties, biological activities, and in general the total soil health and environmental damage (Mahajan et al., 2008; Masayoshi, 1990). The oversupply of nitrogen fertilizer alone makes plants more sensitive to diseases and pests by softening of plant tissue, and inhibits symbiotic nitrogen fixation by rhizobia. It enhances the decomposition of soil organic matter and cause the degradation of soil structure and nutrients as it is easily lost from soils through fixation, leaching or gas emission (Jen-Hshuan, 2006).

The supply of nutrients from organic fertilizers improves the exchange capacity of nutrients due to the increase of organic matter content of the soil. It increases soil water retention, slow release of nutrients and contribute to the residual pool of organic nitrogen and phosphorus in the soil. It enhances soil biological activity, which improves nutrient mobilization from organic and chemical sources and decomposition of toxic substances (Jen-Hshuan, 2006). However, the use of FYM alone as a substitute to inorganic fertilizer is not sufficient to maintain the present levels of crop productivity of high yielding varieties (Efthimiadou et al., 2010). On the other hand, heavy application of organic manure to agricultural soils has adverse effect in the long term due to accumulation of salt and heavy metal that adversely affect plant growth, soil organisms, water quality and animal and human health (Jen-Hshuan, 2006).

Therefore integrated nutrient management in which both organic manures and inorganic fertilizers are used simultaneously is the most effective method to maintain a healthy and sustainably productive soil (Dejene and Lemlem, 2011). The combined application of manure and nitrogen (50 kg N/ha+10 t/ha as well as 50 kg N/ha+20 t/ha) in Garlic also provided maximum mean fresh bulb weight of 55.43 and 55.17 t/ha respectively (Tadila, 2011). The highest yield (45.5 t/ha) of Brinjal in Bangladesh was also obtained from the combined application of 60% organic and 40% inorganic sources of nutrients...
(Ullah et al., 2008). Shuress et al. (2013) reported that the application of 50% FYM combined with 50% Urea fertilizer provided higher fruit yield of sweet pepper than other treatment combinations in Dovan, Palpa of Nepal. The combined application of 105 kg N/ha+92 kg P2O5 ha+10 t/ha FYM to tomato plant resulted in the highest (97.09 t/ha) fruit yield (Mohammed, 2014).

Farmlands are extremely deficient in nitrogen, available phosphorous and organic matter (Tesfay, 2006). The study by Mitiku et al. (2003) reported that 94% and 21% of the land has a very low level of organic carbon and total nitrogen (N) content as well as 98% low phosphorus content respectively. Most of the crop nutrients such as nitrogen, phosphorus, sulfur, boron and others are depleted (ATA, 2014) that may be amended by the application of organic matter and the production of pepper may be increased by the combined organic and inorganic fertilizers application. There is neither recommendation for the combined application of organic and inorganic fertilizers nor attempt in research to determine the optimum amount of the two fertilizers combinations for pepper production. Considering the importance of the crop in the area, the depletion of soil nutrient, the availability of irrigation facility, and absence of recommendation about the combined application of organic and inorganic blended fertilizers on pepper, therefore, it is necessary to conduct research that leads to make recommendation of economically feasible fertilizer application. Thus, the objective of this paper is to review on the effect of NPSB blended fertilizers and farmyard manure fertilizers application on yield and yield related traits of hot pepper.

2. Response of Hot Pepper (Capsicum annuum L.) to NPSB Blended Fertilizers and Farm Yard Manure

2.1 Importance of Hot Pepper

In many countries of the world, pepper is a cash crop with high domestic and export value (Getahun and Habitie, 2017). Pepper is an important and popular pungent cash crop for smallholder farmers in developing countries such as Ethiopia, Nigeria, Ghana, India, Pakistan, Bhutan, Indonesia, Cambodia, and Thailand (Lin et al., 2013). They were probably first used as medicinal plants to treat asthma, cough sand sore throats (Bosland and Votava, 2012). According to Lin et al. (2013), uses of pepper are generally grouped into five broad market categories: i) fresh market (green, red, multi-color whole fruits), ii) fresh processing (sauce, paste, canning, pickling), iii) dried spice (whole fruits and powder), iv) industrial extracts (paprika/oleoresin, capsaicinoids and carotenoids) and v) ornamental (plants and fruits). Capsicum consumption is increasing and may represent an important source of vitamins for world populations. The antioxidant vitamins C, E and pro-vitamin A as well as good sources of carotenoids and xanthophylls are present in high concentrations in various pepper types (Bosland and Votava, 2012).

Pepper is a very important crop not only in the fresh form but also row material for the processing industries, important cash crop to farmers, and a source of employment to urban and rural populations for spice extraction since it has a lot of oleoresin for dying of food items. Ethiopia is among few developing countries that have been producing paprika and Capsicum oleoresins for export market (Fekadu and Dandena, 2006).

2.2 Status of Pepper production in Ethiopia

According to CSA (2017) the production of both red and green peppers was 391598.6 tons, where vegetables accounted totally 812624.87 tons; thus, green and red peppers share 48.2% in terms of production. Generally, Oromia, Amhara, SNNP, Benishangul, and Tigray National Regional States are the leading in terms of total production in descending order of both green and red pepper with 176,791, 128,568, 73,826, 6948 and 5437 tons, respectively (CSA, 2017).

2.3 Production Potential and Constraints in Ethiopia

Hussen et al. (2013) reported increasing production of the hot pepper, which in turn has a great role to strengthen the growing vegetable industries in the country. The authors also reported that the production and productivity of the crop in the country is influenced by different factors among which improper plant spacing is one of the reasons of the low productivity of this crop. The major factors that limit vegetable crops production are shortage of cultivars and agronomic practice, poor quality seed,
poor irrigation systems, lack of information on soil fertility, diseases, high postharvest loss and poor marketing system (Lemma, 2002). However, the Government of Ethiopia has designed an ambitious Growth and Transformation Plan that foresees Ethiopia in the bracket of a middle-income country by 2020. Owing to the fact that Ethiopia has vast potential for agricultural production, the primarily focuses on boosting agricultural production (Tefera and Tefera, 2013).

Ethiopia is endowed with abundant agricultural resources with diverse physical features that allow the country to be divided into 18 major agro-ecological zones and 62 sub-zones. There are different agricultural investment opportunities in the cultivation of horticultural products. These includes market opportunities, diversified agro-ecological conditions to produce cool season crops (above 2400 meters, day temperatures ranging from freezing to 16°C), mid altitude crops (1500 – 2400 meters, day temperatures from 16 – 30°C) and warm season crops (below 1500 meters, day temperatures above 27°C) (Wiersinga and de Jager, 2009). Vegetable production in the country’s fertile areas is one of a strategy envisioned to help realize the GTP. Tomatoes are among the vegetables identified in the Growth and Transformation Plan as a high value vegetable (Tefera and Tefera, 2013).

2.4 Concept of Nutrient Uptake and Function of Some Nutrients

Factors that affect nutrient absorption are type of ion, soil pH, solubility of ion soil oxygen, temperature, and soil nutrient levels. Most of the nutrients that plants need are dissolved in water and then absorbed by the roots. Ninety-eight percent of these plant nutrients are absorbed from the soil solution, and only about 2% are actually extracted from soil particles by the roots (Flynn, 2010). In smallholder farming system, the causes of nutrient deficiency include high plant nutrient uptake, removal of entire crop residues, use of cattle dung as source of fuel energy for cooking, nutrient loss through leaching, P-fixation in acid soil and gaseous loss of N Aticho (2011) as cited by (Atichoet al., 2014).

2.4.1 Nitrogen Requirements for Hot Pepper

Of the three primary macro nutrients, plants require N in the largest amounts. N enhances rapid growth, increases leaf size and quality (Tucker, 1999). N being a major nutrient for plants is constituent of chlorophyll (enable the process of photosynthesis) and used as building block of amino acids and then protein. It also involves in catalization of chemical responses and transportation of electrons and present in many major portions of the plant body. N imparts dark-green color in plants, promotes leaves, stem and other vegetative growth. Moreover, N produces rapid early growth, improves fruit quality, and enhances the growth of leafy vegetables. It enhances the uptake and utilization of potassium, phosphorous and regulates overall growth and development of plant (Tucker, 1999; Bloom, 2015; Hemerly, 2016; Alhrout, 2017).

The available forms of N for the plants are ammonium and nitrateand contribute for synthesis of proteins. Soil concentrations of NO3-N and NH4-N influenced by biological activity; it also fluctuates with changes in temperature and moisture. Nitrate is easily leached from the soil with high rainfall or excessive irrigation. NH4-N usually does not accumulate in the soil; as soil temperature and moisture conditions suitable for plant growth they also are ideal for conversion of NH4-N to NO3-N (Horneck et al., 2011). Pepper plants were found to positively respond (by increasing canopy, number of flowers and fruits) to higher nitrogen concentrations than the usual norms for other crops (Chemicals, 2016). N is mobile in plants; upon deficiency it slows down plant growth, yellowing of leaves (chlorosis) and gradual drying beginning at leaf margins of the lower leaf veins, the petioles bend and hang downwards, development of few flowers and fruit setting (Flynn, 2010; Chemicals, 2016). Too much N in a plant results succulent growth, very dark green color, weak spindly growth, and not much fruit (Flynn, 2010).

2.4.2 Phosphorus Requirements for Hot Pepper

Phosphorus is the second most important plant nutrient next to N and essential for development of the roots and reproductive organs. It also contributes for cellular division and formation of energetic structures. It is needed for the seedling growth and establishment of the transplant; although plants actually use relatively small amounts of P when compared to N and K (Flynn, 2010; Chemicals, 2016).
It is needed for photosynthesis, sugar and starch formation, energy transfer and movement of carbohydrates (Hamza, 2008).

Phosphorus is absorbed in the form of H2PO4- or HPO42- ion. This complex does not leach readily from the soil and mobile in the plant once taken up from the soil. P is rapidly fixed with iron and aluminum when applied under acidic soil conditions and fixed as insoluble calcium phosphate in alkaline soils with Ca and unavailable to plants (Flynn, 2010; Simson and Straus, 2010). Excess P can induce N and micronutrient deficiencies such as Zn, Fe, and Co (Flynn, 2010). Phosphorous deficiency in plants causes too small and short branches, many undeveloped buds and less fruit, intense coloring, browning or purpling of foliage in some plants, thin stems, loss of lower leaves and reduced flowering (Hamza, 2008; Flynn, 2010; Chemicals, 2016).

2.4.3 Sulfur Requirements for Hot Pepper

Sulphur is secondary macro plant nutrients and involve in protein synthesis. S is present in the structure of the amino acids cysteine and methionine, both of which are important components of proteins (Hamza, 2008). Thus, it was currently suggested to be applied as chemical fertilizer like P and N by blending with other essential plant nutrients depending on soil nutrient deficiency. Its fertilization encourages the uptake of N, P, K and Zn in the plant; which results in increased crop productivity. Additionally, application of S containing fertilizer is a feasible technique to alleviate the uptake of toxic elements like Na and Cl as they act antagonistic to each other; thus, its application is useful for increasing crop production and improves soil conditions for healthy crop growth (Zhang et al., 1999).

Sulphur deficiency was little practical importance decades ago. However, in Ethiopia the idea of S deficiency has raised in recent years by soil mapping. Land degradation, crop residue removal, clearing and burning of forests and other vegetation, crop uptake, and use of non-S fertilizers are major causes of sulfur deficiency in the Rift Valley (Itanna, 2005; Simson and Straus, 2010; ATA, 2015). Maintenance of the soil organic matter, utilization of subsurface inorganic S and proper management of soils should maintain the S status of the soils in the future (Itanna, 2005).

Sulphur is absorbed as So4- ion form and constituent of amino acids, which in turn are building blocks for essential proteins in the plant. S is not mobile in the plant; thus, deficiency symptoms include a light green to yellowish color of young leaves, small and spindly plants, retarded growth rate, and delayed maturity. S can be leached from soil with excess rain and irrigation (Flynn, 2010).

2.4.4 Boron Requirements for Hot Pepper

Boron is absorbed by plants as boric acid, which is easily leached in soils. Globally, B deficiency has been recognized as the second most important micronutrient constraint in crops after zinc (Zn) (Ahmad, et al., 2014). Boron helps in the absorption of water and carbohydrate metabolism (Haque et al., 2011), translocation of carbohydrates in plants, DNA synthesis in meristems, cell division and elongation, active salt absorption, water relation and photosynthesis and involves indirectly in metabolism of nitrogen, phosphorous, fat and hormones. Due to the lack of boron, there is hypertrophy, degeneration and disintegration of cambium cells in the meristematic tissues. Its deficiency may cause sterility, small fruit size, and poor yield (Davis et al., 2003) and deficiency retards apical growth and development because of its impacts on cell development and on sugar formation and translocation. Boron also plays an important part in flowering and fruiting processes, N metabolism, hormonal action and cell division. Boron deficiency can be caused by high pH in the soil, the availability of B decreases when the pH is higher than 6.5-7.0 (Sims, 2000). Boron has also helped to reduce disease severity in some crops because of the effect that B has on plant metabolism, cell membranes and cell wall structure (Dordas, 2009).

2.5 Effect of farmyard manure on growth and yield of Hot pepper

Organic matter in the form of decayed leaves, compost, sawdust or animal manure applied to pepper field is a source of plant nutrients and acts as a soil conditioner. It increases the capacity of the soil to retain water and nutrients. It also promotes root growth and the infiltration of water and air into the soil. It increases the capacity of the soil to retain water and nutrients. It also promotes root growth and the
infiltration of water and air into the soil. Care should be taken to use, where applicable good quality organic matter known to be free of plant pathogens (Anonymous, 2014).

The application of farmyard manure to alkaline soils low in organic matter increase the solubility and plant uptake of zinc (Srivastava and Sethi, 1981). In alkaline soils (except Chernozems) the availability of phosphorus is generally low. As with zinc the concentration of phosphorus in the soil solution is determined primarily not by dissolution or precipitation of definite inorganic compounds such as tri-calcium phosphate, but by the desorption and adsorption of phosphorus, particularly in soils with more than 1% organic matter. In these soils, at least in the pH range 6-8, the phosphorus concentration in the soil solution may not decline but rather increase with pH (Welp et al., 1983). In alkaline soils of increasing pH and decreasing soil organic matter content, the equilibrium constants of inorganic phosphates become increasingly important for the concentration of phosphorus in the soil solution.

Manure and compost not only supply many nutrients for crop production including micronutrients, but it is also valuable sources of organic matter. Increasing soil organic matter improves soil structure or filth, increases the water-holding capacity of coarse textured sandy soils, improves drainage in fine-textured clay soils, provides a source of slow release nutrients, reduces wind and water erosion and promotes growth of earthworms and other beneficial soil organisms (Carl and Peter, 2005). The different types of farm manures are an interesting source of macro nutrients (N, P, K, Mg) and others like sulfur and calcium, zinc, copper, boron…) (Le Sillon, 2004). Most vegetable crops return small amounts of crop residue to the soil so manure, compost and other organic amendments help maintain soil organic matter levels (Carl and Peter, 2005).

Furthermore, Craig (2003) reported that many of the inorganic nutrients in manure are the same as those in as commercial fertilizer. Manure contains valuable plant nutrients, like nitrogen, phosphorus, potassium and sulfur. The nutrients in manure are a mixture of inorganic and organic forms (Aliyu, 2000). In a nutrient practice of semi-arid areas of Senegal, 10 t/ha organic manure was recommended to best grow pepper (Bosland and Votava, 2000). Awodun et al; (2007) reported that application of 10t/ha goat dung provided higher yield of sweet pepper. Farmyard manures are responsible to nutrient availability for the crop in demand, improve soil physical properties (aggregation) and hence improve water retention capacity, infiltration rate and biological activity of the soil (Aliyu, 2000). Farmyard manure is mostly available and produced in farms, and is an important organic resource for agricultural production in livestock based farming systems in many countries including semi-arid regions of India (Satya Narayana et al., 2002). The advantage of farmyard manure however, greatly depends on proper application methods which increase the value, reduce cost and effectiveness of the crop (Teklu et al., 2004).

Tutia et al. (2013) reported that application of 10 and 20 t FYM/ ha increase pepper yields by 30.8% and 71.0% respectively over no farmyard manure applied. Application of FYM has greater influence on the number of fruits per plant of pepper (Tutia et al., 2013). This increase in yield and yield attributing traits was due to improvement in the level of carbohydrates owing to greater photosynthesis and ultimately increase in number and weight of the fruit (Tutia et al., 2013). However, organic manure/organic matter alone are not sufficient and often not available in large quantities for the level of crop production and mineral fertilizers have to be applied in addition (FAO, 2000). Organic manure is comparatively low in nutrient content, so larger volume is needed to provide enough nutrients for crop growth.

2.7 Effect of integrated use of manure and inorganic fertilizer on growth and yield of Hot pepper

Vegetable crops put tremendous pressure on soil for nutrient demand because of their high productive ability. As such, generous application of fertilizers is needed to meet their nutritional requirements (Gopinath et al., 2009). However, in the wake of energy crisis and the ever-increasing price of chemical fertilizers, there is a need to reduce the dependence on such a costly input (Srivastava et al., 2009). This can be accomplished through an integrated nutrient management which involves conjunctive use of chemical fertilizers and organic manures to sustain crop production and maintenance of soil health (Gopinath et al., 2009; Srivastava et al., 2009).
Ofori et al; (2005) reported that integrated approach for the maintenance of soil productivity with the complementary use of both mineral and organic fertilizers offers a good opportunity to small scale farmers to maintain yields at reasonable and sustainable levels. Considering cost of inorganic fertilizer and its negative effects on the environment, reduced usage at half the recommended rate combined with half rates of farmyard manure is feasible farmers, soil and environment (Muriithi and Irungu, 2004). Thus the negative impacts of chemical fertilizers coupled with their high prices have prompted the interest in the use of organic fertilizers as source of nutrients. Organic fertilizer application has been reported to improve crop growth by supplying plant nutrients including micro-nutrients as well as improving soil physical, chemical and biological properties thereby provide a better environment for root development by improving the soil structure (Dejene and Lemlem, 2011). Clean agriculture recently depends upon using organic and bio fertilizers in order to produce high yields with the best fruit quality without contamination and less accumulation with heavy metals.

Abdi -El-Hakeem (2003) reported that nitrogen fertilizers had not enough phosphorus and potassium to cover sweet pepper requirements so as plants low vegetative growth. According to his report, the sweet pepper supplied with 60 kg organic-N plus P and K as super phosphate and potassium sulphate per hectare encouraged vegetative growth of sweet pepper.

3. Summary and Conclusions

Pepper (Capsicum annuum L.) is the world’s most important vegetable after tomato and used as fresh, dried or processed products, as vegetables and as spices or condiments. The supply of nutrients improves the exchange capacity of nutrients due to the increase of organic matter content of the soil. It increases soil water retention, slow release of nutrients and contribute to the residual pool of organic nitrogen and phosphorus in the soil. It enhances soil biological activity, which improves nutrient mobilization from organic and chemical sources and decomposition of toxic substances.

The major factors that limit vegetable crops production are shortage of cultivars and agronomic practice, poor quality seed, poor irrigation systems, lack of information on soil fertility, diseases, high postharvest loss and poor marketing system. In smallholder farming system, the causes of nutrient deficiency include high plant nutrient uptake, removal of entire crop residues, use of cattle dung as source of fuel energy for cooking, nutrient loss through leaching, P-fixation in acid soil and gaseous loss of N. Of the three primary macro nutrients, plants require N in the largest amounts. N enhances rapid growth, increases leaf size and quality. Phosphorus is the second most important plant nutrient next to N and essential for development of the roots and reproductive organs. Sulphur is secondary macro plant nutrients and involve in protein synthesis. Boron is absorbed by plants as boric acid, which is easily leached in soils. Organic manure is comparatively low in nutrient content, so larger volume is needed to provide enough nutrients for crop growth. Integrated approach for the maintenance of soil productivity with the complementary use of both mineral and organic fertilizers offers a good opportunity to small scale farmers to maintain yields at reasonable and sustainable levels.

Considering the importance of the crop in the area, the depletion of soil nutrient, the availability of irrigation facility, and absence of recommendation about the combined application of organic and inorganic blended fertilizers on pepper, therefore, it is necessary to conduct research that leads to make recommendation of economically feasible fertilizer application.

As to recommendation Hot pepper crops production put tremendous pressure on soil for nutrient demand because of their high productive ability. To increase the production and the productivity of hot pepper the grower should use:

- Integrated nutrient management in which both organic manures and inorganic fertilizers are used simultaneously which is the most effective method to maintain a healthy and sustainably productive soil.
- Considering cost of inorganic fertilizer and its negative effects on the environment, reduced usage at half the recommended rate combined with half rates of farmyard manure is feasible farmers, soil and environment.
- Care should be taken to use, where applicable good quality organic matter known to be free of plant pathogens.
The amount of fertilizer to be applied should depend on soil fertility, fertilizer recovery rate and organic matter, soil mineralization of nitrogen and soil leaching of N.

Organic manure/organic matter alone are not sufficient and often not available in large quantities for the level of pepper production and mineral fertilizers have to be applied in addition.

Organic manure is comparatively low in nutrient content, so larger volume should be needed to provide enough nutrients for crop growth.

Finally, considering the importance of the crop in the area, the depletion of soil nutrient, the availability of irrigation facility, and absence of recommendation about the combined application of organic and inorganic blended fertilizers on pepper, it is necessary to conduct research that leads to make recommendation of economically feasible fertilizer application.

4. Acknowledgment

We would heartedly like to thank and praise the Lord Almighty God in giving me strength and wellbeing to successfully complete the study. We sincerely thank Sebeta town administration office for all necessary support. We also want to thanks all the data collectors who help me in data collection and for all their concern and moral support. Finally, all the reference materials used in this article are dully acknowledged

5. Conflict of Interest

Regarding the publication of this manuscript, there is no any conflict of interest.

6. References


