Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

Effect of NPK Fertilizer on Growth and Yield Components of Maize and Chilli Pepper in Intercropping Systems under Tamil Nadu Conditions

[1]Kavya R., [2]Keerthana S., [3]Lakshmi Priya M., [4]Priyanka K., [5]Rashmi H.

[1,2,3,4,5]Anbil Dharmalingam Agricultural College and Research Institute – Tiruchirappalli, Tamilnadu, India

Abstract: The adoption of intercropping systems with optimized nutrient management is critical for enhancing productivity and profitability for smallholder farmers in Tamil Nadu. This review synthesizes evidence from field experiments conducted across Tamil Nadu on the effects of NPK fertilizer application on the growth and yield components of maize (Zea mays L.) and chilli pepper (Capsicum spp.) in intercropping systems. Research from Tamil Nadu Agricultural University and various research stations demonstrates that the recommended dose of fertilizer (RDF) for maize-chilli intercropping systems typically ranges from 120:60:60 to 90:80:80 kg N:P_2O_5:K_2O ha^{-1}, depending on the specific agro-ecological zone and cropping system. Studies indicate that intercropping systems with fertilizer application based on Soil Test Crop Response (STCR) - Integrated Plant Nutrient Supply System (IPNS) can yield up to 17.8 t ha^{-1} for cassava and 1.6 t ha^{-1} for chilli in agroforestry systems. Economic analyses reveal that integrated nutrient management (INM) practices, combining inorganic fertilizers with organic sources such as farmyard manure (FYM) at 12.5 t ha^{-1} and vermicompost, record higher benefit-cost (B:C) ratios and net returns. Redgram intercropping with greengram under integrated phosphorus management recorded a net return of ₹51,810 ha^{-1} with a B:C ratio of 2.74. This review highlights that for Tamil Nadu's diverse agro-ecological zones, site-specific fertilizer recommendations integrating organic and inorganic nutrient sources are essential for maximizing the productivity and profitability of maize-chilli intercropping systems while sustaining soil health.

Keywords: Maize, chilli pepper, intercropping, NPK fertilizer, Tamil Nadu, integrated nutrient management, benefit-cost ratio.

1. Introduction

Tamil Nadu, one of India's most agriculturally productive states, faces the challenge of sustaining crop productivity on limited land resources while ensuring profitability for its predominantly smallholder farming community. The state's diverse agro-ecological zones, ranging from the Western Ghats to the coastal plains and the rainfed districts of the south, present both opportunities and challenges for crop intensification. Intercropping, the practice of growing two or more crops simultaneously on the same land, has emerged as a promising strategy to enhance land use efficiency, diversify farm income, and improve resource use efficiency in Tamil Nadu's agricultural systems. Maize (Zea mays L.) and chilli pepper (Capsicum spp.) intercropping is particularly relevant for Tamil Nadu's farming systems. Chilli is the fourth major crop cultivated globally and India is the world's largest producer, with Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra accounting for approximately 75% of the country's chilli farming area. The variety KKM Ch-1, developed for Tamil Nadu conditions, has shown promising performance as an intercrop under various cropping systems.

The judicious application of NPK fertilizer is fundamental to achieving optimal crop growth and yield in intercropping systems. Nitrogen promotes vegetative growth and photosynthetic capacity, phosphorus supports root development and flowering, while potassium enhances stress tolerance and fruit quality. However, the effectiveness of fertilizer application in intercropping systems is influenced by complex interspecific interactions, including competition for nutrients and facilitative effects through root exudates and microbial activity. Research from Tamil Nadu has demonstrated that integrated nutrient management practices, combining inorganic fertilizers with organic sources such as farmyard manure (FYM) and vermicompost, can significantly enhance crop productivity while improving soil health. In the North Western Zone of Tamil Nadu, higher system groundnut equivalent yield

Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

was recorded with FYM @ 12.5 t ha^{-1} along with 100% recommended dose of fertilizer, accompanied by higher B:C ratios and net returns.

This review aims to synthesize current scientific evidence from Tamil Nadu on the effect of NPK fertilizer on the growth and yield components of maize and chilli pepper in intercropping systems, with specific emphasis on economic returns and the integration of organic nutrient sources.

2. NPK Fertilizer Recommendations for Maize-Chilli Intercropping in Tamil Nadu

2.1 Recommended Fertilizer Doses

The recommended dose of fertilizer for maize and chilli in intercropping systems varies across Tamil Nadu's different agro-ecological zones. Research conducted at Tamil Nadu Agricultural University, Coimbatore, and various research stations has established baseline fertilizer recommendations for these crops.

For chilli pepper as an intercrop, the recommended fertilizer dose is typically 120:80:80 kg N:P_2O_5:K_2O ha^{-1}. In agroforestry systems, studies have examined chilli intercropping with fertilizer applications at 100% RDF (60:80:80 kg N:P_2O_5:K_2O ha^{-1}), 125% RDF (75:100:100 kg ha^{-1}), and 150% RDF (90:120:120 kg ha^{-1}). The Soil Test Crop Response - Integrated Plant Nutrient Supply System (STCR-IPNS) based recommendation, which tailors fertilizer application to soil test values, has shown superior results in sustaining yields and soil fertility.

For maize, recommended fertilizer doses vary depending on the cropping system and the specific variety. In the maize + fodder cowpea (1:1) cropping system evaluated in the North Western Zone, nutrient management practices included FYM at 12.5 t ha^{-1} along with variable fertilizer levels of 100%, 75%, and 50% of the recommended dose.

2.2 Nutrient Uptake Patterns

Nutrient uptake patterns in maize-chilli intercropping systems are influenced by interspecific competition and complementarity. Research has shown that higher uptake of N, P, and K with lower nutrient balance is observed when crops are grown in intercropping systems compared to sole cropping. Application of nitrogen at higher levels (40 kg N ha^{-1}) registered higher post-harvest soil available nutrients over lower levels of N application.

In the Western Zone of Tamil Nadu, studies on intercropping systems and nitrogen levels revealed that nutrient balance sheets and yield of component crops are significantly influenced by both the intercropping arrangement and the nitrogen application rate. The coriander + mustard intercropping system in 2:1 ratio was identified as better for realizing higher system productivity and economic returns, with a mustard equivalent yield of 1227 kg ha^{-1}.

3. Growth and Yield Performance with NPK Fertilization

3.1 Chilli Pepper Growth and Yield

Field experiments conducted in the Thoothukudi district of Tamil Nadu have demonstrated the importance of nutrient management for chilli growth and yield in intercropping systems. The chilli variety KKM Ch-1, when grown as an intercrop under palmyrah plantations with the recommended fertilizer dose of 120:80:80 kg NPK ha^{-1}, showed significant growth and yield responses to foliar nutrient applications.

The application of biostimulants in addition to the recommended NPK fertilizer dose further enhanced chilli performance. Panchagavya spray at 3% concentration recorded the maximum plant height at 30 (25.48 cm), 60 (56.79 cm), and 90 days after transplanting (70.75 cm), along with the highest number of branches and early flowering. Yield attributes were also significantly improved, with individual fruit weight of 2.18 g, 78.20 fruits per plant, and a fresh yield of 6.30 t ha^{-1} under the Panchagavya treatment. In Dalbergiasissoo-based Horti-silvicultural systems in Trichy district, research showed that chilli yields of 1.6 t ha^{-1} were

Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

achieved with fertilizer application based on STCR-IPNS recommendations. The study noted that fertilizers applied to the intercrops contributed to the nutrient requirement of the tree crop, thereby reducing the overall cost of cultivation.

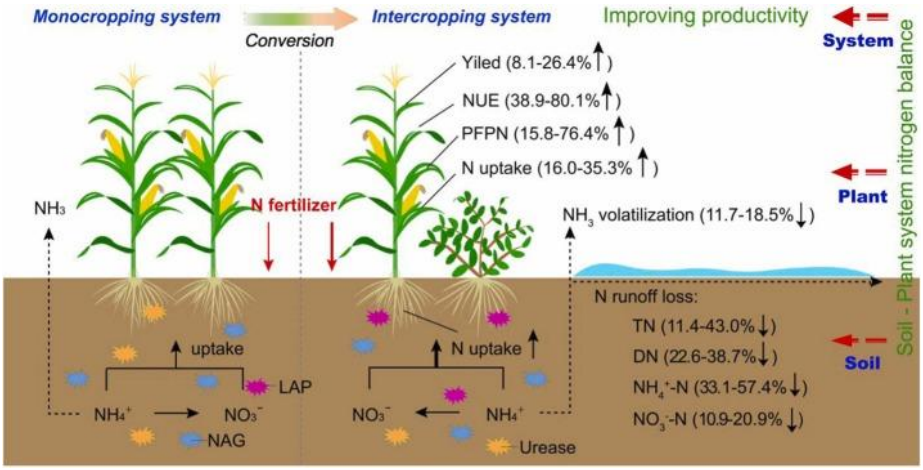

Figure 1: Intercropping-driven nitrogen

3.2 Maize Yield Components

Maize yield components in intercropping systems respond positively to optimized NPK fertilization. In the North Western Zone of Tamil Nadu, studies on diversified intensive cropping systems have shown that higher system groundnut equivalent yield is achieved with FYM @ 12.5 t ha^{-1} along with 100% recommended dose of fertilizer.

The performance of maize in intercropping systems is influenced by the row ratio and the companion crop. Studies on finger millet intercropping with black gram at a 4:1 ratio, which is relevant to the broader context of cereal-legume intercropping, demonstrated taller plants (92.7 cm), more productive tillers (5.7 per plant), and higher equivalent grain yield (2895 kg ha^{-1}) with a favourable benefit-cost ratio of 2.84.

3.3 System Productivity and Resource Use Efficiency

The overall productivity of maize-chilli intercropping systems, as measured by system equivalent yield and land equivalent ratio, is enhanced by optimized NPK fertilization. Research from Tamil Nadu has established that integrated nutrient management practices can significantly improve system productivity while reducing input costs.

In redgram intercropping systems, the higher redgram grain equivalent yield (1207 kg ha^{-1}) was recorded under redgram intercropped with greengram. The application of 62.5 kg P_2O_5 ha^{-1} (125% of recommended P) in combination as SSP (1/3rd) + enriched Mussoorie rock phosphate (2/3rd) along with phosphobacteria registered higher yield in redgram.

4. Economic Analysis and Profitability

4.1 Cost of Cultivation and Returns

The economic viability of maize-chilli intercropping systems in Tamil Nadu depends significantly on the nutrient management strategy adopted. Research from Tamil Nadu Agricultural University provides detailed cost and return analyses for various intercropping systems with different nutrient management approaches. For integrated nutrient management in winter maize-based intercropping systems, the cost of cultivation varied significantly based on the proportion of inorganic and organic nutrient sources. Application of 50% N through inorganic urea + 50% N through organics involved a maximum cost of ₹58,786 ha^{-1} for cultivation, which was ₹6,675 ha^{-1} (12.81%) and ₹14,036 ha^{-1} (31.36%) more than 75% inorganic + 25% RDN through organic and 100% RDN

Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

through inorganic, respectively.

In the whole cropping system context, the maximum cost of cultivation was ₹79,886 ha^{-1} with 50% N through inorganic + 50% N through organics, which was ₹6,675 ha^{-1} (9.12%) and ₹14,036 ha^{-1} (21.32%) more than 75% inorganic + 25% RDN through organic and 100% RDN through inorganic, respectively.

4.2 Net Returns and Benefit-Cost Ratios

Economic analyses reveal that integrated nutrient management practices can significantly enhance net returns in intercropping systems. Application of 75% inorganic + 25% RDN through organic recorded significantly higher system gross return during 2013-14 (₹125,605 ha^{-1}), 2014-15 (₹143,621 ha^{-1}), and on mean basis (₹134,600 ha^{-1}) over other INM practices.

In redgram intercropping systems, integrated application of SSP (1/3rd) and enriched MRP (2/3rd) with phosphobacteria registered a net return of ₹51,810 ha^{-1} with a benefit-cost ratio of 2.74.Redgram intercropped with greengram followed by redgram intercropped with soybean recorded corresponding net returns of ₹48,141 ha^{-1} and B:C ratio of 2.29.

Finger millet-black gram intercropping at a 4:1 ratio demonstrated a favourable benefit-cost ratio of 2.84, highlighting its potential for improving profitability. Similarly, the maize + fodder cowpea (1:1) cropping system with FYM @ 12.5 t ha^{-1} and 100% recommended dose of fertilizer recorded higher B:C ratios and net returns in the North Western Zone of Tamil Nadu.

4.3 Integrated Nutrient Management Economics

The economic advantages of integrated nutrient management extend beyond immediate crop returns to include long-term soil fertility benefits. Application of 100% RDN as inorganic fertilizer fetched significantly higher system net return of ₹56,319 ha^{-1} over application of 75% inorganic + 25% RDN through organic during one year, while the INM practice was found best in the subsequent year, earning ₹70,410 ha^{-1}.

On the basis of the whole cropping system, the INM practice of 75% inorganic + 25% RDN through organic was established as a profitable INM protocol, increasing system net return by 0.26% and 36.61% compared to 100% RDN through inorganic and 50% N through inorganic + 50% N through organics, respectively.

5. Integrated Nutrient Management and Soil Health

5.1 Combined Use of Organic and Inorganic Fertilizers

Research from Tamil Nadu has consistently demonstrated the benefits of integrating organic and inorganic nutrient sources for sustaining soil health while maintaining crop productivity. In aerobic rice cultivation at Tamil Nadu Agricultural University, Coimbatore, the incorporation of dhaincha (Sesbaniaaculeata) intercropping along with half dose of RDN from inorganic fertilizer + quarter dose of RDN from enriched FYM + quarter dose of RDN from vermicompost + AM fungi + foliar nutrients recorded the highest soil microbial biomass, enzyme activity, and yield (3,777 and 4,599 kg ha^{-1}).

This integrated approach serves as a sustainable and effective strategy to improve soil health, enhance biological indicators, and increase crop yields under Tamil Nadu conditions. The study recommended that combined use of organic and inorganic nutrient sources serves as a sustainable and effective strategy to improve soil health, enhance biological indicators and increase the yield of aerobic rice.

5.2 Soil Biological Indicators and Nutrient Cycling

Integrated nutrient management practices have been shown to enhance soil biological activity and nutrient cycling in Tamil Nadu's cropping systems. The application of organic sources such as FYM and vermicompost increases soil microbial biomass, enzyme activity, and the availability of plant nutrients. Studies in the North Western Zone of Tamil Nadu demonstrated that FYM at

Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

12.5 t ha^{-1} along with recommended fertilizer doses improved soil fertility status and supported higher crop yields. The incorporation of green manures such as dhaincha has also been shown to improve soil organic matter content and nutrient availability in intercropping systems.

6. Conclusion

This review has examined the effect of NPK fertilizer on the growth and yield components of maize and chilli pepper in intercropping systems under Tamil Nadu conditions, and several key conclusions emerge from the synthesis of research evidence from the state. The recommended dose of fertilizer for chilli in intercropping systems is typically 120:80:80 kg $N:P_2O_5:K_2O$ ha^{-1}, while Soil Test Crop Response - Integrated Plant Nutrient Supply System (STCR-IPNS) based recommendations have shown superior results in sustaining yields and soil fertility across different zones. Integrated nutrient management, combining inorganic fertilizers with organic sources such as farmyard manure at 12.5 t ha^{-1} and vermicompost, significantly enhances crop yields and system productivity, with economic analyses revealing that application of 75% inorganic nitrogen combined with 25% recommended dose of nitrogen through organic sources represents a profitable INM protocol, increasing system net return by 0.26% over 100% inorganic nitrogen and 36.61% over 50% inorganic plus 50% organic nitrogen sources. Furthermore, biostimulants such as Panchagavya at 3% concentration complement NPK fertilization, enhancing chilli growth and achieving up to 6.30 t ha^{-1} fresh yield when applied as a foliar spray. Intercropping systems with optimized nutrient management provide higher system equivalent yields and benefit-cost ratios compared to sole cropping systems, while the combined use of organic and inorganic nutrient sources improves soil biological indicators, microbial biomass, and enzyme activity, contributing to long-term soil health and sustainability. The diversity of Tamil Nadu's agro-ecological zones necessitates site-specific fertilizer recommendations that consider soil characteristics, cropping systems, and available organic resources. The findings underscore the importance of integrated nutrient management approaches that combine inorganic NPK fertilizers with locally available organic resources for maximizing the productivity and profitability of maize-chilli intercropping systems in Tamil Nadu, enabling smallholder farmers to reduce input costs while sustaining soil fertility and crop yields. Future research should focus on refining fertilizer recommendations for specific agro-ecological zones, evaluating the long-term effects of integrated nutrient management on soil health, and developing decision support tools for farmers to optimize fertilizer application in intercropping systems.

REFERENCES

[1] Integrated Nutrient Management in Winter Maize-based Intercropping Systems. Shodhganga, INFLIBNET.
[2] Sangothari, A., Radhamani, S., & Gnanachitra, M. (2025). Effect of combined use of organic and inorganic sources of nutrients on soil biological indicators and yield in aerobic rice (Oryzasativa).FAO/AGRIS.
[3] Chandrasekaran, R., Solaimalai, A., Jayakumar, M., & Surendran, U. (2023). Assessment of Intercropping Systems and Nitrogen Levels on Nutrient Balance and Yield of Crops Under Irrigated Condition in Western Zone of Tamil Nadu. Communications in Soil Science and Plant Analysis, 54, 2675-2682.
[4] Yasodha, M., & Chinnusamy, C. (2022). Production and Profitability of Diversified Intensive Cropping System Suitable for North Western Zone of Tamil Nadu.Indian Journal of Agricultural Research.
[5] Nandhini, M., Manivannan, M. I., Premalakshmi, V., Theradimani, M., Srinivasan, S., Sabarinathan, K. G., & Kennady, N. R. (2024). Effects of biostimulants on growth, yield, and quality of chili intercropped with palmyrah. Plant Science Today, 11(sp4), 01-10.
[6] Chandrasekaran, R., Solaimalai, A., Jayakumar, M., & Surendran, U. (2023). Assessment of Intercropping Systems and Nitrogen Levels on Nutrient Balance and Yield of Crops Under Irrigated Condition in Western Zone of Tamil Nadu. Communications in Soil Science and Plant Analysis, 54(19), 2675-2683.
[7] Yasodha, M., & Chinnusamy, C. (2022). Production and Profitability of Diversified Intensive Cropping System Suitable for North Western Zone of Tamil Nadu.INFLIBNET.
[8] Intercropping in Juvenile Coconut Plantations. Tamil Nadu Agricultural University, RAWE Success Stories.
[9] Econometric Analysis and Intercropping Nutri-cereals with Legumes (Urad Bean, Arhar) on Climate Resilience in North Eastern Zone of Tamil Nadu. Legume Research: An International Journal.
[10] Shanmugam, P. M. (2025). Synergistic agronomic practices in redgram (Cajanuscajan) productivity and soil health

Journal of Recent Trends in Agriculture and Natural Science
Volume 2, Issue 2, Pages 36-41, 2026 (April-June)
ISSN (online): 3139-1494
DOI: https://doi.org/10.47001/JRTANS/2026.202004
Available Online at https://jrtans.com

enhancement under semi-arid tropics. The Indian Journal of Agricultural Sciences.

[11] Shanmugam, P. M. (2025). Synergistic agronomic practices in redgram (Cajanuscajan) productivity and soil health enhancement under semi-arid tropics. DOAJ.

[12] Sivakumar, K., Ramah, K., Surendran, U., Kaleeswari, R. K., & Jayakumar, M. (2022). Assessment of compatibility of intercrops in Dalbergiasissoo based Hortisilvicultural system in Mondipatty, Manapparai block of Trichy district, Tamil Nadu. FAO/AGRIS.

Citation of this Article:

Kavya R., Keerthana S., Lakshmi Priya M., Priyanka K., & Rashmi H. (2026). Effect of NPK Fertilizer on Growth and Yield Components of Maize and Chilli Pepper in Intercropping Systems under Tamil Nadu Conditions. *Journal of Recent Trends in Agriculture and Natural Sciences.* 2(2), 36-41. Article DOI: https://doi.org/10.47001/JRTANS/2026.202004

***** End of the Article *****