Boosting Spice Production under Coconut Gardens of Kerala: Maximizing Yield of Turmeric with Balanced Fertilization

By M. Meerabai, B.K. Jayachandran, K.R. Asha, and V. Geetha

A two-year field study was conducted on turmeric intercropped under partial shade of coconut. Results indicated that turmeric responded to higher nitrogen (N) and potassium (K) fertilizer application. Proper nutrition produced higher yield and net profit compared to turmeric supplied with state fertilizer recommendations.

Turmeric is a spice used extensively by all classes of people in India and is one of India's most ancient and traditional export commodities. The healing property of turmeric has long been acknowledged by practitioners of traditional medicine. Scientists working in the U.S. and Britain have found evidence supporting claims that turmeric acts as an anti-cancer agent (Anonymous, 1994). Alleppey turmeric from Kerala is highly profitable as an internationally accepted variety (Thampi, 1997). The turmeric industry is emerging stronger year after year with increased production capabilities and product range. India continues to be the largest producer (659,000 tonnes) from an area of 147,000 ha and earns about 461 million rupees (Rs.) annually (George, 1997).

The agro-climatic conditions in Kerala state are favorable for successful turmeric cultivation. Thus Kerala can play a predominant role in turmeric production by improving productivity through balanced fertilizer use. However, area expansion as an individual crop is limited due to scarcity of cultivable land in Kerala.

Coconut is a widely spaced (i.e., 7.6 m x 7.6 m) crop with minimal root density in the top 30 cm of soil. Also, lateral spread of most tree roots is confined within a two meter radius of the tree base. Turmeric is shallow rooted with 95 percent of its roots confined to the top 30 cm of soil. This combination of root distribution makes turmeric and coconut a compatible, agronomically sound, and economically viable cropping system.

A cultivar's genetic potential and environmental setting usually control crop yield. However, crop nutrition plays an important role by allowing full exploitation of a cultivar's genetic potential. Quite often it also plays a crucial role in overcoming biotic and abiotic stresses. Earlier experiments conducted on open field conditions indicated significant improvements in rhizome yield of turmeric with increased N levels up to 120 kg N/ha (Singh *et. al.,* 1992). Similarly, Thamburaj (1991) reported a favorable effect on yield with increased K up to 90 kg K_2O/ha. Kerala Agricultural University (KAU, 1996) recommends 30-30-60 kg N-P_2O_5-K_2O/ha for turmeric grown in open field conditions, but these recommendations are not suitable for turmeric grown in shaded areas of coconut gardens.

Materials and Methods

The field study was undertaken at Vellayani, Kerala during 1998-2000. The experimental site was lateritic, sandy clay loam in texture, pH 4.4, low in available N, K, boron (B), and zinc (Zn). Other nutrients were near optimum. The experiment was conducted in a randomized block design with 14 treatments each and replicated three times. Treatments were determined by initial soil test values and soil requirements based on sorption/fixation studies. They consisted of selected combinations of four levels of N (30, 60, 90, 120 kg N/ha), two levels of P (0, 30 kg P_2O_5/ha), and four levels of K (60, 120, 180, 240 kg K_2O/ha). Blanket applications of 10 kg Zn/ha and 2 kg B/ha were also provided. These treatments were compared with the state fertilizer recommendations and a control. Nutrients were supplied in the form of urea, mussoriephos (rock phosphate), muriate of potash, elemental sulfur (S), and borax. Zinc oxide (ZnO) was the Zn source. All the P and micronutrients and half the N and K were supplied basally. The remaining N and K were given one month after planting. The remaining recommended cultural practices were applied uniformly for all treatments (KAU, 1996).

Results

Averaged over two years, graded N rates applied with 120 kg K_2O/ha raised turmeric yields from 16.2 to 19.8 t/ha (**Table 1**). Similarly, incremental rates of K applied along with 90 kg N/ha increased fresh rhizome yields from 16.5 to 19.3 t/ha. Sufficient soil P prevented a significant response to P application. Application of 120-120-2-10 kg N-K_2O-B-Zn/ha resulted in the highest average rhizome yield of 19.8 t/ha over two years. These rates could be considered necessary for a maximum economic yield (MEY). This MEY recommendation produced a 25 percent higher yield compared to the current state fertilizer recommendation (**Table 2**).

Table 1. Selected responses of N and K on fresh rhizome yield of turmeric, Kerala, India.

Nutrient	Rate, kg/ha	Fixed rates[1], kg/ha	Fresh rhizome yield, t/ha 1998-99	1999-2000	Average
N	30		17.6	14.7	16.2
	60	K_2O (120)	19.4	14.9	17.1
	90		20.5	16.1	18.3
	120		23.0	16.6	19.8
K_2O	60		18.4	14.6	16.5
	120	N (90)	20.5	16.1	18.3
	180		21.2	16.5	18.8
	240		21.4	17.1	19.3

[1]Blanket rates applied to all treatments: 2 kg B/ha, 10 kg Zn/ha.

Table 2. Effect of selected nutrient rates on fresh rhizome yield of turmeric, Kerala, India.

Treatments N	Treatments K_2O	Average fresh rhizome yield, t/ha	Net returns, Rs/ha	Benefit: cost ratio
State recommendation[1]		15.8	92,824	2.15
90	60	16.5	93,013	2.05
90	120	18.3	112,565	2.26
120	120	19.8	128,788	2.44

[1]30-30-60 kg N-P_2O_5-K_2O/ha; all treatments received 2 kg B/ha and 10 kg Zn/ha except for the state recommendation.

Despite the higher rates of nutrients prescribed by the MEY recommendation, the MEY system produced net returns equivalent to US$2,862/ha and a benefit:cost ratio of 2.44. This income is in addition to income from coconut harvest from the same land. The MEY recommendation provided farmers additional profit equivalent to US$799 on every hectare of coconut garden turmeric production when compared to current state fertilizer recommendations. As a high value, export-oriented crop, this economic comparison should be of interest to farmers, extension workers, and policy-makers.

Conclusion

This study indicates the present state fertilizer recommendation for turmeric is insufficient when turmeric is intercropped in coconut gardens. Higher yields for turmeric grown under such conditions can be achieved with higher doses of N and K applied in a balanced manner. Application of 120 kg N and 120 kg K_2O/ha, along with micronutrients such as B (2 kg B/ha) and Zn (10 kg Zn/ha), produced MEY. Inclusion of P would be necessary in soils testing low and medium in available P. This practice was found to be agronomically sound and economically beneficial. Results of these studies also suggest that higher yields could be achieved using higher fertilizer application rates under open field conditions. Further research with higher levels of N and K is needed to find a true MEY. **BCI**

M. Meerabai and B.K. Jayachandran are Associate Professors and K.R. Asha and V. Geetha are Research Associates in the College of Agriculture, Kerala Agricultural University, Vellayani, Thiruvananthapuram, Kerala.

Acknowledgement

The authors are thankful to PPIC for funding the research project.

References

Anon. 1994. Turmeric – an anti-cancer agent. Spice India 7 (6): 13.

George, M.V. 1997. Status of Plantation Crops in India. J. Plantation Crops 25 (1): 1-14.

KAU. 1996. Package of practices recommendations –'Crops'. Directorate of Extension, Mannuthy, Kerala Agricultural University, Kerala.

Singh, V.B., B. Swer, and P.P. Singh. 1992. Influence of nitrogen and potassium on yield and quality of turmeric cv. Lakading. Indian Cocoa Arecanut and Spices J. 15: 106-108.

Thamburaj, S. 1991. Research on spice crops at TNGDNAU. Spice India. 4 (3): 17-21.

Thampi, P.S.S. 1997. The wonderland of turmeric. Spice India. 10 (4): 5.