

Designer Foliar Micronutrient Formulations for Enhanced Yield and Quality in Major Spice Crops

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Micronutrients are those essential elements like copper, manganese, zinc, iron, boron, molybdenum, sulphur, etc., which are required by plants in very small amounts. Besides promoting plant metabolic activities and growth of the plants, they play a major role in improving quality, size, earliness, disease resistance, input use efficiency of nitrogen, phosphorus and potassium (NPK) fertilisers, etc.

About 48.1% of Indian soils are deficient in available zinc, 11.2% in iron, 7% in available copper and 5.1% in available manganese.

Besides, deficiencies of boron and molybdenum are also becoming yield limiting and soils with multi-micronutrient deficiencies are also reported. Hence, straight or complex fertilisers with just nitrogen, phosphorus and potassium will not be enough to fully exploit the potential of crops and cropping systems.

Indian Institute of Spices Research (IISR), Kozhikode, Kerala, an R&D institution under the Indian Council of Agricultural Research, Ministry of Agriculture, Government of India, has developed crop specific/designer

micronutrient foliar formulations for major spices (black pepper, ginger, turmeric, cardamom) to correct the micronutrient deficiencies in soil and to meet the physiological and metabolic requirement of the crop by maintaining optimal nutrient ratio of secondary (magnesium) and micronutrients (zinc, boron, manganese, copper, etc.) in the leaf. This crop-specific micronutrient mixture is recommended as a foliar spray and guarantees 10 to 25% increase in yield while also improving the quality of the crop produced. The composition is compatible with the normal fertilisers and can be mixed with common straight or complex fertilisers for application to crops. However, it is strictly recommended to avoid mixing with chemical pesticides during application. An innate advantage of these mixtures is that they can also be used in organic agriculture in restricted amounts and are benign and environment friendly. The evaluation trials conducted at farmer's field in Kerala and Karnataka have given a clear yield advantage of 10-30%. Besides increase in yield, the size and quality of produce in sprayed fields has also



Dr. Srinivasan (left) with a farmer in ginger crop field sprayed with ginger special micronutrient formulation

Effect on crop yield

Place	With spray of micronutrient formulation	Control	% increase
Ginger rhizome yield (kg/bed of 3 × 1 m²)			
Kozhikode, Kerala	7.0-10.5	6.0-8.0	16.3
Suntikoppa, Karnataka	23.8	18.75	26.7
Hassan, Karnataka	23.6	18.00	31.0
Turmeric rhizome yield (kg/bed of 3 × 1 m²)			
Kozhikode, Kerala	18.0-20.0	15.0-16.0	18-25
Erode, Tamil Nadu	10.0-25.0	8.0-22.0	10-15
Black pepper (kg/standard)			
Kozhikode, Kerala	10.3	7.6	30-35
Cardamom (kg/ha)			
Madikeri, Karnataka	880.0	795.0	10.2

significantly improved as compared to control (non-sprayed) fields.

Advantages

- Soil pH based
- Crop specific
- Increases yield by 15-25%
- Enhances quality of the crop produce
- Low cost
- Easy to apply
- Can be used in organic agriculture

Method of application

Black pepper: Foliar spray at 5 g per litre water during spike initiation with the onset of monsoon and after monthly intervals

Ginger: Foliar spray at 5 g per litre water once during 60 days after planting and another 90 days after planting.

Turmeric: Foliar spray at 5 g per litre water once during 60 days after planting and another 90 days after planting.

Cardamom: Foliar spray at 5 g per litre water should be given once

during panicle initiation and after monthly intervals.

Spread of technology across spice growing states of India

The technology has now spread to majority of the spice cultivating states like Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra, Madhya Pradesh, Gujarat and even NE states like, Nagaland, Assam, Tripura, etc., covering 10% of the area and it is expected to double by the next 5 years.

Bulk density (BD) of black pepper in different locations (g/L):

Bulk density (g/L) is one of the criteria for better quality of black

Location	BD Without Micronutrient spray	BD With Micronutrient spray	% increase
G. Hosahalli, Mudigere	520	582	11.92
Attihole, Madikeri	502	562	11.95
Hoskote, Madapur	488	505	3.48
Chikkanahalli, Belur	510	562	10.20
Madapura, Kodagu	510	546	7.06
Wayanad, Kerala	485	515	6.19

pepper as it adds to the weight of the produce per unit volume. Higher the BD, higher the price it fetches in the market.

The users of black pepper micronutrient mixture recorded increase in bulk density of the produce due to its balanced nutrition. Cardamom micronutrient has not only improved the yield but also the size and colour of the capsules enabling the farmers to get a premium price.

Our licensees (as in October 2017) Micronutrient composition for black pepper:

- M/s. Shrey Agritech, Hubli, Karnataka
- M/s. Rainbow Agri Life, Kadapa, Andhra Pradesh
- M/s. Hi-7 Agro Bio Solutions, Bengaluru, Karnataka
- M/s. Linga Chemicals, Madurai, Tamil Nadu
- M/s. Natura Nursery & Agro Products, Kozhikode, Kerala

Micronutrient composition for turmeric (for soils with pH below 7):

- M/s. Rainbow Agri Life, Kadapa, Andhra Pradesh

Micronutrient composition for turmeric (for soils with pH above 7):

- M/s. Natura Nursery & Agro Products, Kozhikode, Kerala



Health of black pepper vine and bold berries of black pepper

Collaboration of IISR with NRDC for Intellectual Property Protection & Commercialisation

The process patents for these micronutrient foliar formulations have been filed for protection in the country and non-exclusive licences of the technical know-how for commercial exploitation for each formulation are being issued by NRDC, New Delhi. The Institute Technology Management and Business Planning and Development Unit (ITM-BPD Units) at IISR, Kozhikode helps the entrepreneurs to prepare business plans for establishing manufacturing units. The BPD unit also provides consultancy services for commercial production. The foliar micronutrient mixtures are also available at ICAR-IISR Chelavoor campus in limited quantities.

Entrepreneurs and industries interested in obtaining the licence for commercial exploitation of the technical know-how in the country for the manufacture of the micronutrient foliar formulations for spices crops may contact:

The Chief-Business Development, National Research Development Corporation, 20-22, Zamroodpur Community Centre, Kailash Colony Extension, New Delhi 110048 along with their enquiry (E-mail: lnarayan@nrdc.in).

Micronutrient composition for ginger (for soils with pH below 7):

- M/s. Rainbow Agri Life, Kadapa, Andhra Pradesh
- M/s. Hi-7 Agro Bio Solutions, Bengaluru, Karnataka

Micronutrient composition for ginger (for soils with pH above 7):

- M/s. Hi-7 Agro Bio Solutions, Bengaluru, Karnataka
- M/s. Natura Nursery & Agro Products, Kozhikode, Kerala

Micronutrient composition for cardamom:

- M/s. Hi-7 Agro Bio Solutions, Bengaluru, Karnataka
- M/s. Linga Chemicals, Madurai, Tamil Nadu
- M/s. Raja G Enterprises, Salem, Tamil Nadu
- M/s. Rainbow Agri Life, Kadapa, Andhra Pradesh
- M/s. A & N Traders, Idukki, Kerala
- M/s. Natura Nursery & Agro Products, Kozhikode, Kerala



Foliar micronutrient formulations for spices manufactured by NRDC-licensees

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