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Road to successful floriculture through soil micronutrient mapping of different zones of India

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ABSTRACT

The present scenario for natural resource conservation demands for crop diversification and efficient management of natural resources, viz. water, nutrient, soil. The horticultural crops are always looked upon for diversification and within horticultural crops; fruits and vegetables are given prime importance for nutritional value and high outputs. Floricultural crops have emerged as potent livelihood crops for small and marginal farmers, employment for youth with low inputs, crop diversification and natural resource management. The improper use of inputs, viz. fertilizer and water in floral crops limits their production and can adversely affect soil health. So floriculturists should work on this least attended area and recommend appropriate fertilizers to flower growers for good quality production. In comparison to other crops, the nutrient requirement of floral crops is more due to which they scavenge more nutrients from soil so large amount of these nutrients are needed to replenish the soil to maintain balance. The critical limits of micronutrients for different agronomic crops have been developed and same are used for floricultural crops too but as requirement of these crops is higher so critical limits for floral crops need to be developed. Keeping in view all above, an attempt has been made to map micronutrient status of major flower producing states that could be used in management of micronutrient requirement of different floral crops. This will further help in development of policies pertaining to sound micronutrient management packages and precision fertilization in floriculture.

Keywords: Floriculture, Flower producing districts, Micronutrients, PCD maps, Soil micronutrient status

Floriculture, as an agro industry, is widening up its horizon and setting up a new platform in production of flowers with wide range of uses from curative to aesthetic. The globalization and its impact on income generation worldwide, has led to an increase in consumption of flowers in most of the countries (Misra and Sudip 2016). Floriculture has immense potential to generate remunerative self-employment among different farmers. The scenario of floriculture products is expanding at a rapid rate worldwide with a good prospective in India too. Earlier, floriculture in our country was restricted to growing of traditional flowers like marigold, jasmine, chrysanthemum and rose but today, realizing the importance of flowers at national and international levels, cultivation of high valued cut flower crops like carnation, gladiolus, gerbera, lilies etc. and seed production have been emphasized. India has diverse agro-climatic conditions that provide opportunities for production of different horticultural crops like fruits, vegetables, ornamental and plantation crops, spices, medicinal and aromatic plants etc. The present scenario demands cultivation of these crops to achieve basics of livelihood for small and marginal farmers, employment for youth with low inputs, crop diversification and natural resource management. Floriculture includes the study pertaining to growth, development, culture, management, post harvest physiology, production and marketing of cut and loose flowers, potted flowers, bedding and foliage plants, succulents, herbaceous annuals and perennials including geophytes. The total area under floriculture in India is 3.39 lakh ha with total production of 28.58 lakh metric tons. Out of this total production, 19.91 lakh metric tons (MT) production is of loose flowers and 8.67 lakh MT of cut flowers during 2018-19 (National Horticulture Board, 2018-19 1st adv. Estimates). India exported 19726.57 MT of floriculture products to the world worth ₹ 571.38 crores in 2018-19 (http://nhb.gov.in/statistics/State_Level/2018-19. The per cent share of floriculture to total horticulture production has increased to 1.1 in 2018-19.To increase production and get more income by flower production in the country, excessive use of inputs, viz. nutrients, water, chemicals etc is done. As floral produce is not edible so excessive inputs are used by flower growers without considering ill effect of these inputs on soil or animal health. Soil environment is the most

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vulnerable to direct effects of overuse of inputs in modern agriculture. In a long run, this could affect soil fertility and demand researchers for alternatives such as organic farming, integrated nutrient management etc. There is an urgent need of scientific approach in floriculture industry pertaining to improvement of flower germplasm, balanced nutrient management, modern production technologies, quality planting material, precision farming etc., for its commercialization and diversification from the traditional field crops due to higher returns per unit area (Misra and Sudip 2016). The overall strategy for increasing and sustaining yields, an integrated approach to management of nutrients is needed (Goswami *et al*. 2012, Wani *et al.* 2017). The program of National Research Council (1991) emphasized the reduction in application of inorganic amendments which would lead to ecologically sustainable crop production. Nutrient management in floricultural crops addresses the issues pertaining to quality of planting material and cut flowers, planting methods and fertilization practices which could improve yield and quality. The improper fertilizer application in floral crops limits their production so floriculturists should work on this least attended line and recommend appropriate fertilizers to flower growers for good quality production. There is lot of variations in nutrient management of even one crop as it varies with topography, climatic conditions, cropping system etc. Horticultural crops may absorb 500-1000 kg of NPK/ha/year or even more under good management conditions (Ganesha Murthy *et al.* 2015). This suggests that floral crops remove nutrients from soil in large amounts so for sustainability of yield, large amount of these nutrients are added to soil.

Keeping in view the present scenario of crop diversification through adoption of horticultural crops, emerging floriculture sector and high requirement of nutrients by floral crops, the present study is to seek the attention of researchers towards correlating the nutrients' especially micronutrients' requirement of floral crops with altering micronutrient status of soils of major flower producing states.

Role of micronutrients

Along with macronutrients, micronutrients are essential but required in small quantities by plants. The amount of micronutrients taken by crop is less than one pound per acre but their unavailability leads to limited plant functions that result in reduced or abnormal growth and yield. Thus limited micronutrients results in wastage of all other inputs such as nitrogen, water etc. The major functions performed by some nutrient can be summarized as:

Copper (Cu): Copper is essential for photosynthesis, respiration, carbon and nitrogen metabolism, for oxidative stress protection, and lignin synthesis in cell wall. Li (2011) found that Cu fertilization (0.4 mg/kg) promoted flower yields of medicinal *Chrysanthemum morifolium* and improved quality by increasing total flavonoids, chlorogenic acids, flavone ingredients (cyanidenon and versulin) and Cu in flowers and roots.

Iron (Fe): Iron constitutes as component/or catalyst of enzymes associated with energy transfer, in various redox reactions of photosynthesis and respiration, nitrogen fixation and reduction, reduction of sulphates, synthesis of chlorophyll molecule, lignin and helps in the absorption of other elements, biosynthesis of hormones (ethylene, gibberellic acid, jasmonic acid), production and scavenging of reactive oxygen species, osmoprotection and pathogen defense (Hansch and Mendel 2009).

Molybdenum (Mo): Molybdenum act as component of enzymes involved in nitrogen metabolism especially nitrate reductase enzyme relating to symbiotic nitrogen fixation in legumes, sulfur metabolism, protein synthesis, pollen formation and carotenoid formation (Srivastava and Singh 2003).

Manganese (Mn): Manganese acts as cofactor in several metabolic reactions, photolysis of water in photosynthesis, germination, increase the availability of phosphorus (P) and calcium (Ca). Manganese has an influential effect on carbohydrate metabolism between source and sink organs and thus act as deterimental factor for yield (Jhanji *et al*. 2015).

Zinc (Zn): Zinc is essential for energy production, protein synthesis, carbohydrate metabolism, structural integrity of biomembranes, growth regulation through hormones especially auxin, balancing intake of P and K inside the plant cells, tryptophan synthesis leading to biosynthesis and metabolism of auxin, elongation of internode for stem growth, formation of pollen (Shukla *et al.* 2016)

Chlorine (Cl): Chlorine affects energy reactions like photosynthesis, growth by stomatal regulation, electrical charge balance in physiological functions, turgor regulation in plants, improved solution uptake, relative water content and membrane integrity (Mortazavi *et al.* 2010).

Boron (B): Several plant metabolic processes such as cell division, translocation of metabolites like sugar, starch, synthesis of amino acids and proteins, action of hormones, regulation of carbohydrate metabolism, phloem development and growth require B in appropriate quantities. Deficiency of B leads to poor development of middle lamella of new cells and break down of phloem tubes. Boron is primarily concerned with improvement of metabolism, root elongation, synthesis of DNA, phenol metabolism, solubility and mobility of Ca, lignifications, absorption of nitrogen, membrane stability, formation of pollen and pollination (Shukla *et al.* 2009).

All nutrients are important for normal growth and development of plant and deficiency, excess or imbalance of any nutrient provokes the symptoms. In ornamental plants besides affecting production, the visual symptoms on flower or inflorescence lowers the quality of product that further affects the commercialization of flowers and ornamental plants (Veatch-blohm *et al.* 2012).

Nutrient availability and its absorption

The micronutrients are present in sufficient quantities in most of the soils to meet the demand of crop. The plant's ability to absorb nutrients from the soil depends upon physiochemical properties of soil as well as basic chemical properties of micronutrients. The availability of micronutrient is regulated by equilibrium between soil organic matter, insoluble compounds of micronutrients, cation exchange sites and soil solution.

*p*H, i.e. soil acidity or alkalinity affects ionic state of nutrients or binding to other components of soil and hence, their availability to plants. The micronutrients are readily available in acidic soils, whereas often unavailable in alkaline soils. The availability of micronutrients decreases as soil pH increases with exception of molybdenum; For ornamentals the soil *p*H affects the coloration as hydrangea plants have blue flowers in acid soils and pink in alkaline soil (Yoshida *et al*. 2009); The soil *p*H also influences incidence of diseases in various species by altering the availability of nutrients and growth of pathogenic microorganisms in soil (Zambolim *et al.* 2012); Organic matter is a reservoir of essential plant nutrients that supply nutrients to the crop by decomposition and affects micronutrient availability. Soils with low (less than 2.0%) or high (greater than 30%) organic matter have lower availability of micronutrients. Regular application of organic matter such as farmyard manure enriches the soil with micronutrients and rare deficiency is seen in such soils. The organic matter is especially important for anionic nutrients like boron which are subjected to leaching losses as they do not bind to soil particles. The high organic matter reduces the availability of micronutrients particularly copper, manganese and zinc as there is strong chelating of micronutrient with organic molecules. Also excess of phosphorus in manured soils results in manganese deficiency. The organic fertilizers supply nutrients and improve soil properties, such as increase in CTC and moisture retention; Fine textured soils (higher amounts of clay) have higher micronutrient availability than course textured soils (higher amounts of sand). Coarse textured soils receiving heavy rainfall are prone to B deficiency as B is lost by leaching. Zinc deficiency is common on sandy soil; Soil temperature and moisture are other important factors affecting the availability. Cool, wet soils reduce the rate and amount of micronutrients taken up by crops; The basic chemical properties of micronutrients like cationic or anionic nature influence their availability in soils. The cationic or positively charged nutrients (Cu, Fe, Mn, Zn) are readily present in available forms in acidic soils and deficient in calcareous soils or soils rich in organic matter where chelating restricts their availability. The anionic or negatively charged nutrients (B, Cl, Mo) are subjected to leaching and not replenished by decomposing organic matter.

Effect of micronutrientson fertilization in floral crops

The importance of micronutrients in all direct and indirect components of agriculture, viz. soil, plants, animals and humans has been well reported (Shukla *et al*. 2018, 2019). Prabhat *et al*. (2002) found that foliar application of 0.2% ferrous sulphate alone or in different combinations with other nutrients improved quality of gladiolus spikes, whereas Rao (2005) reported that foliar spraying of ferrous sulphate @ 0.6% improved plant height, increased the number of florets per spike, extended flowering duration and increased corm yield of gladiolus. Kumar *et al.* (2009) reported that foliar application of ferrous sulphate improved flowering duration and yield in chrysanthemum. Iron chlorosis occurs commonly in jasmine but foliar spray of ferrous sulphate resulted in revival of plant growth (Jeyakumar and Balamohan 2007).

Zinc influencing the cascades of metabolic processes, improved the overall growth in flowering plants. Soil application of Zn promoted growth and yield in several crops like chrysanthemum, marigold, tuberose, gladiolus etc. Foliar spray of Zn in gladiolus increased the spike length, floret number per spike, number of corms and cormels per plant (Jauhari *et al.* 2005). Application of Zn along with urea increased the overall growth of plants and flowers of gerbera (Bashir *et al.* 2013). Copper is of utmost importance for life. The application of Cu not only improved the yield of medicinally important *Chrysanthemum morifolium* but also improved the quality by increasing content of flavonoids, chlorogenic acids and flavones (Li 2011).

Several studies have been conducted with combination sprays of micronutrients to improve the quality and yield and overcome multifaceted deficiency. The interaction of B and Zn increased spike length, floret number and size, corm and cormel number and weight in gladiolus (Halder *et al.* 2007). The promotive and interactive effect of $MnSO_4$, $FeSO_4$ and $ZnSO_4$ (0.2, 0.4, 0.6 and 0.8) on number of branches and flowers per plant and flowering duration of chrysanthemum was reported by Kumar *et al.* (2009). Bihari and Narayan (2009) observed promotory effect of foliar spray of 0.5% $ZnSO_4$ after 30 days of transplanting on flowering of African marigold. *Dianthus caryophyllus* cv. Red Sim was fertilized five times during growing period and recorded increase in stem length, stem diameter, stem fresh and dry weight, number of leaves per plant, fresh and dry weight of leaves (El-Naggar 2009). An experiment on marigold cv. Pusa Narangi, Kumar *et al.* (2010) recorded maximum secondary branches, plant spread, flower and seed yield with 1.5% $FeSO_4$ and maximum height, plant spread, fresh weight of flower, flower diameter and seed number per peduncle with 0.1% boric acid. Khalifa *et al*. (2011) found that foliar spray of $ZnSO_4$ (4.5g/l) and boric acid (20 ppm) promoted the growth of iris plant in sandy soils. Plant height, number of branches and leaves per plant, leaf area, stalk length, flower emergence, diameter and quality of gerbera improved when potted plants were sprayed at fifteen days interval with solution of macronutrients (NPK) and micronutrients (Zn, B, Fe and Mn, Khosa *et al.* 2011).The effect of twice application of boric acid,$FeSO_4$ and $ZnSO_4$ (all @ 2%) on gladiolus plants after 30 and 60 days of planting revealed increase in plant height, leaf chlorophyll content, spike and rachis length, flower and corm fresh weight,florets per spike, floret size and vase life (Fahad *et al.* 2014). The sprays of boric acid, magnesium sulphate

($MgSO_4$), $MnSO_4$, $FeSO_4$, $ZnSO_4$ and copper sulphate ($CuSO_4$) at different concentrations on rose cv. Sophia Loren had pronounced effect on growth, yield and vase life (Khode *et al.* 2015). Sahu *et al.* (2017) reported that foliar application of $MnSO_4$ (0.2%), $FeSO_4$ (0.1%), and $ZnSO_4$ (0.2%) resulted in increase in plant height, plant spread, number of leaves, stalk length, stalk diameter, number of flowers per plant and vase life of gerbera. Similar experiments to study the effect of different concentrations of different micronutrients on different crops like gladiolus (Basoli *et al*. 2014), rose (Poornima *et al.* 2018), marigold (Dhatt *et al*. 2019), lilium (Rani *et al*. 2005) etc were conducted and it was found that the spray of micronutrients had pronounced effect on growth, quality and yield of all the floral crops. Fulfilling B requirements of flowers like chrysanthemum, tuberose, carnation etc prevented deformities in plants and floral structures. Application of B at appropriate levels prevents various physiological disorders like calyx splitting, flower malformation (Jawaharlal *et al.* 2012).

Thus, a brief review of micronutrient studies being carried out revealed that most of the researchers use micronutrients to promote growth of floral crops and found enhanced effects at higher doses. This suggests that demand of floral crops for micronutrients is higher than other crops but at the same time exact concentration of particular micronutrient required for particular crop is not mentioned and moreover the status of micronutrient in the soil is also not focused while deciding concentration of micronutrient for application. Further, this suggests that researchers related to the field should focus on micronutrient status of the soil, requirement of the crop and critical limit of particular micronutrient for crop below which deficiency symptoms will appear.

Nutrient management

Nutrient management links different factors such as soil, crop, and weather with crop cultural practices to optimize efficiency of nutrient utilization, yield and quality. It results in good returns as it reduces off site movement of nutrients (Delgado and Lemunyon 2006). Mikkelsen (2011) stated that nutrient management needs synchronization of soil, climate, field and crop management techniques to source, time, place and rate of nutrient application which is commonly known as 4R nutrient stewardship. The various factors like crop quality, yield and cost of inputs, reduction in leaching out of nutrients from root zone, surface run off and volatilization affect the management of nutrients. There exists difference in nutrient pathways and dynamics that need to be focused while standardizing nutrient management practices as reduction in leaching or improvement in mobilization of one nutrient may increase leaching or decrease mobilization of other nutrient. The above complexities challenges workers to interrelate factors like soil, weather, water, crop to have management practices that not only increase profit but also conserve biosphere.

Floricultural consumers are quality conscious so besides production, quality can only be achieved if nutrient needs of plants are properly managed. Recommendations for fertilizing crops are based on soil test reports. Thus, soil testing prior to planting leads to efficient nutrient management. Further, plant tissue analysis is the most important diagnostic techniques for determining deficient, sufficient or excessive amounts of essential elements in plant tissue. These tests help farmers in overcoming many problems and give them better approaches for nutrient management of horticultural crops. The success through testing depends on selecting right tissue and stage of sample used for test.

Current status of micronutrients in Indian soils

As mentioned earlier the content of micronutrients in soils is high but still micronutrient deficiency has been reported in many crops due to low levels of available micronutrients in soils (Shukla *et al.* 2014). The micronutrient status based on critical limits of micronutrients in different soils in different states of India was assessed from more than 2.0 lakh soil samples and it revealed that on an average, 36.5, 23.2, 12.8, 7.1 and 4.2 % soil samples were deficient in Zn, B, Fe, Cu and Mn respectively.

Critical limits of micronutrients

Critical limit is that nutrient concentration which indicates the level at which crop will respond to the applied nutrient, i.e. it is indicator of responsive and non-responsive conditions. The critical nutrient range is widely adopted method for diagnosis of crop and plant nutrient status in which comparison is made between nutrient concentration from plant tissue and a soil sample with a reference level (Marschner 2012). The critical level or concentration of nutrient can be based on both soil and plant analysis. The critical limit governs the deficiency of available micronutrient content in soil-plant system. Defining and redefining of critical limits for different soils with reference to growing environment, soil characteristics and plant parts of specific crops need to be done regularly. The critical limits enable the farmers to apply balanced nutrients to get maximum yield potential of crops (Prasad *et al.* 2017).

The deficiency and sufficiency limits of DTPA extractable Zn, Cu, Fe and Mn and hot water extractable B have been established for soils of different states and found to vary with micronutrients, crops, soil, and the extractants used. Earlier pot experiments were done to determine critical limits of different micronutrients and revealed only two levels of concentration (adequacy and deficiency) for each nutrient. But now, these limits have been redefined by conducting on-farm trials in cluster of villages (Shukla and Tiwari 2016). The current critical levels of micronutrient deficiency used for delineating the responsive soils from non responsive ones for B, Cu, Fe, Mn, Mo and Zn are 0.5, 0.2, 4.5, 2.0, 0.2 and 0.6 ppm. (Patil and Kalaivanan 2019).

Compared with most agronomic crops, horticultural crops especially floricultural crops have high nutrient requirement. Greenhouse roses needs fertigation with 5000 kg/ha or more of nitrogen and proportionally high

Table 1 Micronutrient values (in ppm) from foliar analysis of floricultural crops

Crop	Nutrient	Deficient	Low	Sufficient	High	Excess
Carnation	Boron (B)	<25	26-29	30-100	101-699	>700
	Copper (Cu)	<5	6-9	10-30	31-35	>36
	Iron (Fe)	<30	31-49	50-150	151-155	>156
	Manganese (Mn)	<30	31-99	100-300	301-799	>800
	Molybdenum (Mo)	-	-	-	-	-
	Zinc (Zn)	<15	16-24	25-75	76-80	>81
Chrysanthemum	Boron (B)	<20	21-49	50-100	101-124	>125
	Copper (Cu)	<5	6-24	25-75	76-80	>81
	Iron (Fe)	<50	51-59	60-500	501-525	>526
	Manganese (Mn)	<20	21-29	30-350	351-800	>801
	Molybdenum (Mo)	-	-	-	-	-
	Zinc (Zn)	<15	16-20	21-50	76-80	>56
Rose	Boron (B)	<30	31-39	40-60	61-400	>401
	Copper (Cu)	<5	6-7	7-15	16-18	>19
	Iron (Fe)	<50	51-79	80-120	121-150	>151
	Manganese (Mn)	<30	31-69	70-120	121-250	>801
	Molybdenum (Mo)	-	-	-	-	-
	Zinc (Zn)	<15	16-19	20-40	41-50	>76
Other crops	Boron (B)	<25	26-30	31-100	101-200	>201
	Copper (Cu)	<5	6-10	11-20	21-24	>25
	Iron (Fe)	<50	51-60	61-150	151-350	>351
	Manganese (Mn)	<30	31-50	51-300	310-500	>501
	Molybdenum (Mo)	-				-
	Zinc (Zn)	<14	15-20	21-50	51-75	>76

amounts of other nutrients (Cabrera 2006).The year round productivity of most of the floricultural crops demands high fertilizer application or withdrawal of nutrients from soil reserves but till date, critical nutrient concentration ranges based on plant and soil analyses have not been developed for flower or biomass productivity that leads to overuse of fertilizers. The standardization of critical limits of different nutrients for different horticultural crops and diagnosis of nutrient status of soils of the area's growing these crops will enable the growers to maximize productivity and optimize fertilizer use and minimize input costs and environmental impact (Ramos-Miras *et al.* 2011). The critical values for some micronutrients from foliar analysis of few floral crops have been worked out (Table 1, Patil and Kalaivanan 2019). With this background pertaining to micronutrient status in soils, defined critical limits of micronutrients for agronomic crops and their high demand for floricultural crops, an attempt has been made to map the soil micronutrient status of major flower producing districts that could enable efficient management of micronutrients in these areas.

Mapping micronutrient deficiencies in flower producing states of India

Among all the states, Tamil Nadu ranks first by producing 482.52 thousand MT of floricultural crops and contributes about 19% to the total production of country. Karnataka contributes 13% of the total flower production of country and the corresponding value for West Bengal is 12%, Madhya Pradesh 10%, Gujarat 8%, Andhra Pradesh 6%, Chattisgarh, Maharashtra and Uttar Pradesh 5% , Assam 4% and remaining states 14% (Source: Hoticultural Statistics at a Glance-2018). The micronutrient status of soils of major flower producing districts of these states was collected from the reports of ICAR-All India Coordinated Research Project on Micro & Secondary Nutrients and Pollutant Elements in soils and plants.

Mapping B deficiency in flower producing states depicted that more than 50% of the soils in flower producing districts of Maharashtra, Karnataka and Odisha were found to be deficient. Some flower producing districts of Maharashtra and Andhra Pradesh showed 20-30% of B deficiency (S Map 1). Most of the soils of flower producing districts have required Cu content as mapping Cu deficiency in flower producing states revealed that less than 5% of the soils have Cu below critical limits (S Map 2). Iron, an important micronutrient, was found to be below critical limits in more than 20-25% of soils in flower producing districts of Maharashtra, Andhra Pradesh and Tamil Nadu. About 10-15% of soils in other flower producing districts of these states were also found to be deficient (S Map 3). The soils of flower producing districts were mapped for Mn and it was found that about 95% of the soils had Mn content above critical limits (S Map 4). Few flower producing districts of Odisha, Karnataka, Madhya Pradesh and Andhra Pradesh showed S deficiency in about 40-50% of soils whereas in other districts less than 10% of soils were found to be deficient (S Map 5). In comparison to other micronutrients, Zn deficiency was more severe in flower producing districts. More than 50% of soils in flower producing districts of major flower producing states, viz. Tamil Nadu, Karnataka, Andhra Pradesh and Madhya Pradesh exhibited Zn deficiency. About 40-50% soils in Odisha and Madhya Pradesh were also found to be deficient in Zn (S Map 6). Thorough insight of these maps demands special emphasis on increasing micronutrient deficiencies in flower producing districts. There are total six Agri-Export Zones under Floriculture in Karnataka, Uttarakhand, Maharashtra, Tamil Nadu and Sikkim and from maps we come to know that micronutrient deficiencies are existing or begin to exist in flower producing districts in these zones. So, there is an urgent need to identify and standardize nutrient requirement of floriculture crops as well as micronutrient status of soils especially of these areas so that production of floricultural crops could be increased without any ill effect on soil health.

Conclusion

Floriculture is an emerging profitable agro industry that has potential to uplift the earnings of farmers with low inputs. This demands special emphasis on standardization of nutrient requirement along with development of critical limits for each nutrient for specific crop. India has diverse agro climatic zones that favour the production of different flowers in different areas and seasons. Till date farmers in different zones use these nutrients on their own with emphasis on flower production and show least concern with soil nutrient status and plant requirement. So, our study is to divert the attention of researchers in the concerned fields to develop critical limits for micronutrients in floricultural crops. The maps prepared in our report will be useful in understanding the micronutrients deficiencies in different flower producing districts and associating soil micronutrient content and its availability with climate and soil properties. These maps will further help to understand the distribution pattern of micronutrient deficiencies in these regions for further development of policies pertaining to sound micronutrient management packages and precision nutrient management in floriculture.

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