



Study of Inorganic and Organic Source for the foliar spray with $ZnSO_4$ on growth and yield in Okra (Cv., Arka Anamika)

¹N. Senthilkumar

¹Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, AnnamalaiNagar-608 002. (TN) India
E-mail: senthilkumar.n.au@gmail.com, senthilkumar.n.09807@annamalaiuniversity.ac.in

Abstract: A pot culture experiment was conducted in clay loam soil at Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University. To study the combined application of RDF (Recommended Dose of Fertilizer) with organic manure and Zincsulphate on okra (*Abelmoschus esculentus* L., Moench. Variety *Arka Anamika*). During 2012-2013. The treatments were in T_1 - Control, T_2 - RDF (40:50:30 N, P_2O_5 , K_2O Kg ha^{-1}), T_3 - T_2 + FYM 12.5 t ha^{-1} , T_4 - T_3 + Soil application $Zn SO_4 @ 12.5$ Kg ha^{-1} , T_5 - T_3 + $Zn SO_4 @ 0.1$ % Foliar spray, T_6 - T_3 + $Zn SO_4 @ 0.2$ % Foliar spray, T_7 - T_3 + $Zn SO_4 @ 0.3$ % Foliar spray. The experiment was laid out in CRBD with seven treatments in three replications. The increases dose of application with foliar spray increases plant growth parameters and yield (T_7), followed by (T_6), no significant difference between T_7 treatments. From the pot culture experiments find out the optimum dose in T_6 - T_3 + $Zn SO_4 @ 0.2$ % foliar spray improving the growth characters significantly like plant height, no of branches, internode length and yield components like number of fruits per plant, fruit weight, length and girth and fruit yield per pot 70 DAS 200.07 g pot^{-1} and 90 DAS 207.00g pot^{-1} and quality (12.84 mg 100 g^{-1} of fruits) of okra crop.

Key words: Inorganic, Organic Sources, $ZnSO_4$, growth and yield okra crop)

I. INTRODUCTION

Bhendi (*Abelmoschus esculentus* L. Moench) is one of the most important warm season fruit vegetable, grown extensively for its tender and

succulent fruits through the tropics and subtropics. Its adaptability to a wide range of growing conditions make it popular among vegetable growers.

The area under cultivation of this crop in India is about 4,32,000 hectares and production is about 45, 28,000 metric tonnes. The maximum area under this crop lies in Uttar Pradesh followed by Orissa. In Tamil Nadu, the area under cultivation is 7070 hectares with production of about 67,140 tonnes and the productivity is about 9.5t ha⁻¹ where the national productivity is 10.5t ha⁻¹ [2].

Integrated plant nutrient management (IPNM) primarily relates to combined application of organic and inorganic sources of the plant nutrients. Organic sources, when applied with mineral fertilizers, improve the efficiency of the latter due to their favorable effects on physical and biological properties of soil. The mechanisms for certification is in place through Agricultural and processed food products Export development Authority (APEDA) and national programme for organic production. (NPOP). We need to expand organic production and export with value addition.

Micronutrients play an important role in maintaining optimum plant growth, yield and quality of vegetables. The fact is that trace elements are vital as they function as catalysts. Usually as a part of an enzyme system. In a delicately balanced plant system, micro nutrients, deficiencies can easily upset the balance. Among the various micro nutrients. The deficiency of zinc is reported to be of widespread occurrence.

In Tamil Nadu, about 41 per cent of the total area is deficient in zinc of these Tanjore alone accounts for the 80 per cent of the total zinc deficient area [7]. Zinc is an essential component of plant enzymes required for energy production, protein synthesis and degradation and insufficient zinc can decrease the plant growth hormone IAA [8].

Okra is an important vegetables crop growth throughout the year in a fairly large scale in India. It requires heavy manuring for its potential production [11, 10]. However, the use of expensive commercial fertilizers as per requirement of the crop is not much

affordable to the average farmers. Therefore, the application of plant nutrients, through organic sources like compost, farmyard manure, press mud etc., remains the alternative choice of the farmers for maintaining its sustainable production [15].

With this background the present study aim to find Study of Inorganic and Organic Source for the foliar spray with ZnSO₄ on growth and yield in Okra (CV., *Arka Anamika*).

II. MATERIALS AND METHODS

An investigation was carried out in the vegetables field unit, Department of Soil science agricultural chemistry. Annamalai University, Annamalai Nagar, to study the response or effect of okra to combined application of NPK with organic manures and zinc, during the year 2012-2013. Annamalai Nagar is situated at 11°24' N latitude and 79°41' E longitude at an altitude of 5.79m above mean sea level. Experiments soil was clay loam in texture. pH7.85, electrical conductivity 0.75 dSm⁻¹, and low in available 0.75 dSm⁻¹, and low in available N (195kg/ha⁻¹) and P (60 kg/ha⁻¹) and K (150 kg/ha⁻¹) status. The treatments combined application of organic manures like FYM and inorganic fertilizers like nitrogen (urea), phosphorus (single super phosphate) and potassium (Murate of potash) along with zinc as zinc sulphate (ZnSO₄.7H₂O). The treatments were in T₁- Control, T₂- RDF (40:50:30 N, P₂O₅, K₂O Kg ha⁻¹), T₃- T₂ + FYM 12.5 t ha⁻¹, T₄- T₃ + Soil application Zn SO₄ @12.5 Kg ha⁻¹, T₅- T₃ + Zn SO₄ @ 0.1 % Foliar spray, T₆- T₃ + Zn SO₄ @ 0.2% Foliar spray, T₇- T₃ + Zn SO₄ @ 0.3% Foliar spray, The experiment was laid out in CRBD with seven treatments in three replications.. During the experimentation growth characters and yield components with quality were recorded. All the data should be analysed statistically.

III. RESULT AND DISCUSSION

The result obtained from the present investigation are presented below,

Growth characters

Growth attributes like plant height, number of branches per plant, number of internodes, numbers of flowers per plant were accentuated and significantly by different treatments (table 2). The perusal of result indicated that okra plants fertilizer with the recommended dose of fertilizers with FYM and 0.2 per cent ZnSO₄ as foliar spray 0.2 per cent (T₆) in plant height (96.85 cm), number of branches per plant (4.25), number of internodes per plant (6.98 cm), number of flowers per plant (31.89) noted in the same treatment. Which was at par with treatment (T₆ recommended dose of fertilizer with FYM and foliar spray 0.2 per cent ZnSO₄) T₇ (recommended dose of fertilizer with FYM and foliar spray 0.3 per cent ZnSO₄). The minimum growth characters of plant height (88.64 cm), number of branches (3.48), number of internodes (5.98 cm), number of flowers of flowers (35.36) was recorded and T₁ control. This was obviously due to better vegetative growth in terms of plant height and number of branches inclusive of internodes and number of flowers. The pronounced effect of organic with inorganic fertilizers on several growth parameters might be the evidence of increased assimilation of protoplasm resulting in greater cell division, formation of more tissues and vigour of the plant. These findings are in conformity with same authors. [6, 13, 9] 2012 in okra crop. All above researchers have observed better growth characters of okra crop under the combined application of inorganic fertilizers along with organic manures and zinc as well to soil.

Yield components

Almost both the yield attributes viz., fruit length, fruit girth, single fruit weight, number of fruits per plant and total yield per pot (Table3) were significantly influenced with application of inorganic fertilizers in combination with organic manures as well as zinc. The combined application of inorganic fertilizers along with recommended dose of fertilizers with

FYM and foliar spray 0.2 per cent ZnSO₄ (T₆) favorably noted higher yield attributes viz., fruit length (18.48 cm), fruit girth (6.44), single fruit weight (14.84g), number of fruit per plant (14.48) and total yield per pot (207.90g) and proved superior over the other treatments.

The treatments consisting of organic manure alone T₇ and T₅. Which registered lower fruit yield of okra indicating. [4, 12, 3].

Table 1 (a)
Physical and chemical properties of the soil

S. No	Properties	Values
1	Physical properties	
	Clay (per cent)	36.2
	Silt (per cent)	15.3
	Fine sand (per cent)	33.3
	Coarse sand (per cent)	15.2
	Textural class	Clayey loam
2	Chemical properties	
	Soil reaction (pH)	7.85
	Electrical conductivity (EC) dSm ⁻¹	0.75
	Available nitrogen (kg ha ⁻¹)	195.00 (low level)
	Available phosphorous (kg ha ⁻¹)	60.00
	Available potassium (kg ha ⁻¹)	150.00
	Zinc (kg ha ⁻¹)	1.50 (low)

Table 1 (b)
Physico-chemical properties of FYM

S. No	Properties	FYM
1.	pH	8.38
2.	EC (dSm ⁻¹)	1.50
3.	Organic carbon (%)	10.80
4.	Total N (%)	0.95
5.	Total P (%)	0.35
6.	Total K (%)	0.60

Table 2
Effect of organic and inorganic manure combination with ZnSO₄ on growth characters in Okra (CV. ArkaAnamika)

S.No	Treatments	Plant height (cm)			No of Branches plant ⁻¹			Intermodal length (cm)			No of Flower plant ⁻¹	
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	5 DAS	60 DAS
T ₁	Control	43.44	73.47	88.64	1.51	2.46	3.48	6.68	6.39	5.98	35.44	35.36
T ₂	Recommended fertilizer (full dose)	44.55	74.71	90.59	1.78	2.77	3.61	6.78	6.47	6.10	35.96	35.87
T ₃	Recommended fertilizer +FYM	47.83	76.24	92.10	2.00	2.90	3.69	6.88	6.62	6.26	36.12	36.06
T ₄	Recommended fertilizer+ ZnSO ₄	50.53	79.41	93.17	2.11	3.37	3.81	7.06	6.78	6.38	36.44	36.18
T ₅	Recommended fertilizer+FYM +0.1% ZnSO ₄	53.32	82.13	94.89	2.22	3.47	3.96	7.22	6.92	6.63	37.23	37.14
T ₆	Recommended fertilizer+FYM +0.2%ZnSO ₄	55.65	85.56	96.85	2.38	3.63	4.25	7.42	7.18	6.98	40.54	40.45
T ₇	Recommended fertilizer+FYM +0.3%ZnSO ₄	55.49	85.30	96.71	2.29	3.56	4.17	7.35	7.14	6.87	40.03	39.46
	SED	0.87	0.86	0.58	0.06	0.08	0.05	0.05	0.05	0.07	0.36	0.36
	CD(p=0.05)	1.74	1.72	1.17	0.12	0.16	0.11	0.10	0.11	0.14	0.72	0.72

*FYM=12.5 t ha⁻¹, ZnSO₄@ 12.5Kg ha⁻¹Recommended fertilizer= 40:50:30 Kg ha⁻¹ NPK.

Table 3
Effect of organic and inorganic manures combination with ZnSO₄ on yield components in Okra Cv. (ArkaAnamika)

S. No	Treatments	Fruit length (cm)		Fruit girth (cm)		Single fruit weight (gm)		No of fruit plant ⁻¹ (gm)		Total yield pot ⁻¹ (gm)		Ascorbic acid content (mg 100 g ⁻¹)
		70 DAS	90 DAS	70 DAS	90 DAS	70 DAS	90 DAS	70 DAS	90 DAS	70DAS	90DAS	
T ₁	Control	14.03	14.92	4.41	4.54	11.24	11.38	10.74	11.51	124.47	136.62	12.19
T ₂	Recommended fertilizer (full dose)	14.51	15.64	4.62	4.76	12.07	12.06	11.32	12.07	143.78	155.66	12.31

contd. table 3

S. No	Treatments	Fruit length (cm)		Fruit girth (cm)		Single fruit weight (gm)		No of fruit plant ⁻¹ (gm)		Total yield pot ⁻¹ (gm)		Ascorbic acid content (mg 100 g ⁻¹)
		70 DAS	90 DAS	70 DAS	90 DAS	70 DAS	90 DAS	70 DAS	90 DAS	70DAS	90DAS	
T ₃	Recommended fertilizer + FYM	15.44	16.16	4.80	4.94	13.35	13.54	11.66	12.46	161.87	171.44	12.40
T ₄	Recommended Fertilizer FYM + ZnSO ₄	15.91	16.32	5.24	5.32	13.91	14.15	12.29	13.06	177.12	185.76	12.54
T ₅	Recommended Fertilizer + FYM + 0.1% ZnSO ₄	16.34	17.48	5.75	5.58	14.20	14.43	12.86	13.62	192.38	196.67	12.64
T ₆	Recommended Fertilizer + FYM + 0.2% ZnSO ₄	17.29	18.48	6.32	6.44	14.60	14.84	13.70	16.48	200.07	207.90	12.84
T ₇	Recommended Fertilizer + FYM + 0.3% ZnSO ₄	17.01	17.98	6.20	6.32	14.45	14.67	13.42	14.16	202.37	198.98	12.74
	SED	0.23	0.25	0.13	0.13	0.24	0.24	0.21	0.21	4.53	5.95	0.46
	CD(p=0.05)	0.46	0.50	0.27	0.27	0.48	0.49	0.42	0.42	9.06	11.91	0.09

* FYM = 12.5 t ha⁻¹, ZnSO₄ @ 12.5 Kg ha⁻¹, Recommended dose fertilizer = 40:50:30 Kg⁻¹ NPK.

Quality

The ascorbic acid content of the fruits ranged from 12.19 mg 100g⁻¹ to 12.84 mg 100g⁻¹ among the various treatments (Table 3). The maximum value was recorded in the treatment T₆ (12.84 mg 100g⁻¹) closely followed by the treatment T₇ (12.74 mg 100g⁻¹). All the other treatment were on par with each other, but significantly differed over the control. In the present study, highest ascorbic acid content was recorded in the treatment with a recommended dose of NPK with FYM and ZnSO₄ @ 0.2 per cent. The increase in ascorbic acid content of fruits may be due to be increased availability of nitrogen and there existed a positive relationship between nitrogen and ascorbic acid content. [11,13] in Okra reported similar results.

IV. CONCLUSION

Based on the finding of the present study, it can be concluded that the application of recommended dose of NPK with FYM and 0.2 per cent ZnSO₄ as foliar spray has beneficial effect on the growth characters and yield components of Okra.

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