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# Effect of Magnesium, Boron and Zinc on Growth, Yield and Quality of Sweet Potato

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ABSTRACT

A field experiment was conducted to study the effect of magnesium, boron and zinc along with recommended doses of NPK and organic manure on growth, yield and quality of sweet potato. The treatments consist of T1 : Recommended dose of FYM and NPK, T2 : Recommended dose of FYM and NPK + soil application of MgSO4 @ 20kg/ha, T3 : Recommended dose of FYM and NPK + soil application of Borax @ 15kg/ha, T4 : Recommended dose of FYM, NKP + Dipping of cutting for 15 minutes in 2% Znso4.7H2O, T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments, T6 : (control). Result revealed that highest vine length (393.03 cm), no of branches (9.0), leaf length (8.57 cm) and leaf width (9.07 cm) were recorded in T3 which was however statistically at par with T5. Tuber size (length: 14.12 cm and girth: 4.98 cm) and tuber yield (25.78 t/ha) was found highest in T5 which was statistically at par with T3. Similarly, highest dry matter (26.24 %), total sugars (3.72%) and starch content (20.49 %) was recorded in T5. From the experiment, it appeared that application of magnesium, boron and zinc along with recommended doses of NPK and organic manure can be used to improve growth, yield and quality of sweet potato.

## 1. Introduction

Sweet potato (*Ipomoea batatas* L), a member of the family Convulvulaceae is a dicotyledonous root crop. It is the seventh most important food crop in the world, after wheat, rice, maize, potato, barley and cassava. It is the fourth most important food crop in developing tropical countries and is grown in most of the tropical and subtropical regions of the world, where the vine, as well as the roots, is consumed by humans and livestock (Woolfe 1992). China is the largest producer of sweet potato with 72% of the world's production (104.26 m t) and 40% of the Chinese harvest is used as animal feed to support a growing domestic demand for animal protein. In South America and Africa, 90% of the production is used for ` human consumption. In India it is grown in an area of 1.35 lakh ha with a production of 16.39 lakh tonnes and the average productivity is 12.20 t ha-1 (Anonymous 2017). In Meghalaya, it is cultivated in an area of 0.046 lakh ha with a production of 0.17 lakh tones and the state has a low productivity of 9.30 t $ha^{-1}$ as against the world average productivity of 13.15 t $ha^{-1}$. Sweet potato is an excellent source of vitamins, minerals and antioxidants (Baybutt and Molteni 2000; Wallerstein 2000).

Soil acidity is a major constraint in most of the agricultural soils and liming is a common practice to ameliorate the acid soils (Brady and Weil 2006). Deficiency of secondary

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nutrients such as Ca and Mg and micronutrient, Zn and Boron is a major constraint to crop production in these soils (Laxminarayana and John 2014). Application of chemical fertilizers alone has not been found helpful under intensive agriculture to maximize productivity and maintain soil health because it is often associated with reduced crop yield, increased soil acidity and nutrient imbalances (Kang and Juo 1980; Obi and Ebo 1995). Keeping this in view, the present study was conducted to find out the effect of application of secondary nutrient (Mg) and the micronutrient (Zn and Boron) along with recommended doses of NPK and organic manure on growth, yield and proximate composition of sweet potato.

## 2. Materials and methods

A field experiment was conducted during two successive seasons of 2016-17 and 2017-18 at Horticulture Farm of Division of System Research & Engineering, ICAR Research Complex for NEH Region, Umiam to study the effect of zinc (Zn), boron (B) and magnesium (Mg) on growth, yield and proximate composition of tubers in sweet potato. The soil of the experimental site was acidic (pH 5.19), organic C: 2.87 %, N: 304 kg/ha, P: 33 kg/ha and K: 153 kg/ha. The experiment was laid out in randomized block design with three replications. The treatments consist of T1 : Recommended dose of FYM and NPK, T2 : Recommended dose of FYM and NPK + soil application of MgSO4 @ 20kg/ha, T3 : Recommended dose of FYM and NPK + soil application of Borax @ 15kg/ha, T4 : Recommended dose of FYM, NKP + Dipping of cutting for 15 minutes in 2% ZnSO4.7H2O, T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments, T6 : (control). Well rotten farmyard manure was applied one month in advance of planting of the cuttings. One third of N, entire P and half K in the form of urea, single super phosphate and muriate of potash, respectively were applied at the time of planting followed by one third N and half of K at 45 days after planting (DAP) and the balance one third of N at 60 DAP. Data on vine length (cm), no. of branches, leaf length (cm), leaf width (cm), leaf area (cm2), tuber length (cm), tuber width (cm), tuber weight (g), yield (kg/ha) were collected and proximate composition of tuber such as dry matter content (%), sugars (%) and starch (%) was analyses and data recorded following standard procedure. All data were statistically analyzed as per the methods suggested by Panse and Sukhatme (1967).

## 3. Results and discussions

### *Yield attributes*

At harvest stage, highest vine length (393.03 cm), no of branches (9.0), leaf length (8.57 cm) and leaf width (9.07 cm) were recorded in T3 : Recommended dose of FYM and NPK + soil application of Borax @ 15kg/ha which was however statistically at par with T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments (table 1). Tuber size (length: 14.12 cm and girth: 4.98 cm) and tuber yield (25.78 t/ha) was found highest in T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments which was statistically at par with T3 : Recommended dose of FYM and NPK + soil application of Borax @ 15kg/ha. This might be due to conducive physical environment through integrated use of organic manures like FYM along with optimum levels of chemical fertilizers including secondary and micronutrients which have helped in better root growth and absorption of nutrients from the native as well as applied sources which in turn favored highest growth and tuber yields. These results are in conformity with the findings of Singh *et al.* (2002) and Laxminarayana and John (2014). Similarly Moinuddin *et al.*, (2017) obtained highest tuber yield of potato (22.45 t/ha) which is 32.01 per cent higher than control plot yield in potato with the application of micronutrients mixture *i.e.* Zn, B, Fe, Mn along with NPK. The results obtained in these acid soils which are marginal with respect to all essential nutrients are in accordance to the findings of Halavatau *et al.* (1998) that by satisfying both the major as well as micronutrient requirement of marginal soils, the tuber as well as vine yield can be increased considerably.

### *Proximate composition*

Fig. 1 & 2 revealed that application of secondary nutrient (Mg) and the micronutrient (Zn and Boron) along with recommended doses of NPK and organic manure influenced the bio-chemical composition of sweet potato. However, highest dry matter (26.24 %), total sugars (3.72%) and starch content (20.49 %) was recorded in T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments. This is in conformity with the finding of Vele *et al.* (2000) who reported that application of Mg and Zn along with the recommended doses of organic and inorganic fertilizers had significant effect on enhancing the productivity of sweet potato, efficiency of applied chemical fertilizers by countering the acidity and exchangeable aluminum content in the soils and thereby improving the soil fertility.

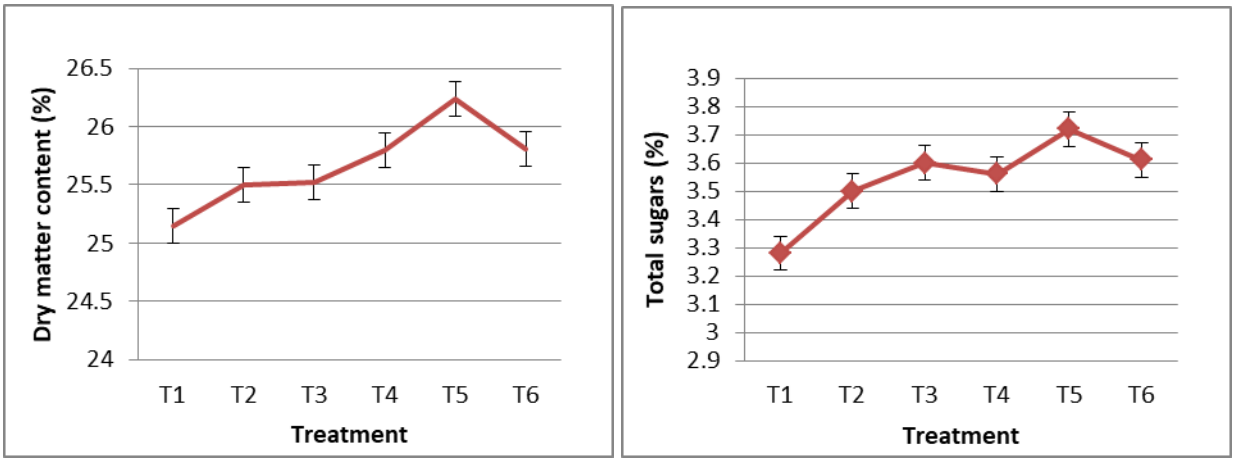


**Fig.1: Effect of secondary and micronutrients on dry matter and total sugars content of sweet potato cv. Sree Bhadra**

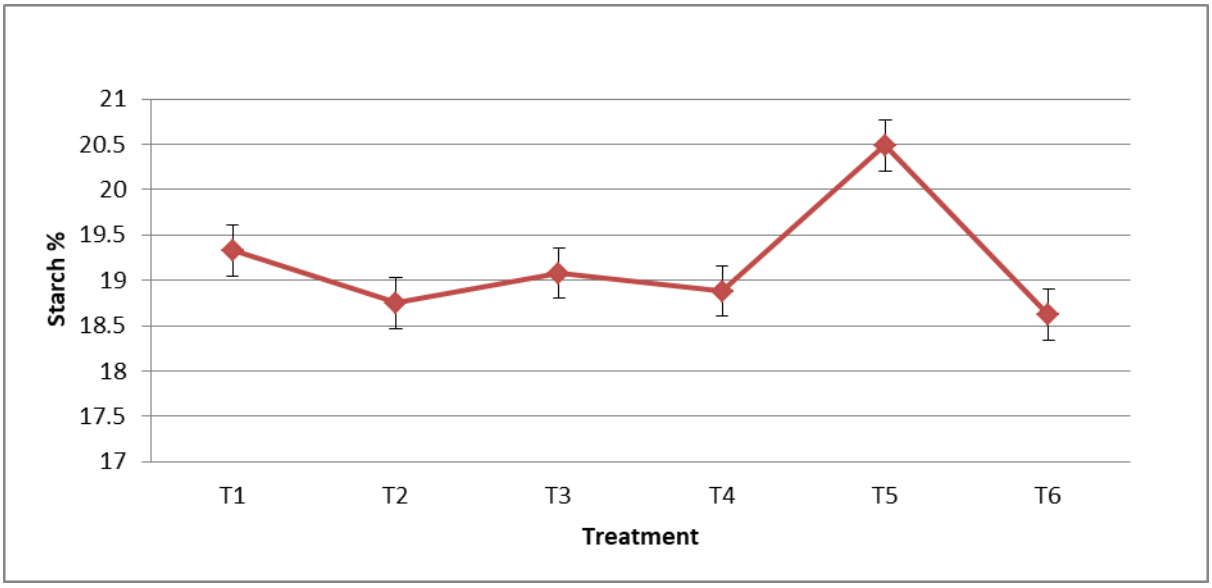


**Fig.2: Effect of secondary and micronutrients on starch content of sweet potato cv. Sree Bhadra**

**Table 1: Effect of secondary and micronutrients on growth and yield parameters of sweet potato cv. Sree Bhadra**

| Treatment | Vine length at harvest (cm) | No. of branches at harvest | Leaf length (cm) | Leaf width (cm) | Tuber length (cm) | Tuber girth (cm) | Tuber yield (t/ha) |
|---|---|---|---|---|---|---|---|
| T1 | 338.70 | 7.81 | 7.40 | 7.73 | 12.97 | 3.22 | 20.56 |
| T2 | 291.07 | 8.15 | 6.23 | 6.30 | 11.36 | 4.86 | 22.32 |
| T3 | 393.03 | 9.08 | 8.57 | 9.07 | 13.88 | 4.90 | 23.90 |
| T4 | 301.27 | 8.33 | 7.87 | 8.43 | 8.51 | 4.38 | 21.98 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| T5 | 388.20 | 8.80 | 8.33 | 8.87 | 14.12 | 4.98 | 25.78 |
| T6 | 266.33 | 8.64 | 8.07 | 8.57 | 11.60 | 3.16 | 20.05 |
| CD at 5% | 20.77 | 1.51 | 0.45 | 1.0 | 1.48 | 0.12 | 3.54 |

T1 : Recommended dose of FYM and NPK, T2 : Recommended dose of FYM and NPK + soil application of MgSO4 @ 20kg/ha, T3 : Recommended dose of FYM and NPK + soil application of Borax @ 15kg/ha, T4 : Recommended dose of FYM, NKP + Dipping of cutting for 15 minutes in 2% ZnSO4.7H2O, T5 : Recommended dose of FYM, NPK + Mg + B + Zn treatments, T6 : (control).

## 4. Conclusion

The experimental findings revealed that application of recommended dose of FYM, NPK + MgSO4 @ 20kg/ha + Borax @ 15kg/ha + Dipping of cutting for 15 minutes in 2% ZnSO4.7H2O enhanced the growth, yield and quality of sweet potato cv. Sree Bhadra. Therefore, it may be concluded that application of Mg, B and Zn along with the recommended doses of organic and inorganic fertilizers can be used to improve growth, yield and quality of sweet potato.

## 5. Acknowledgments

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## 6. References

Anonymous (2017) All India area and production of fruits a vegetables. Indian Hort. Database, National Horticultu Board, Ministry of Agriculture, Govt. of India., pp. 1 (http.//www.nhb.gov.in)

Baybutt RC and Molteni HL (2000) Vitamin A deficiency injures lung and liver parenchyma and impairs function of rat type II pneumocytes. Journal of Nutrition 130(5): 1159-65

Brady NC and Weil RR (2006) Nature and Properties of Soils. 13th Edn. Prentice-Hall, London, United Kingdom

Halavatau SM O'Sullivan JN, Asher CJ and Blamey FPC (1998) Better nutrition for the improvement of sweet potato and taro yields in the South Pacific. Tropical Agriculture 75: 6-12

Kang BT and Juo ASR (1980) Management of low activity clay soils in tropical Africa for food crops production, pp.129-133, *In*: Terry ER, KA Oduro and S Caveness (eds.) Tropical Roots crops. Research strategies for the 1980s.Ottawa, Ontario IDRC

Obi ME and Ebo PO (1995) The effect of different management practices on the soil physical properties and maize production in severely degraded soil in Southern Nigeria. Biological Research Technology 51: 117-123

Laxminarayana K and John KS (2014) Effect of Zinc and Magnesium on Orange-Fleshed Sweet Potato in Alfisols of Odisha, India. Journal of Root Crops 40(1): 1-7

Moinuddin G, Jash S, Sarkar A and Dasgupta S (2017). Response of potato (*Solanum tuberosum* L.) to foliar application of macro and micronutrients in the Red and Lateritic Zone of West Bengal. Journal of Crop and Weed 13(1): 185-188

Panse VG and Sukhatme PV (1985) Design of Experiments. VIII Randomized Blocks and Latin Square. In: Statistical Methodology for Agricultural Workers, ICAR, New Delhi, pp. 145-56

Singh S, Singh RN, Prasad J and Kumar B (2002) Effect of green manuring, FYM and biofertilizer in relation to fertilizer nitrogen on yield and major nutrient uptake by upland rice. Journal of Indian Society of Soil Science 50(3): 313-314

Taya JS, Malak YSML, Pandila SC and Khurana SE (1994). Fertilizers management in potato based cropping system: Growth and yield of potato. Journal of Indian Potato Association 21(3-4): 164-188

Woolfe JA (1992). Sweet potato: an untapped food resource. New York: Cambridge University Press

Vele PI, Pax B and Colin JA (2000). Effects of lime and gypsum on growth of sweet potato in two strongly acid soils. Australian Journal of Agriculture Research 51(8): 1031-1037

Wallerstein C (2000). New sweet potato could help combat blindness in Africa. British Medical Journal 30: 321(7264): 786