International Journal of Chemical Studies

**P-ISSN: 2349–8528**
**E-ISSN: 2321–4902**
IJCS 2018; 6(5): 1118-1121

Received: 19-07-2018
Accepted: 20-08-2018

**PP Srivastava**
Soil Science & Chemistry laboratory, Central Tasar Research & Training Institute, Piska Nagri, Ranchi, Jharkhand, India

**T Pandiaraj**
Soil Science & Chemistry laboratory, Central Tasar Research & Training Institute, Piska Nagri, Ranchi, Jharkhand, India

**Susmita Das**
Soil Science & Chemistry laboratory, Central Tasar Research & Training Institute, Piska Nagri, Ranchi, Jharkhand, India

**AK Sinha**
Soil Science & Chemistry laboratory, Central Tasar Research & Training Institute, Piska Nagri, Ranchi, Jharkhand, India

**Correspondence**
**T Pandiaraj**
Soil Science & Chemistry laboratory, Central Tasar Research & Training Institute, Piska Nagri, Ranchi, Jharkhand, India

# Status of micronutrients in the tasar host plants growing soils in Purulia district of West Bengal

**PP Srivastava, T Pandiaraj, Susmita Das and AK Sinha**

**Abstract**
One hundred and sixty soil samples representing fourteen major tasar sericulture adopting regions of Purulia district in West Bengal were studied for available micronutrients (Zn, B, Fe, Mn and Cu). The result showed that the mean value of Zn, B, Fe, Mn and Cu was 4.10, 4.65, 10.42, 4.13 and 1.49 mg $kg^{-1}$ of soil, respectively. Result further revealed that most of the micronutrients showed sufficient in available micronutrients. All the soils were sufficient in DTPA-extractable B, Mn and Cu but Zn and Fe were deficient in 3 and 11 percent of soils, respectively. Hence, it appears that tasar host plants growing soils under acidic pH are sufficient in supply of available reserve micronutrients even without external application.

**Keywords:** Host plants, micronutrients, Purulia, tasar, silkworm

## Introduction
Tasar silkworm (*Antheraea mylitta* D.) is a polyphagous insect feeding primarily on Asan (*Terminalia tomentosa*), Arjun (*T. arjuna*), Sal (*Sorea robusta)* and secondarily on more than two dozens of food plants. The growth and development of tasar silkworm larvae and economic characters of cocoons are directly proportional to the nutritional contents of leaves (Srivastava *et al., 2017*) [21]. The quality of tasar food plant leaves depend on the nutritional status of the soil. Good quality of leaves indicates greater possibility of obtaining good cocoon crops. Sahay *et al.* (2001) [16] indicated that leaf quality is one of the important factors contributing to success of tasar crops. Further, the quality of tasar food plant leaves depend on the nutritional status of the soil. Pandiaraj *et al*., 2017 [14] stated quality of leaves depends on the balanced supply of essential nutrients from soil. Earlier, Sahay and Kapila (1993) [15] also stated that the productivity and quality of host plant foliage depend upon a judicious management of inputs such as water and nutrients.

Micronutrient plays an imperative function in sustain soil health and also productivity of tasar plants. Although the earlier studies (Sakal *et al.* 1988; Singh and Choudhary 1990) [18, 20] showed that the availability of DTPA extractable micronutrients was affected by soil properties (pH, organic carbon, sand, silt and clay content), however, the variation in DTPA extractable Zn, B, Cu, Mn and Fe in relation to these soil characteristics may not be uniform for all soils in general and acid soils in particular. Information on the status and availability of these micronutrients are scanty for this region. Moreover, status of micronutrients in acid soils of Purulia district region typically affects the productivity of tasar host plants due to some undesirable result on the availability of different micronutrients (Singh *et. al.* 1992) [19]. Keeping this in view, the present investigation was carried out to assess the status of micronutrients *viz.* Zn, B, Cu, Mn and Fe in different tasar sericultural important soil series of Purulia terrain.

## Materials and Methods
### Study site
The study was carried out in the Kashipur block of Purulia district which is positioned at 23°26'N latitude and 86°40'E longitude with typical altitude of 228 m MSL and an estimated area of 801.88 $km^2$. Summers are scorching and dry with temperatures ranging from lows of 23 °C to highs above 48 °C. The majority of the rainfall occurs due to south-west monsoon.

### Soil sampling and analysis

A total of 160 soil samples were collected at depth intervals of 0-30 cm from the fourteen villages of Kashipur block in Purulia district, West Bengal where tasar sericulture is predominant in study area. The soil samples were air dried ground and passed through 2 mm sieves in order to run the analysis. The analysis of soil samples has been done by using standard methods. Some available micronutrients in soil *viz.* Zn, Fe, Mn and Cu were extracted with DTPA-$CaCl_2$-TEA solution (Lindsay and Norvell 1978) [9] and determined with the help of atomic absorption spectrophotometer. The hot water soluble B was estimated by UV-VIS Spectrophotometer (Wear, 1965) [24]. Data were analysed by statistical procedure as outlined by Fisher (1950) [5]. For evaluation of the soil fertility of the study area, the spatial distribution for each parameter attribute was assessed using descriptive statistics (Iqbal *et al*., 2005) [6]. The coefficient of variation was ranked according to the procedure of (Aweto, 1982) [2] where, CV < 25% = low variation, CV >25 ≤ 50% = moderate variation, CV >50% = high variation. Duncan's Multiple Range Test was employed in data analysis using SPSS-16v.

### Results and Discussion

### Available Zinc

DTPA- extractable Zn in these soil series ranged from 0.37 to 15.85 mg $kg^{-1}$ of soil (Table 1). It was significantly highest amount in soils of Makhyada (8.04 mg $kg^{-1}$) and lowest in Jurguridi (2.10 mg $kg^{-1}$). The co-efficient of variation of soil showed medium variance as 68.83 percent. According to Katyal (1985) [7] who suggested the critical limit as 0.6 mg $kg^{-1}$ of soil, the soils under study shows that 97 percent soils are sufficient and only 3.0 percent are deficient in DTPA extractable Zn (Fig. 1). The solubility of native forms of Zn is highly pH and EC dependent and decreased by a factor of 100 percent per unit raise in pH (Lindsay, 1972) [10]. In the present study also all the soil samples of selected sites showed pH in acid range might be resulted in favour to accumulate Zn in available form. Similar results were reported by Mahesh *et al*., 2011 [11] and Murthy *et al*., 2005 [13].

**Table 1:** Available micronutrient (mg $kg^{-1}$) status of soil at tasar silkworm's food plants grown regions of Purulia district

| Village | No. of samples | Zn | B | Fe | Mn | Cu |
|---|---|---|---|---|---|---|
| Pabra | 20 | $4.83^{d}$ | $6.64^{b}$ | $11.92^{b}$ | $44.78^{d}$ | $1.05^{gh}$ |
| Sonaijuri | 05 | $3.35^{h}$ | $4.04^{ef}$ | $10.28^{d}$ | $37.23^{fg}$ | $1.32^{ef}$ |
| Damankiyari | 23 | $4.07^{f}$ | $7.38^{a}$ | $9.22^{e}$ | $38.04^{f}$ | $1.51^{de}$ |
| Simla | 06 | $5.76^{b}$ | $3.01^{i}$ | $10.36^{d}$ | $41.13^{e}$ | $0.93^{h}$ |
| Agardih | 07 | $4.85^{d}$ | $3.68^{gh}$ | $11.74^{b}$ | $59.41^{a}$ | $0.84^{h}$ |
| Lara | 12 | $2.93^{i}$ | $4.46^{d}$ | $10.39^{d}$ | $49.60^{c}$ | $1.15^{fg}$ |
| Gourangadih | 20 | $5.06^{c}$ | $4.03^{ef}$ | $10.12^{d}$ | $44.69^{d}$ | $2.50^{b}$ |
| Gagnabad | 18 | $3.30^{h}$ | $3.78^{gh}$ | $10.23^{d}$ | $33.34^{i}$ | $1.30^{ef}$ |
| Sonathali | 07 | $4.44^{e}$ | $3.56^{h}$ | $14.34^{a}$ | $35.82^{gh}$ | $1.41^{de}$ |
| Siayda | 10 | $3.63^{g}$ | $3.12^{i}$ | $10.26^{d}$ | $49.01^{c}$ | $0.85^{h}$ |
| Jurguridi | 10 | $2.10^{j}$ | $3.81^{fg}$ | $7.60^{f}$ | $40.21^{e}$ | $1.85^{c}$ |
| Ranjandih | 09 | $4.84^{d}$ | $4.13^{e}$ | $11.07^{c}$ | $32.0^{8}$ | $1.61^{d}$ |
| Kalapathar | 12 | $3.78^{g}$ | $3.22^{i}$ | $10.18^{d}$ | $34.96^{hi}$ | $1.35^{ef}$ |
| Makhyada | 01 | $8.04^{a}$ | $4.89^{c}$ | $9.60^{e}$ | $54.00^{b}$ | $9.61^{a}$ |
| Mean | | 4.10 | 4.65 | 10.42 | 41.33 | 1.49 |
| Median | | 3.56 | 3.49 | 9.75 | 44.58 | 0.88 |
| Mode | | 2.47 | 1.98 | 4.90 | 48.35 | 0.79 |
| Minimum | | 0.37 | 0.76 | 2.30 | 9.05 | 0.26 |
| Maximum | | 15.85 | 17.82 | 19.70 | 81.05 | 9.87 |
| SD | | 2.82 | 3.52 | 4.52 | 15.41 | 1.85 |
| CV | | 68.83 | 75.76 | 43.40 | 37.28 | 124.32 |

### Available Boron

The available B content of the soils of tasar sericulture practicing in the study area varied from 0.76 to 17.82 mg $kg^{-1}$ of soil with a mean value of 4.65 mg $kg^{-1}$. The median and mode values were 3.49 and 1.98 mg $kg^{-1}$, respectively (Table 1). The co-efficient of variance of sampling sites showed high as 75.76%. A significant highest amount of available B had recorded in the soils of Damankiyari village (7.38 mg $kg^{-1}$) and lowest in Simla (3.01 mg $kg^{-1}$) and Siyada villages (3.63 mg $kg^{-1}$). Considering 0.5 mg $kg^{-1}$ of available B as the critical limit (Stewart, 1953) [22] in soil, 100 percent soil samples of sites were sufficient in available B (Fig. 1). Berger and Troug (1946) [3] reported that availability of B was comparatively more in the acidic to neutral soil pH range. Thus, B-availability is not a limited in the selected sites. The result of Anitha *et al*., (2013) [1] is also confirmed with our result.

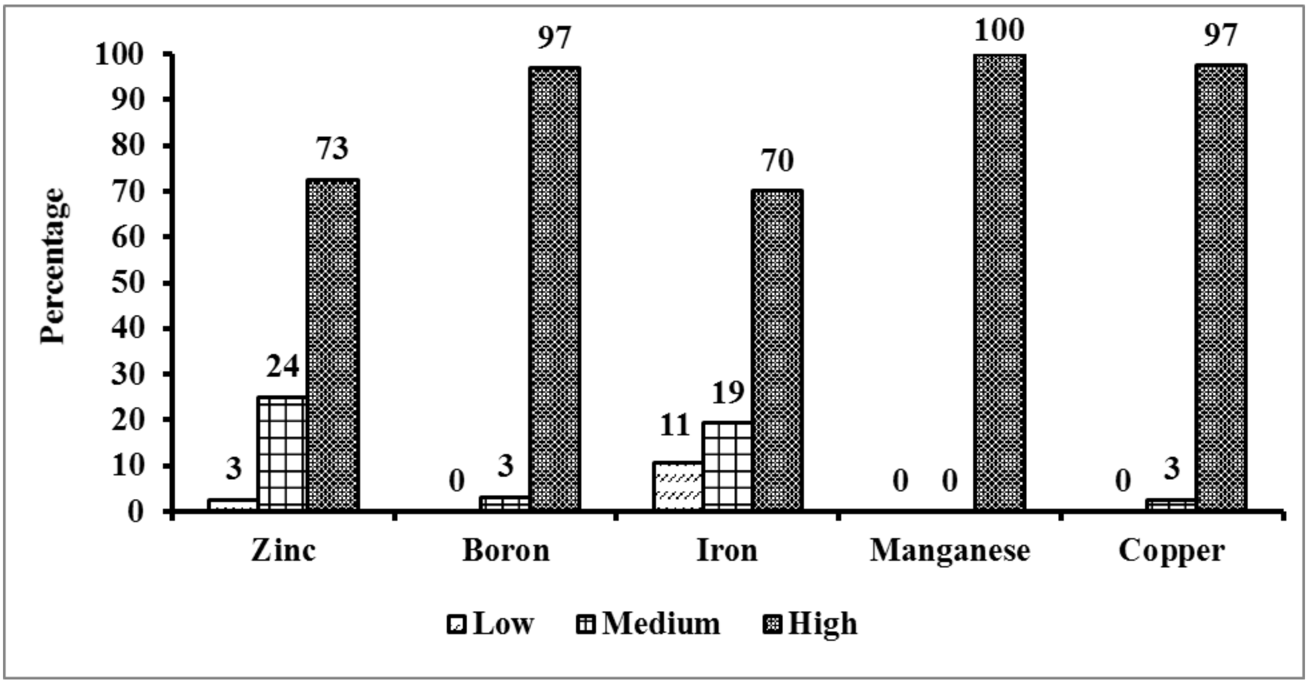


**Fig 1:** Percentage of micronutrients in different category under sampling area

**Available Iron**

DTPA extractable Fe content in these soil series varied from 2.30 to 19.70 mg $kg^{-1}$ with a mean, median and mode values of 19.70, 9.75 and 4.90 mg $kg^{-1}$, respectively (Table 1). The significant highest content of available Fe was observed in soils of Sonathali (14.34 mg $kg^{-1}$) and lowest in Jurgurdi (9.60 mg $kg^{-1}$). About 89 and 11 percent soil samples of study places are found to be sufficient and deficient, respectively (Fig. 1) when we consider 4.5 mg $kg^{-1}$ soils as threshold value for DTPA extractable Fe in soil (Katyal and Randhawa, 1983) [8]. Soils with acidic pH range leads higher solubility could be resulted in higher availability of Fe content. Therefore, iron availability is generally high in acid soils. This is supported by the findings of Medhe *et al*. (2012) [12].

**Available Manganese**

A wide variation in the DTPA extractable Mn (9.05 to 81.05 mg $kg^{-1}$) was observed in the different soil series with minimum in Gaganabad (33.34 mg kg-$^{1}$) and the maximum in Agardih (59.41 mg $kg^{-1}$). The mean, median and mode values are 41.33, 44.58 and 48.35 mg $kg^{-1}$, respectively with a medium co-efficient of variance as 37.28 percent (Table 1). Such variations in Mn status of acid soils have also been reported by Sakal *et al*. (1996) [18]. Considering 2.0 mg $kg^{-1}$ soils of DTPA extractable Mn as critical limit (Takkar *et al*. 1989) [23], all soils were sufficient in available Mn (Fig. 1). This implies that the soils contain sufficient Mn for successful tasar sericulture in the area studied as they are above the critical limits of 2.0 mg $kg^{-1}$.

**Available Copper**

The available Cu in the soils varied from 0.26 to 9.87 mg $kg^{-1}$ of soil with a mean value of 1.49 mg $kg^{-1}$ (Table 1). The available Cu was the highest (9.61 mg $kg^{-1}$) in Makhyada and lowest in Agardih (0.84 mg $kg^{-1}$), Siyada (0.85 mg $kg^{-1}$) and Simla (0.93 mg $kg^{-1}$). All the soils are found to be adequate in DTPA-extractable Cu (Katyal and Randhawa 1983) [8] as 0.2 mg Cu $kg^{-1}$ soil is considerable the threshold value (Fig. 1). Available Cu was positively correlated with organic carbon, clay and Zn. This is in accordance with the earlier report of Chatterjee and Khan (1997) [4].

**Conclusion**

Supplying of quality leaves is paramount crucial for production of high quality tasar cocoons. Nutrient plays a vital role in leaf quality resulting in produce the superior silk yarn. In common, soils are adequate in cationic micronutrients. Consequently, regular dressing of these micronutrients is most necessary in these soils for higher tasar silk production. A judicial use of other nutrients in organic and inorganic source seems to be necessary for sustainable tasar silk production and soil health.

**References**

1. Anitha MS, Anil KS, Nair KM, Prasad SCR, Naidu LGK, Sarkar D. Soil boron and it s fractionation in agro-climatic zones of Karnataka. Clay Research 2013; 32(1):25-33.
2. Aweto AO. Variability of upper slope soils developed under sandstones in South-western Nigeria. Geographic J. 1982; 25:27-37.
3. Berger KC, Truog E. Boron availability in relation to soil reaction and organic matter content. Soil Science Society of America Journal. 1946; 10:113-116.
4. Chatterjee AK, Khan SK. Available Zn, Cu, Fe and Mn and effect of submergence on available Zn in relation to properties of some Alfisols of West Bengal. Journal of the Indian Society of Soil Science. 1997; 45:399-401.
5. Fisher RA. Statistical Methods for Research Workers. (Oliver and Boyd. Limited : Edinburgh), 1950.
6. Iqbal J, Thomasson, John A, Jenkins, Johnie N, Owens. *et al*. Spatial variability analysis of soil physical properties of alluvial soils. Soil Sci. Soc. Am. J. 2005; 69:1338-1350.
7. Katyal JC. Research achievements of All India Co-ordinated Scheme of Micronutrients in soils and plants. Fertilizer News. 1985; 30:67-75.
8. Katyal JC, Randhawa NS. Micronutrients. Rome: Food and Agriculture Organization of the United Nations Publication, 1983.
9. Lindsay WL, Norvell WA. Development of DTPA soil tests for Zn, Fe, Mn and Cu. Soil Science Society of America Journal. 1978; 42:421-428.

10. Lindsay WL. Zinc in soil and plant nutrition. In: Advances in Agronomy 24, 147-186. Academic Press Inc., New York, 1972.
11. Mahesh Kumar, Singh SK, Raina P, Sharma BK. Status of available major and micronutrients in arid soils of Churu district of Western Rajasthan. Journal of the Indian Society of Soil Science. 2011; 59:188-192.
12. Medhe SR, Tankankhar VG, Salve AN. Correlation of chemical properties, secondary nutrients and micronutrient anions from the soils of Chakur Tahsil of Latur district, Maharashrta. Journal of Trends in life sciences. 2012, 1(2).
13. Murthy RK, Srinivas Murthy CA. Distribution of some available micronutrients in black and red soils of Karnataka. Mysore Journal of Agricultural Science. 2005; 39:57-63.
14. Pandiaraj T, Srivastava PP, Susmita Das, Sinha AK. Evaluation of Soil Fertility Status for Soil Health Card in Various Tasar Growing Fields of Bihar and Jharkhand States, India. Int. J Curr. Microbiol. App. Sci. 2017; 6(4):1685-1693.
15. Sahay Alok, Kapila ML. Role of nutrition in synthesis of tasar silk. Indian Silk. 1993; 30(2):8-11.
16. Sahay Alok, Sahay DN, Thangavelu K. Disease management during tasar seed production. Workshop on Tasar seed production, planning and grainage. Central Tasar Research and Training Institute, Ranchi. 2001; 2001, 32-45.
17. Sakal R, Singh AP, Sinha RB, Bhogal NS. Twenty five years of research on micro and secondary nutrients in soils and crops of Bihar. Technical Bulletin RAU, Pusa, Samastipur (Bihar), 1996.
18. Sakal R, Singh AP, Singh SP. Distribution of available zinc, copper, iron and manganese in old alluvial soils as related to certain soil characteristics. Journal of the Indian Society of Soil Science. 1988; 36:59.
19. Singh BP, Das M, Ram M, Dwivedi BS, Prasad RN. Characterisation of Fe-toxic soils and affected plants in Meghalaya. Journal of the Indian Society of Soil Science. 1992; 40:326-328
20. Singh RR, Choudhary SN. Soil copper status of the calcareous belt of Bihar. Journal of the Indian Society of Soil Science. 1990; 38:317-318.
21. Srivastava PP, Pandiaraj T, Susmita Das, Sinha SK and Sinha AK. Characteristics of Soil Organic Carbon, Total Nitrogen and C/N Ratio in Tasar Silkworm Growing Regions of Jharkhand and Bihar States. Imperial Journal of Interdisciplinary Research. 2017; 3(5):426-429
22. Stewart AB, Cobalt deficiency in pastures in Great Britain. Proceeding 6$^{th}$ International Grass Congress held in London (UK). 1953; 1:718-719.
23. Takkar PN, Chibba IM, Mehta SK. Twenty years of co-ordinated research on micronutrients in soils and plants Bulletin 1. IISS. Bhopal, 1989, 314.
24. Wear JI. Boron. In: Methods of Soil Analysis (C.A. Black *et al*., Eds.), Part II. American Society of Agronomy, Madison, Winconsin, USA, 1965.