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Effect of Zinc Fertilization on Leaf Yield and Economic Return of Magahi Pan

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ABSTRACT

The experiment was conducted at Betelvine Research Centre, Islampur (BAU, Sabour) under ICAR-AICRP on MAP and Betelvine project in order to determine optimum dose of zinc application for enhancing leaf production and economic return of Magahi Pan in Agro-Climate Zone IIIB of Bihar where Zinc was deficient in the soil. Pooled mean of three consecutive years (2013, 2014 and 2015) data showed that the soil application of zinc @ 30 kg $ZnSO_4$ ha^{-1} had significant influence on growth attributes, number of marketable leaves $vine^{-1}$ and economic return of Magahi pan as compared to their lower doses of zinc sulfate including control treatment. The increase in marketable leaves with 30 kg/ha ZnSo4 was 4.06 %, 10.04 %, 15.66 %, 20.62 % and 26.51% more than that of 25, 20, 15, 10 kg/ha ZnSo4 and control, respectively. The highest gross monetary return (Rs. 2651850 ha^{-1}), net monetary return (Rs. 826260 ha^{-1}) and benefit: cost ratio (1.45) was found with the application of 30 kg $ZnSO_4$ ha^{-1} followed by application of 25 kg $ZnSO_4$ ha^{-1}. However, the lowest benefit: cost ratio was recorded under control (1.17).

***Key words**: Zinc fertilization, Magahi pan, Betel leaf production and Economic return.*

INTRODUCTION

Betel vine (*Piper betle* L.) is a perennial, dioecious (male and female plants are different), evergreen climber that is cultivated intensively for the sake of its leaves due to its medicinal, religious and ceremonial value .In India it is customary to serve betel leaf on various social, cultural and religious occasions and is also offered to guests as a mark of respect. In India, it is grown on commercial scale as cash crop mainly in the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Assam, Bihar, Madhya Pradesh, Maharashtra, Orissa, Tripura, Uttar Pradesh and West Bengal. About 55, 000 ha area is covered under betelvine cultivation in the country. Bihar, occupied only 4000 ha area under betel vine cultivation out of which Magahi pan covered 439 ha (Jha & Kumar, 2014). Magahi pan is the most popular betelvine cultivar of Bihar and it is mainly grown in Magadha region (O'Malley, 1906 & Singh, 1967) which comprising of Aurangabad, Gaya, Nawada and Nalanda districts.

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However, this district has been experiencing decline in betel leaf production due deficiency of zinc in soil though zinc is an essential nutrient required for proper growth of plants (Hemantharanjan, 1996). Zinc deficiency is most commonly corrected by application of zinc sulphate ($ZnSO_4$.7H2O) as of its high water solubility and low cost (Rattan et al., 1997). The economic part of betelvine is green, leaves that are harvested at regular intervals. Therefore, it needs continuous nutrient supply for maintaining higher yield and productivity (Saravanan & Maiti; 2008). Due to high input demanding nature of the crop, the nutrient requirement of the betelvine is quite high (Immam et al., 2012). Hence, micro nutrient (Zn) is key inputs in increasing productivity through healthy growth and marketable leaves production.

Therefore, an experiment was conducted in order to determine optimum dose of zinc application for enhancing leaf production and economic return of Magahi Pan in Agro-Climate Zone IIIB of Bihar where Zinc was deficient in the soil

MATERIALS AND METHODS

The present investigation was conducted during three consecutive kharif season 2013, 2014 and 2015 in zinc deficient soil of Betelvine Research Centre, Islampur (25°07' N Latitude and 85°24' E Longitude with an altitude of 9.75m above mean sea level) under AICRP on MAP &Betelvine poject. The soil of experimental field was medium in Zn content (0.95 ppm). The experiment was laid out in randomised block design with six treatments (T_1- Control, T2-10 kg $ZnSO_4$/ha, T_3-15 kg $ZnSO_4$/ha, T_4-20 kg $ZnSO_4$/ha, T_5-25 kg $ZnSO_4$/ha and T_6- 30 kg $ZnSO_4$/ha) replicated three times. Zinc fertilizer was applied as per treatment wise in soil at the time of land preparation through broadcast, followed by surface incorporation. NPK fertilizers were applied as per the recommended dose in all the plots of the experimental field (200:100:100 kg ha^{-1}). The entire amount of P and K were applied at the time of transplanting. However, nitrogen was applied in four equal split doses. First split dose of N was given at the time of planting and the rest of the N was given at the interval 90 days after transplanting of vines. The most popular local cultivar (Magahi pan) was selected for the study and their planting was done during the month of May-June in the respective years. Other agronomical practices like weeding, gap filling, irrigation and lowering of vines were done as and when necessary. Observations on growth and yield parameters like length of vine ,nnumber of branch per vine, and number of marketable leaves per vine were recorded from randomly selected five tagged plants excluding the border rows from each treatment and their average values were worked out. The economics of different treatment was calculated on the basis of prevailing market price. The price of betel leaf was Rs. 50 per dholi (1 Dholi = 200 betel leaves).

RESULTS AND CONCLUSION

Effect of zinc fertilization on vine length and number of lateral branches of Magahi Pan: Data presented in table 1 clearly indicate that different nutrient management treatment had marked influence on increment of vine length in betelvine crop during all the three years of experimentation. Among the different treatments, application of 30 kg $ZnSO_4$ ha $^{-1}$ exhibited longest mean value of vine length (180.10 cm) which was significantly higher than rest of the treatments. Next highest mean value for vine length (173.40 cm) was obtained where 25 kg $ZnSO_4$ ha $^{-1}$ was applied. This was also significantly superior over their lower dose of zinc fertilized treatments but all these zinc fertilized treatments (10, 15, 20, 25 and 30 kg $ZnSO_4$ ha $^{-1}$) showed their significant superiority over control plot where shortest length of vine with mean value of 144.10 cm was obtained. Almost similar influence of micronutrient on number of lateral branches $vine^{-1}$ was observed as noted in case of vine length. However, application of 30 kg $ZnSO_4$ ha $^{-1}$ produced maximum mean value of lateral branches $vine^{-1}$ (5.2) followed by 25 kg $ZnSO_4$ ha $^{-1}$ (4.6 branches vine^{-1}), whereas the minimum mean value of lateral branches vine^{-1} (3.0) was found with control plot. The results are in close conformity with the finding of Saravanan and Maiti (2008). They reported that application of micro-nutrients zinc 0.25% to 0.5% improved the growth and leaf yield attributes however, they also agreed with application of 200: 100: 100 kg NPK ha^{-1} for improvement in growth and yield attributes of betelvine at Sangli (Maharastra).

Table 1: Effect of Zinc fertilization on Vine length of Magahi Pan

Treatments	**Length of Vine (Cm.)**			
	2013-14	**2014-15**	**2015-16**	**Pooled mean**
T_1- Control	145	140	147.3	144.1
T_2- 10 kg $ZnSO_4$ ha $^{-1}$	156	150	149.7	151.9
T_3- 15 kg $ZnSO_4$ ha $^{-1}$	162	160	158.3	160.1
T_4- 20 kg $ZnSO_4$ ha $^{-1}$	166	165	162.7	164.6
T_5- 25 kg $ZnSO_4$ ha $^{-1}$	176	173	171.3	173.4
T_6- 30 kg $ZnSO_4$ ha $^{-1}$	180	185	175.3	180.10
Sem ±	2.47	1.85	1.9	1.83
C.D. (P=0.05)	7.4	5.93	6.4	5.5
Treatments	**No. of lateral branches vine^{-1}**			
	2013-14	2014-15	2015-16	Pooled mean
T_1- Control	3.2	3.0	2.7	3.0
T_2- 10 kg $ZnSO_4$ ha $^{-1}$	3.6	3.3	3.0	3.3
T_3- 15 kg $ZnSO_4$ ha $^{-1}$	3.7	3.5	3.3	3.5
T_4- 20 kg $ZnSO_4$ ha $^{-1}$	3.9	3.7	3.7	3.8
T_5- 25 kg $ZnSO_4$ ha $^{-1}$	4.5	4.9	4.3	4.6
T_6- 30 kg $ZnSO_4$ ha $^{-1}$	5.4	5.2	5.0	5.2
Sem ±	0.15	0.16	0.78	0.1
C.D. (P=0.05)	0.43	0.52	NS	0.3

Effect of zinc fertilization on leaf yield of Magahi pan: Experimental data from the pooled mean of three consecutive years (Table 2a) revealed that the soil application of Zn showed marked influence on leaf yield (leaves vine^{-1}) as compared to control. Ssignificantly higher marketable leaves (74.70 leaves vine^{-1}) were registered with the application of 30 kg $ZnSO_4$ ha^{-1} which exhibited its superiority over rest of the treatments. It was also noticed that application of 25 kg $ZnSO_4$ ha^{-1} ranked second in registering appreciably higher marketable leaves/vine (71.70). However, the variation between this two treatments was found to non significant in terms of number of marketable leaves vine^{-1}. The increase in marketable leaves with 30 kg/ha ZnSo4 was 4.0.6 %, 10.04 %, 15.66 %, 20.62 % and 26.51% more than that of 25, 20, 15, 10 kg/ha ZnSo4 and control, respectively. The highest marketable leaves with 30 kg ha^{-1} ZnSo4 was might be due to more number of branching and vine lengths of betel vine crop on account of adequate and prolonged supply of zinc in the concerned plot. Similar result was also reported by Arulmozhiyan et al. (1993) and he found that application micronutrients influenced the leaf yield of betel vine with highest yield of 2045 leaves per hill with 0.50% zinc sulphate sprays compared to 1906 leaves in control was obtained in cv. Vellaikodi. Similar finding was also reported by Hamza and Sadanandan (2005) in case of black pepper under field condition. Also, Saravanan and Maiti (2008) reported that application of micro-nutrients zinc (0.25%) at Bapatla (A.P) and zinc (0.5%) at Kalyani (W.B) improved the leaf yield but at Sangli (Maharastra), application of 200 : 100: 100 kg NPK ha^{-1} [1] was beneficial to improve yield of betelvine leaves..

Effect of Zinc fertilization on economic return of Magahi Pan: The pooled data cited in Table 2b revealed that the different nutrient management treatment caused appreciable variation on economics of Magahi pan cultivation. The economics of Magahi pan were increased with increased dose of zinc application. The highest gross monetary return (Rs. 2651850 ha^{-1}) and net monetary return (Rs. 826260 ha^{-1}) was found with the application of 30 kg $ZnSO_4$ ha^{-1} followed by application of 25 kg $ZnSO_4$ ha^{-1}. Similar trend was also found in case of benefit: cost ratio. Maximum benefit: cost ratio (1.45) was obtained with the application of 30 kg $ZnSO_4$ ha^{-1} followed by 25 kg $ZnSO_4$ ha^{-1} (1.39). The lowest benefit: cost ratio was recorded under Control (1.17). Hamza and Sadanandan (2005) also reported in case of black pepper that soil application of $ZnSO_4$ @ 2.5 kg Zn ha^{-1} produced maximum benefit: cost ratio (5.27), followed by 0.5% foliar $ZnSO_4$ spray in field condition.

Table 2a. Effect of Zinc fertilization on leaf yield of Magahi Pan

Treatments	Leaf yield (leaves $vine^{-1}$)			
	2013-14	2014-15	2015-16	Pooled
T_1- Control	60	55	49.7	54.90
T_2- 10 kg $ZnSO_4$ ha^{-1}	65	60	53.0	59.30
T_3- 15 kg $ZnSO_4$ ha^{-1}	69	64	56.0	63.0
T_4- 20 kg $ZnSO_4$ ha^{-1}	71	69	61.7	67.20
T_5- 25 kg $ZnSO_4$ ha^{-1}	76	72	67.0	71.70
T_6- 30 kg $ZnSO_4$ ha^{-1}	80	75	69.0	74.70
Sem ±	1.53	1.89	1.5	0.58
C.D. (P=0.05)	4.62	6.05	4.8	1.73

Table 2b. Effect of Zinc fertilization on economic return of Magahi Pan (Pooled mean)

Treatments	Leaf yield (Dholi ha^{-1})	Gross Return (Rs.ha^{-1})	Net Return (Rs.ha^{-1})	Benefit cost (B:C) ratio
T_1- Control	42547	2127375	303435	1.17
T_2- 10 kg $ZnSO_4$ ha^{-1}	44475	2223750	399260	1.22
T_3- 15 kg $ZnSO_4$ ha^{-1}	47250	2362500	537735	1.29
T_4- 20 kg $ZnSO_4$ ha^{-1}	47712	2385600	560560	1.31
T_5- 25 kg $ZnSO_4$ ha^{-1}	50907	2545350	720035	1.39
T_6- 30 kg $ZnSO_4$ ha^{-1}	53037	2651850	826260	1.45
Sem ±	-	-	-	-
C.D. (P=0.05)	-	-	-	-

CONCLUSION

Based on three years pooled yield data and net return, it would be concluded that application of ZnSo4 @ 30 Kg ha^{-1} is suitable for enhancing marketable leaves and net return of Magahi pan cultivation in Agro-Climate Zone IIIB of Bihar where Zinc was found to be deficient in the soil.

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REFERENCES

Arulmozhiyan, R, Nagalakshmi, J, Jonathan, EI. Ayyamperumal, A, Padmanabhan, D. (1993). Effect of micronutrients on the growth and yield of betelvine cv. Vellaikodi. *South Indian Horticulture*. *41***(**5), 305-306.

Hamza, S., & Sadanandan AK (2005). Effect of source and method of application of zinc on yield and quality of black pepper (*Piper nigrum* L.) *Journal of Spices and Aromatic Crops 14*(2), 117–121

Hemantaranjan, A. (1996). Physiological and biochemical significance of zinc nutrition in plants. In: Hemantaranjan A (Ed.) Advancement in Micronutrient Research (pp. 151.178). Scientific Publisher, Jodhpur.

Imam, M.N., Pariari, A., & Sahu PK (2012). Effect of integrated nitrogen application on growth and yield of betelvine *(Piper betle* L.) *Journal of Crop and Weed 8*(1), 141-144.

Jha, P.K., & Kumar, N. (2014). Status of betelvine crop in Bihar, pp.102-105. In: Hima B K, Surayanarayana M A, and Vasantha K T(eds.)*Compendium, National meet on Betelvine-Farmers, Traders and Researchesr Interface*, Febrruary 22-23,2014 IIHR, Bengaluru.

O'Malley, L.S.S. (1906). *Bengal District Gazetteers: Gaya*. Lagoss Press, New Delhi (Reprint 2007). P. 113.

Rattan, R.K., Datta, S. P., Saharan, N., & Katyal, J.C. (1997). Zinc in Indian agriculture. Fert. News *42*, 75.89.

Saravanan, R., & Maiti, S. (2008). Agronomic manipulations for crop production in *Piper betle: Conference paper in Natonal Seminar on Piperaceae.* (https://www.researchgate.net/publication/266081133

Singh, M.M.. (1967). *Life in North-eastern India in Pre-Mauryan Times* PP. 200. Motilal Banarasi das.