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EFFECT OF MACRO-MICRO NUTRIENTS AND LIMING ON WINTER SEASON *KUSMI* LAC YIELD ON *FLEMINGIA SEMIALATA*

S. GHOSAL, S.C. MEENA V.D. LOHOT AND K. THAMILARASHI

Lac Production Division, Indian Institute of Natural Resins and Gums, Ranchi, Jharkhand
E-mail: soumen66iinrg@gmail.com

ABSTRACT

Effect of liming and application of different macro/ micro nutrients on lac yield of *Flemingia semialata* plants were evaluated by an experiment consisted 12 treatments/ combinations. These included recommended doses of Zinc, Copper, Boron, Molybdenum; liming @ 125 g/m^2, two doses of potassium (30 and 60 g/plant), two doses of nitrogen (25 and 50 g/plant), combination of N-P-K (50, 25 and 50 g/ plant) and two control treatments (lac inoculated and lac uninoculated) replicated thrice in Randomized Block Design. Treatments like liming, two doses of potassium (30 and 60 g/ plant) and nitrogen application @ 25 g/ plant produced very low yield ration but high sticklac productivity. While all micro nutrient applied treatments and control produced relatively higher yield ratio but significantly lower stick lac production. Higher rate of nitrogen application and NPK combination are the inferior most treatments as they produced both yield ratio and sticklac yield in lower side. Higher sticklac yield on treatments like lime, potassium application, etc. signified that encrustation was quite dense and thick with those treatments. This finding inferred that these treatments are congenial for satisfactory lac production. Liming and potassium application @ 30 g/ plant registered a significant increase of 41 and 48 per cent increases in sticklac production over control. Spraying boron and molybdenum proved to be much better than spray of zinc and copper. However, output from control plants were in between and remained at par to both the groups.

Key words: *Flemingia*, Macro- micro nutrients, Lac.

Introduction

Lac insect (*Kerria lacca* Kerr.) is the only source of natural resin of animal origin. The resin secreted from the resin gland of the insect is a product of commerce. Presently, due to its diversification of uses in different industries, demand of the commodity has increased significantly. As a result, price of the commodity is increasing steadily, though production of the same has also increased side by side. Lac cultivation is the second important source of income in Jharkhand.

Traditionally, *kusum*, *ber* and *palas* are important tree hosts of lac insect. Recently, *F. semialata* has emerged to be an important bushy lac host. It has facilitated lac cultivation to integrate with general agriculture in farmers' field. Since it is a bushy host, proper growth of host plants should be ensured for satisfactory lac production. Main threat behind poor growth of *semialata* in lateritic soils is soil acidity which impairs root growth significantly (Vitorello *et al.*, 2005; Polomski and Kuhn, 2002). Reclamation of soil acidity not only supports root growth, but also makes a congenial soil condition for satisfactory plant growth. As such acidic soils are poor in macro/ micro nutrients particularly boron and molybdenum content. Besides plant growth, lac yield has been reported to be influenced by application of different macro-micro nutrients or liming also (Ghosal, 2012). Therefore, an experiment was conducted to ascertain which plant nutrients/amendment are important for lac production purpose.

Material and Methods

For evaluating the effect of liming and application of different macro/micro nutrients on lac yield of *F. semialata* plants, an experiment was conducted in the Institute Research Farm, Namkum (23^{0}23'N longitude, 85^{0}23' E latitude and 650 m amsl) during 2011-12 to 2013-14 in a five year old plantation. The experiment consisted 12 treatments/combinations. These included recommended doses of Zinc, Copper, Boron, Molybdenum; liming @ 125 g/m^2, two doses of potassium (30 and 60 g/plant), two doses of nitrogen (25 and 50 g/plant), combination of N-P-K (50, 25 and 50 g/ plant) and two control treatments (lac inoculated and lac uninoculated) replicated thrice in Randomized Block Design. Main purpose to include uninoculated control was to compare differences of growth due to inoculation of lac.

All micro nutrients and full dose of phosphorus and potassium and half dose of nitrogen were applied at the onset of monsoon and rest half dose of nitrogen was applied during third week of August. Liming was done two months before monsoon. Sources of fertilizer were

Liming and potassium application can increase *Kusmi* lac yield in *Flemingia semialata.*

diammonium phosphate and urea for nitrogen and phosphorus, muriate of potash for potassium. For application of micronutrients, zinc sulphate and copper sulphate @ 25 kg/ha for zinc and copper respectively, borax @ 10 kg/ha for boron and sodium molybdate @ 1.00 kg/ha for molybdenum were used during the study. All the micro nutrients were used for first year only while macronutrients and lime application was done all the years. The purpose of putting macronutrients, micronutrients and liming in a single experiment was to evaluate relative importance of these factors in acid lateritic soil of Ranchi.

A separate experiment was carried out to see plant response as affected by spraying of the same micro-nutrients in recommended dose. Same salts as applied for soil application were taken for spraying and it was done in the months of August and November in the year 2013-14.

Kusmi lac was inoculated in July in all the three years. Shoots without insect settlement were collected for studying dry matter per cent on oven dry basis. Whole plant along with lac was harvested in the month of February every year. Random sampling of broodlac (45 cm long) was done and sticklac (scrapped lac) was scrapped and weighed to examine treatment difference on sticklac production. Values were reported as grams per 10 cm broodlac. Chlorophyll Content Index was estimated by direct measurement through Chlorophyll Content Metre (CE USA model CCM 200).

Results and Discussion

Broodlac yield ratio and sticklac (scrapped lac) production per unit length are two important parameters which dictate lac production potentiality of any treatment significantly. Lac yield ratio (output/ input ratio) obtained due to some treatment is reflected grossly, while the sticklac yield denotes the direct relationship of treatment to the insect growth. These two parameters as affected by different factors/treatments and years are presented in Table 1. Lac yield ration was found to be maximum in control (5.9) and minimum in nitrogen application @ 50 g/ plant. Performance of control, zinc, boron and molybdenum application were at par to each other. The rest of the treatments formed the inferior group. Broodlac yield data obtained in different treatments was not proportional to sticklac production data. It indicated that lac encrustation was not uniformly spread throughout the stem. Thus some treatments having higher yield ration gave very less sticklac production and *vice-versa*. As the data suggested, relative amount of unsettled places were much more on treatments giving higher yield ratio. Treatments like liming, two doses of potassium (30 and 60 g/ plant) and nitrogen application @ 25 g/ plant produced very low yield ration but high sticklac productivity. While all micro nutrient applied treatments and control produced relatively higher yield ratio but significantly lower sticklac production. Higher rate of nitrogen application and NPK combination are the inferior most treatments as they produced both yield ratio and sticklac yield in lower side. Higher sticklac yield on treatments like lime, potassium application etc signified that encrustation was quite dense and thick with those treatments. This finding inferred that these treatments are congenial for satisfactory lac production. Liming and potassium application @ 30 g/ plant registered a significant increase of 41 and 48 per cent increases in sticklac production over control. Since K_2O helps in efficient translocation of assimilates and maintains water relation in the cells, shoot succulence increases considerably. Increased shoot succulence could be the reason of increased sticklac yield. Ghosal (2012) reported that lac yield and succulence of *ber* shoots increased due to K_2O application. The same was true for sugarcane also (Abayomi, 1987). Besides, potassium has been reported to influence activation of enzymes which in turn influence photosynthesis, protein synthesis, nitrogen uptake and water movement (Nguyen *et al.*, 2002). Zengin *et al.* (2009) reported that moisture per cent in sugar beat increased due to increased water uptake in potassium applied plants.

Table 1: Plant growth and lac yield / yield attributes on F. semialata as affected by application of different macro- micro nutrients.

	Yield Ratio	Sticklac wt/ 10 cm brood (g)	Shoot dry matter (%)	Fresh wt/ plant (kg)
2011-12	2.6	11.1	28.9	1.54
2012-13	--		24.6	1.35
2013-14	5.0	5.2	26.4	1.11
CD (0.05)	0.8*	1.0*	0.7*	0.11*
C1	5.9	7.3	27.3	1.23
Zn	4.8	8.2	26.8	1.36
Cu	3.3	9.3	26.8	1.29
B	4.6	7.2	25.9	1.30
Mo	5.3	6.7	27.3	1.19
Lime	3.6	10.3	28.8	1.47
K_{30}	3.7	10.8	25.2	1.28
K_{60}	3.0	8.3	25.6	1.18
N_{50}	2.1	5.9	26.0	1.42
N_{25}	3.5	9.3	27.8	1.19
$N_{50}P_{25}K_{50}$	2.2	6.5	25.7	1.48
C2	-	-	26.4	1.58
CD (0.05)	1.8*	2.4*	1.4*	0.21*

*Significant at 5% level

C_1: Control inoculated; C_2: Control uninoculated

Since soil pH of the area has gone down significantly, liming has worked prominently to increase soil pH and

Table 2: Growth characters and lac yield and yield attributes on *F. semialata* as affected by spraying of different micro nutrients.

	CCI in Oct	Dry matter per cent in Sept	Fresh wt/ plant (kg)	Brood wt/ 10 cm	Sticklac wt/10 cm
C	20.2	20.6	1.49	16.49	7.79
Zn	23.5	22.8	1.29	11.81	5.95
Cu	21.8	22.7	1.29	12.76	5.81
B	24.0	23.8	1.92	16.89	10.25
Mo	22.3	24.5	1.35	17.26	9.28
CD (0.05)	2.3*	3.0 NS	0.86 NS	4.27*	3.24*

*Significant at 5% level

subsequently soil fertility. Data on fresh weight of plant revealed that maximum fresh weight was obtained in liming treatment i.e. 19 per cent higher than the control. Addition of lime in acid soil increases soil pH and eventually decreases solubility of Fe^{+3} and Al^{+3} ions in soil. There by it is supposed to promote root growth, which might have increased plant fresh weight and it remained at par to uninoculated control. Plants under uninoculated control, practically did not suffer any stress are expected to produce maximum fresh weight. Lac inoculated plants under lime treatment produced comparable amount of fresh weight as it was found in uninoculated condition. A considerable increase in shoot dry matter per cent (reduced succulence) has been noticed due to liming, but it did not affect the lac yield. Possible reason could be that general succulence level is higher in *F semialata* (dry matter per cent 24.6 to 28.9) compared to 39 to 41 per cent in *ber* (Ghosal, 2013). Therefore, above mentioned dose of lime can be used for sustainable growth of plants under lac cultivation. Satisfactory plant fresh weight was produced in NPK combination treatment. But, it proved to be very inferior treatment as far as lac production is concerned. A negative interaction between higher dose of nitrogen and phosphorous application might have affected lac production significantly.

As far as lac production is concerned, two years data are available, where sticklac production of third year is around 50% of that of first year. Difference was significant. A clear cut decline in fresh weight was also observed in three consecutive seasons. Therefore, it can be assumed that lower fresh weight production is the root cause of lower sticklac / resin production by the insect. Lower fresh weight production, in turn could be attributed to untimely pruning operation done during February- March. Long dry spell after pruning affect proper shoot regeneration in the next season.

Effect of all the micro nutrients in recommended dose neither affected nor proved beneficial for plant growth as well as lac production of *semialata* plants so far as soil application is concerned. Almost similar result on lac yield was obtained when micro nutrients were sprayed on plant (Table 2). However, spraying boron and molybdenum proved to be much better than spray of zinc and copper. Output from control plants were in between and remained at par to both the groups. Tendency of increased sticklac yield on boron treatments could be due to increased chlorophyll content index observed in October. In fact, there had been a little amount of depression in lac yield due to zinc and copper application as the level of nutrients present in acid soil is sufficient for plant need. On the reverse, *semialata* plants on boron deficient acid soil might have shown positive response on plant growth and lac production. Thus both remaining at par to control, had maintained a difference among them.

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फलेमिन्जिया सेमिलाटा पर सर्द मौसम कुसुम लाख उत्पादन पर बृहद-सूक्ष्म पोषकों एवं चूने का प्रभाव

एस. घोषाल, एस.सी. मीना, वी.डी. लोहोट एवं के. थमिलाराशी

सारांश

फलेमिन्जिया सेमिलाटा के लाख उत्पादन पर विभिन्न वृहद/सूक्ष्म पोषकों के उपयोग एवं चूने के प्रभाव का मूल्यांकन 12 उपचारों/संयोजनों को मिलाकर एक प्रयोग द्वारा किया गया। इसमें जिंक, कॉपर, बोरोन, मालीब्डीनम को संस्तुत मात्राएं ; 125 g/m^2 की दर पर चूना, पोटोशियम की दो मात्राएं (30 और 60 ग्रा. प्रति पादप), नाइट्रोजन की दो मात्राएं (25 और 50 ग्रा. प्रति पादप), नाइट्रोजन – फॉस्फोरस – पोटोशियम के संयोजन (50, 25 और 50 ग्रा. प्रति पादप) और दो नियंत्रण उपचार (लाख संरोपित तथा लाख गैर संरोपित) शामिल हैं, जिसे यादृच्छिकीकृत ब्लॉक अभिकल्प में तीन बार दोहराया गया। चूना, पोटेशियम की दो मात्राओं (30 और 60 ग्रा. प्रति पादप) तथा 25 ग्रा. प्रति पादप की दर से नाइट्रोजन अनुप्रयोग जैसे उपचारों ने बहुत

निम्न उपज राशन उत्पादित किया किन्तु उच्च स्टिकलैक उत्पादकता दी। जबकि सभी सूक्ष्म पोषक प्रयुक्त उपचारों और नियंत्रण ने अपेक्षाकृत उच्च उपज अनुपात उत्पादित किया किन्तु महत्वपूर्ण रूप से निम्न स्टिकलैक का उत्पादन किया। नाइट्रोजन अनुप्रयोग एवं नाइट्रोजन – फॉस्फोरस – पोटोशियम संयोजन की उच्च दर सबसे निम्न उपचार है क्योंकि उन्होनें उपज अनुपात एवं स्टिकलैक दोनों का निम्न उत्पादन किया। चूना, पोटोशियम उपयोग जैसे उपचारों में उच्च स्टिकलैक उत्पादन दर्शाता है कि उन उपचारों के साथ पपड़ी जमाव काफी सघन एवं मोटा था। यह निष्कर्ष दर्शाते हैं कि सन्तोषजनक लाख उत्पादन के लिए ये उपयार अनुकूल हैं। 30 ग्रा. प्रति पादप की दर से पोटेशियम और चूने के उपयोग ने नियंत्रण की अपेक्षा लाख उत्पादन में 41 और 48 प्रतिशत बढ़ोतरी की एक महत्वपूर्ण वृद्धि दर्ज की है। जिंक और कॉपर के छिड़काव की अपेक्षा बोरोन और मालीब्डीनम का छिड़काव ज्यादा बेहतर सिद्ध हुआ। तथापि, नियंत्रण पादपों से उत्पादन बीच का रहा और दोनों समूहों के समतुल्य बना रहा।

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