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IMPACT OF NUTRIENT MANAGEMENT OF *ZIZYPHUS MAURITIANA* (LAMB.) ON THE YIELD OF *KUSMI* LAC

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ABSTRACT
Lac production is a major economic activity of rainfed farmers in Seoni district, Madhya Pradesh. In the district lac production is carried on both *Butea monosperma* and *Zizyphus mauritiana* plants. The lac productivity is low due to no nutrient management of these host trees. The study impact of nutrient management of *Z. mauritiana* on the yield of *Kusmi* lac was conducted in Dhapara village, Barghat Block, Seoni District, MP from May 2013 to February 2014. The trial consisted on forty eight *Z. mauritiana* plants with four treatments (basal application of Urea- T_1, Urea and SSP-T_2, Urea, SSP and MOP- T_3, and control- T_4) and six replications. The results revealed that the mean weight of 100 fresh cells of lac at harvest as well as the dry cell weight increased significantly in nutrient treated *Z. mauritiana* plants as compared to the control. The highest increase in the mean fresh weight of 100 cells over the control in was T_3 (30.61%) followed by T_1 (17.26%) and T_2 (12.21%). Similarly the mean dry weight of 100 cells was highest in T_3 (36.63%) followed by T_1 (21.62%) and T_2 (16.02%) over the control respectively. The mean yield of *Kusmi* lac per *Z. mauritiana* was highest in T_3 (39.16%) followed by T_1 (32.63%) and T_2 (18.53%) over the control. The yield of *Kusmi* lac (kg) per *Z. mauritiana* was 5.08, 4.54, 5.33 and 3.83kg respectively among the different treatments T_1, T_2, T_3, and T_4. Thus the nutrient management of *Z. mauritiana* for lac production significantly increased the yield up to 39.16 percent.

INTRODUCTION

Lac production on *Zizyphus mauritiana* is a profitable option for farmers in Jharkhand, Chhattisgarh, Odisha,Madhya Pradesh and West Bengal (Ghosal, 2013). Farmers do not apply manure or fertilizer in *Z mauritiana* (Verma and Gurjar, 1994). Mineral nutrition status is known to influence growth and yield of crop plants by affecting changes in growth pattern, plant morphology, anatomy and particularly chemical composition (Marschner, 1995). The lac insect growth, yield and quality parameters of *Z. mauritiana* improved significantly with the addition of Nitrogen, Phosphorus and Potash (Lal *et al.,* 2003). The increase in the bio-mass of *Z. mauritiana* under *Kusmi* lac production under nutrient management was 4.36 kg per year per tree in comparison to 0.81 kg per year per tree in control (Ghosal, 2013).

Phloem sap is an extreme food source that is used as the dominant or sole diet aphids, whitefly, plant hoppers and some pentatomid bugs (Douglas, 2003). Phloem sap contains two macronutrients, amino acids and sugars (usually sucrose). Although concentrations of these chemicals in phloem sap have been measured in many plants (Zimmerman and Ziegler, 1975).The response of phloem-feeding insects to phloem sugars is physiologically complex, involving nutritional, osmoregulatory and behavioral components. Phloem sugars are the principal carbon source and respiratory fuel for these insects (Rhodes *et al.,* 1996 and Febvay *et al.,* 1999). Phloem feeders adversely affect both growth and amino- nitrogen profile of their host plants (Wellings and Dixon 1987).

Poor plant nutrition can also have adverse effects on the performance and fitness of sap feeders (Cook and Denno 1994). Lac insects are plant sap feeders (Singh *et al.,* 2009) thrive well only on certain plant species known as lac hosts. More than 400 lac hosts have been observed to carry lac insects throughout the world (Sharma *et al.,* 1997). *Palash* (*Butea monosperma*), *Ber* (*Z mauritiana*) and *Kusum* (*Schleichera oleosa*) are the most common hosts commercial for lac production in India (Pal, 2009). *Z. mauritiana* plant with basal application of 100g N, 250g P and 75g K per plant had highest lac yield (Paul *et al.,* 2013).

Therefore, an experiment with basal application of primary nutrients in *Z. mauritiana* plant was planned in Lac growers field with following objectives

Impact of nutrient management in *Z. mauritiana* on weight (both fresh and dry) of *Kusmi* lac cells

Impact of nutrient management in *Z. mauritiana* on the yield of *Kusmi* lac

MATERIALS AND METHODS

The study was conducted during May 2013 to February 2014 on *Z. mauritiana* trees in lac grower's field in the village, Dhapara, Block Barghat, District Seoni, MP to explore the Impact of nutrient management of *Ziziphus mauritiana* (Lamb.) on the yield of *Kusmi* lac

Location of study area

Seoni district

Geographically, Seoni district is located in the southern part of Madhya Pradesh between 21º35′ and 22º58′ N latitudes

and 79º12′ and 80º18′ E longitudes.Geologically, the area forms a part of Maikal range of northern and eastern parts of Satpura Hills tending N-S, NE-SW and E-W. The highest topographic elevation in the district is 756 m above mean sea level in Seoni-Lakhanadon plateau region and the lowest is 430m above mean sea level in the plains of Wainganga-Hirri River.

Agro-climatically, the district lies in the Zone IV- Kymore Plateau and Satpura Hill Zone of MP. Seoni district forms a part of the hills and plateau of the Satpura range of mountains. Major part of the landscape is undulating and rocky with thin layer of soil cover. The portion of the land used for agricultural purpose is 43.22 per cent of the total land cover of which only 11.93 per cent has assured irrigation and hence are double cropped. The rest of the agricultural land is totally rainfed and produces only one crop a year.

Barghat block

Barghat is one among the eight Blocks of the Seoni district and has 142 villages (136 Revenue villages, 4 Forest villages and 2 uninhabited villages). It has a geographical area of 53,924.09 ha of which 44,218.70 ha is a cultivated area. The area under irrigation is 4,536.63 ha (10.25 %) area while 39,682.07 ha is unirrigated (89.75%).

Dhapara village

Dhapara village has a geographical area of 397.08 ha, of which 338.17 ha is under cultivation while 22.20 ha, 6.50 ha and 27.75 ha are uncultivated under river and ponds.

Criteria for selection of

Lac growers: Lac growers having *Z mauritiana* trees in their field and willing to participate in the research were selected for the study. The marking of the selected trees was done in month of May 2013.

Trees: *Z mauritiana* trees which are over five years old, healthy, pruned and possessing sufficient succulent branches were selected for the study.

Operations

There were the following nine major operations during the experiment (Table 2).

Fertilizers application

All the marked *Z mauritiana* trees except control (T_4) were applied with basal dose of fertilizer as per treatments, one month before Broodlac inoculation.

Broodlac inoculation

The process of Brood lac inoculation had following three operations

Brood inoculation

Healthy *Kusmi* Broodlac weighing 300 to 600 g were used for inoculation per *Z. mauritiana* tree. Depending on the size of the tree, the brood lac were divided into three to six bundles (each with 100g per bundle) and inoculated between 16th to17th July, 2013.

Shifting

The Broodlac bundles were shifted carefully after 5 to 6 days of its inoculation to those branches of the same *Z mauritiana* tree which had less or no larval settlement. This was to ensure uniform distribution of the brood on all tree branches where there was no or insufficient lac larval settlement.

***Phunki* removal**

Larvae (crawlers) of lac insect from Broodlac settled on the tree in three weeks from the date of its inoculation. Once the crawlers leave the broodlac and settle on the twigs of the host, the remains of the Broodlac bundle is called *Phunki*. *Phunki* is in fact sticklac. *Phunki* usually consists of predators, was removed after 21 days of Broodlac inoculation and scrapped to recover raw lac, and in this process the predators were manually removed.

Spraying of pesticides

Application of pesticides for predator management is an essential process in the Lac production.The solution of pesticides were prepared by adding its desired quantity (1g of Cartap hydrochloride per litre of water + 1g Mancozeb per litre of water) in a small container followed by brisk stirring with a piece of stick. This concentrate solution was further diluted with clear water to make the spray solution.Spraying of the pesticides was done on 25th to 26thAugust, 2013.

Harvesting of sticklac

At maturity the sticklac was harvested on 9th and 10th of January 2014 for estimation of lac yield.

Scraping of raw lac

After harvesting of sticklac its scraping was done between 25thJanuary to 6th February 2014.

Observations were recorded

The observation on the parameters were recorded as mentioned in Table 3.

RESULTS AND DISCUSSION

Fertilizer application influenced the mean cell weight of lac insect at maturity. There was a significant difference in the mean weight of lac insect among the treatments (Table 4). Mean fresh weight (g) of 100 cell of lac insect was 7.20, 6.89, 8.02 and 6.14 in case of N, NP, NPK and control respectively. The mean fresh weight of 100 cell of lac insect was highest (8.02) in case of T_3 followed by T_1 (7.20 g), T_2 (6.89 g) and T_4 (6.14) fresh weight of 100 lac cell of *Kusmi* lac over the control.It was highest in T_3 (30.61%) followed by T_1 (17.26%) and T_2 (12.21%). The dry cell weight contribute significantly in the lac yield. The mean dry weight (g) of 100 cell of lac insect differed significantly among the different treatments.The mean dry weight of 100 lac cells (Table 5) was highest in T_3 (7.08) followed by T_1 (6.30), T_2 (6.01) and T_4 (5.18). The mean dry weight of 100 cells was more in comparison to control, the increase in the mean dry weight of 100 cell was highest 36.63% in T_3 (NPK) followed by 21.62% T_1 (N) and 16.02% in T_2 (NP). The mean yield (kg/plant) of *Z. mauritiana* obtained after harvesting of lac crop was 5.08, 4.54, 5.33 and 3.83 kg respectively among the treatment T_1, T_2, T_3 and T_4(Table 6). There was a significant difference in the yield of raw lac among all the treatments, and also an increase in the mean yield of lac per *Z. mauritiana* over control. It was highest over control in T_3 (39.16%) followed by T_1 (32.63%) and T_2 (18.53%).

Ghosh *et al.,* 2014 too have reported *Z mauritiana* as a major

Table 1: Details of the Experiment

Host trees		*Ber* (*Z. mauritiana*)
Design		R.B.D.
Number of Replications		6
Number of treatments		4
Number of *Z. mauritiana*trees per treatment		12
Total number of *Z.mauritiana* trees per replication		2
Treatment details (basal application of fertilizers per *Z. mauritiana* tree)		
T_1	Application of Nitrogen (Urea 220g)	
T_2	Application of Nitrogen (Urea 220g) and Phosphorus (SSP 1560g)	
T_3	Application of Nitrogen(Urea 220g), Phosphorous (SSP 1560g) and Potassium (MoP 125g)	
T_4	Control i.e. no use of fertilizers (Lac growers practice)	

Table 2: Details of major operation

S.n	Operations	Period
1	Selection of plant and its marking	Last week of May,2013
2	Soil sample collection	June 2013,November, 2013 and January, 2014
3	Application of fertilizers	19-20th June, 2013
4	Broodlac inoculation	16-17thJuly, 2013
5	Shifting of broodlac inoculated	23rdJuly, 2013
6	*Phunki* removal	6th August, 2013
7	Spraying of pesticide	25-26th August, 2013
8	Harvesting of sticklac	9-10th January, 2014
9	Scraping of raw lac	25th January to 6th February 2014

Table 3: Details of observations and its schedule

S.n	Observation	Scale	Period
a.	Mean Fresh cell weight	Weight (g)of 100 cells	January 2014
b.	Mean Dry cell weight	Weight(g) of 100 cell	January 2014
c.	Lac yield/plant	kg/plant	February 2014

Table 4: Mean fresh weight (g) of 100 cell of *Kusmi* lac insect at maturity

Replications	Mean fresh weight (g) of 100 *Kusmi* lac cells Treatments			
	T_1	T_2	T_3	T_4
R_1	8.03	5.92	8.91	5.47
R_2	8.03	6.02	8.16	6.22
R_3	8.07	6.59	8.39	5.74
R_4	7.26	7.64	6.69	6.17
R_5	6.53	8.52	8.43	7.33
R_6	5.27	6.69	7.56	5.90
Mean	7.20	6.89	8.02	6.14

SEm ± 0.37CD at 5% 1.13

Table 5: Mean dry weight (g) of 100 cells of lac insect

Replications	Mean dry weight of 100 lac cells Treatments			
	T_1	T_2	T_3	T_4
R_1	6.99	4.98	7.84	4.25
R_2	7.02	5.50	7.10	5.21
R_3	7.42	5.55	7.30	4.85
R_4	5.99	6.61	5.62	5.80
R_5	5.64	7.57	7.90	6.14
R_6	4.72	5.86	6.73	4.82
Mean	6.30	6.01	7.08	5.18

SEm ± 0.36CD at 5% 1.11

Lac host tree for kusmi lac production in India. Ghosal (2013) in a nutrient management trial on *Z mauritiana* with *Kusmi* lac also reported an increase in the bio-mass of the tree @4.36kg/ per tree. Patel (2013) reported that the mean fresh weight (g) of 100 mature lac cells was 4.88g in *Kusmi* lac and 3.38g in case of *Rangeeni* lac while the dry weight of 100 cell was 4.66g in case of *Kusmi* lac and 2.63g in case of *Rangeeni* lac.In the present study the mean weight of 100 fresh cells varied from 6.14 to 8.02g in various treatments. The mean fresh weight of 100 cell of lac insect was highest (8.02) in case of T_3 followed by T_1 (7.20g), T_2 (6.89g) and T_4 (6.14) and the mean dry weight of 100 cells varied from 5.18 to 7.08g. The mean dry weight of 100 lac cells was highest in T_3 (7.08) followed by T_1 (6.30), T_2 (6.01) and T_4 (5.18) respectively. Thus it was much higher that reported earlier. It indicate that plant nutrient application influence the increase in cell weight.There was an increase in the mean yield of lac per *Z. mauritiana* over the lac grower practice (no use of fertilizer). It was highest over control in T_3 (39.16%)with treated NPK followed by T_1-N(32.63%) and T_2-NP (18.53%). Potassium application increasing more number of of shoots. Succulency of the shoots due to potassium application, which is supposed to contribute to higher lac production (Ghosal, 2013). Similar result has been reported by (Abayomi, 1987) in sugarcane. Increased succulence could be due to increased water uptake on potassium applied of plant (Zengin *et al.,* 2009). This may have contributed in increasing the lac cell weight as well as the yield of lac. Thus it is evident that nutrition management of *Z. mauritiana* will increase the lac productivity.

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Table 6: Mean raw *Kusmi* lac yield (kg) per plant

Replications	Mean raw lac yield (kg) per plant Treatments			
	T_1	T_2	T_3	T_4
R_1	4.25	3.75	6.00	2.75
R_2	5.25	4.50	4.50	4.50
R_3	6.00	5.00	5.50	3.50
R_4	5.25	4.50	4.00	4.00
R_5	4.75	4.50	7.00	4.25
R_6	5.00	5.00	5.00	4.00
Mean	5.08	4.54	5.33	3.83

SEm ± 0.300CD 5% 0.906

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