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Impact of nutrient management in *Zizyphus mauritiana* (Lamb.) on the weight of lac cells

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ABSTRACT

The present study was carried to evaluate the effects of application of different combinations of primary nutrients to Zizyphus mauritiana on the weight of lac cells. The results revealed that the mean weight of lac cells increased significantly in nutrient treated Z. mauritiana plants as compared to the control. The highest increase in mean fresh weight of 100 lac cells was observed in treatment T_3 (8.11g) followed by T_1 (7.57g), T_2 (7.31g) and T_4 (6.35g). The percent increase in mean fresh weight of 100 lac cells was highest in treatment T_3 (27.72) over control followed by T_1 (19.21) and T_2 (15.11) treatments. The mean dry weight of 100 lac cells among different treatments was also highest in treatment T_3 (6.76g) followed by treatments T_1 (6.28g), T_2 (6.10g) and T_4 (5.16g). The percent increase in mean dry weight of 100 lac cells over control was highest in treatment T_3 (31.01) followed by T_1 (21.71) and T_2 (18.22) treatments. This increase indicates that nutrient management of host improves lac productivity.

Keywords*: *Lac cells, Primary nutrients, Zizyphus mauritiana

I INTRODUCTION

Lac is an export oriented Non-timber Forest Produce (NTFP). It is produced mostly by tribals, sub-forest, forest and rainfed area of Jharkhand, West Bengal, Chhattisgarh, Madhya Pradesh, Orissa, Maharashtra and parts of Uttar Pradesh, Andhra Pradesh, Gujarat and NEH region [1,2,3,4]. India is the largest lac producer in the world with an annual production of over 20,000 metric tons [5,6] and 75 per cent of it is exported to over hundred countries mainly in processed and semi-processed forms.

Madhya Pradesh state is the third largest producer of lac in India. In Madhya Pradesh, Seoni district is the largest producer of lac contributing about 75 percent of the total production of lac in the state together with the Balagahat District [7]. Analysis of lac production trends in last few years is showing some worrying trends. The annual national lac production has declined from 20,050 tons in 2003-04 [5] to 16,495 tons in 2009-10 [4]. One

of the major factors responsible for this decline is the poor nutrient management of the lac host plants. Although the impact of fertilizers in agriculture production and productivity is widely acknowledged but effect of these fertilizers on lac hosts for the yield of lac is not well reported. Many studies have shown a positive effect on herbivore density or performance (fecundity, development, growth and survivability) when plant nutrient status is enhanced through fertilization. Thus, any application of nutrients to the host trees of lac insect is likely to increase the lac productivity. Present research was therefore conducted to evaluate the effect of nutrient management in *Z. mauritiana* on the weight of lac cells.

II METHODOLOGY

The present study was designed in randomized complete block design (RCBD) with four fertilizer treatments (T_1-N, T_2-NP, T_3-NPK and T_4-control) having six replications during the year 2013-14 and 2014-15 on *Z. mauritiana* trees among lac growers in the village Panwas Tolla, Block Barghat, District Seoni, Madhya Pradesh, India. Geographically the village is located between 21°55'51"N latitude and 79°45'49"E longitude. *Z. mauritiana* trees which were over five years old, healthy, pruned and possessing sufficient succulent branches were selected for the study. Recommended [8] doze of fertilizers (N, NP, NPK) were manually applied through urea, single super phosphate and muriate of potash, one month before the broodlac inoculation (BLI). BLI was done between 15th to 20th July during the year 2013-14 and 2014-15, depending upon the emergence of larvae. Healthy Broodlac bundles of 100g with minimum signs of predator and parasite infestation were made for BLI. The broodlac varying in weight from 400-600 g was inoculated per *Z. mauritiana* tree depending on the condition of the plant [9,10,11,12]. *Phunki* (empty broodlac sticks after insect emergence) was removed 21 days after BLI. Two sprays of pesticides solution (Cartap hydrochloride + Mancozeb) were applied on Broodlac inoculated *Z. mauritiana* to prevent incidence of predators on lac insect [13], first spray at 30 days after the BLI while second spray at 30 days after the first spray.

Harvesting of lac was done at crop maturity. The fresh as well as dry weight (g) of 100 cells of lac insect was recorded to calculate the mean cell weight of lac cell [14,15,16]. Data recorded were tabulated and statistically analyzed following [17]. The significance among different treatment means was judged at 5% level of significance for comparison among the treatments.

III RESULTS

The mean fresh weight of 100 lac cells varied significantly among different treatments. The mean fresh weight of 100 lac cells was 7.57g, 7.31g, 8.11g and 6.35g in treatments T_1, T_2, T_3 and T_4 respectively (TABLE-1, Fig.1). It was highest in treatment T_3 and significantly higher than rest of the treatments. The treatment T_1 was significantly superior over the treatment T_4 but at par with the treatment T_2. The treatment T_2 was significantly higher than the treatment T_4. The percent increase in mean fresh weight of 100 lac cells over control was highest in treatment T_3 (27.72) over control followed by T_1 (19.21) and T_2 (15.11) treatments (TABLE-2).

The mean dry weight of 100 lac cells among different treatments is presented in TABLE-3, Fig.1. There was a significant difference in the mean dry weight of 100 lac cells among different treatments. It was highest in treatment T_3 (6.76g) which was significantly superior over other treatments. The treatment T_1 (6.28g) was significantly superior to the treatment T_4 (5.16g) but at par with the treatment T_2 (6.10g). The treatment T_2 was significantly higher than the treatment T_4. The percent increase in mean dry weight of 100 lac cells over control was highest in treatment T_3 (31.01) followed by T_1 (21.71) and T_2 (18.22) treatments (TABLE-4).

The percentage of moisture in 100 lac cells was highest in treatment T_4 (18.7) followed by T_1 (17.04), T_3 (16.65) and T_2 (16.55) treatments (TABLE-5).

IV DISCUSSIONS

Mean fresh weight of 100 lac cells varied significantly among different treatments. The mean fresh weight of 100 lac cells was 7.57g, 7.31g, 8.11g and 6.35g in treatments T_1, T_2, T_3 and T_4 respectively. It was highest in treatment T_3 and significantly higher than rest of the treatments. The treatment T_1 was significantly superior over the treatment T_4 but at par with the treatment T_2. The treatment T_2 was significantly higher than the treatment T_4. Highest weight of 100 lac cells in T_3 showed that *K. lacca* on nutrient managed *Z. mauritiana* trees produced more resin as compared to no nutrients or single nutrient. On *Z. mauritiana*, the mean weight of 100 mature lac cells varied from 3.07 to 5.74 in *Kusmi* lac and 2.35 to 4.14 in case of *Rangeeni* lac [16] while on *B. monosperma*, the mean fresh weight of 100 lac cells of the *Rangeeni* lac was 3.66 g to 4.08 g [15]. The mean fresh weight of 100 lac cells in the present study varied from 6.35 g to 8.11 g which is a higher range in comparison to the previous studies. The percent increase in mean fresh weight of 100 lac cells over control was highest in treatment T_3 over control followed by T_1 and T_2 treatments. The percent increase in mean fresh weight of 100 lac cells was highest in treatment T_3. In T_3, the lac produced was 27.72 percent more heavier than those with no nutrient application. In T_2, it was 15.11 and in T_1, it was 19.21 percent more heavier.

There was a significant difference in the mean dry weight of 100 lac cells among different treatments. It was highest in treatment T_3 (6.76g) which was significantly superior over other treatments. The treatment T_1 (6.28g) was significantly superior to the treatment T_4 (5.16g) but at par with the treatment T_2 (6.10g). The treatment T_2 was significantly higher than the treatment T_4. The highest weight of 100 lac cells in T_3 showed that *K. lacca* on NPK treated *Z. mauritiana* trees produced more resin as compared to no nutrients or single nutrient. The mean dry weight (g) of 100 cells of *Kusmi* lac insect varied from 4.25g to 7.84g [18] while according to [16] it varied from 2.36 g to 4.66 g. The mean dry weight of 100 lac cells in the present study was more as compared to the previous studies which is due to the nutrient management. The percent increase in mean dry weight of 100 lac cells was highest in treatment T_3 (31.01) over control followed by T_1 (21.71) and T_2 (18.22) treatments. The percent increase in mean dry weight of 100 lac cells was highest in treatment T_3. In T_3, the lac produced was 31.01 percent more heavier than those with no nutrient application. In T_2, it was 18.22 and in T_1, it was 21.71 percent more heavier. The positive yield response of NPK can be attributed to highest increase in the mean dry weight of lac cells in treatment T_3. Similar results were also reported by [19] who reported that the weight of

individual seeds increased in response to Potassium fertilization. Moreover, the fruit size, yield, vitamin C content and fruit quality increases with fertilizers applications [20]. The biomass yield in plants increased with fertilizers application [21,22,23,24,25]. In plants, the yield increase due to Potassium may be due to physiological processes. Such physiological processes also may have an influence on the *K. lacca* feeding the plant sap, to produce more resin.

The percentage of moisture in 100 lac cells was highest in treatment T_4 (18.7) followed by T_1 (17.04), T_3 (16.65) and T_2 (16.55) treatments. Highest moisture percentage in T_4 suggests that lac insects may be drawing more sap to obtain its nutrition.

V CONCLUSION

The results of the present study reveal that the nutrient management of host increases the mean weight of lac cells ensuing in higher lac productivity. Therefore for sustainable plant growth and lac production, *Z. mauritiana* may be treated with NPK.

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TABLE-1: Mean fresh weight (g) of 100 lac cells (2013-14 and 2014-15)

S.No.	Replications	Mean fresh weight (g) of 100 lac cells			
		Treatments			
		T_1	T_2	T_3	T_4
1	R_1	7.80	7.09	7.98	6.42
2	R_2	7.26	7.45	8.05	6.38
3	R_3	8.06	6.74	8.28	6.73
4	R_4	7.12	7.34	7.64	6.28
5	R_5	7.99	7.75	8.52	6.06
6	R_6	7.18	7.47	8.18	6.20
Mean		7.57	7.31	8.11	6.35
SEm± 0.14 CD at 5% 0.42					

Significant at 5% level

TABLE-2: Percent increase in mean fresh weight (g) of 100 lac cells over control (2013-14 and 2014-15)

S.No.	Replications	Mean fresh weight (g) of 100 lac cells			
		Treatments			
		T_1	T_2	T_3	T_4
1	R_1	7.80	7.09	7.98	6.42
2	R_2	7.26	7.45	8.05	6.38
3	R_3	8.06	6.74	8.28	6.73
4	R_4	7.12	7.34	7.64	6.28
5	R_5	7.99	7.75	8.52	6.06
6	R_6	7.18	7.47	8.18	6.20
Mean		7.57	7.31	8.11	6.35
Percent increase in weight over control		19.21	15.11	27.72	-------

TABLE-3: Mean dry weight (g) of 100 lac cells (2013-14 and 2014-15)

S.No.	Replications	Mean dry weight (g) of 100 lac cells			
		Treatments			
		T_1	T_2	T_3	T_4
1	R_1	5.95	5.76	6.74	5.32
2	R_2	6.14	6.32	6.36	5.19
3	R_3	6.76	5.77	7.16	5.67
4	R_4	5.98	6.12	6.41	5.02
5	R_5	6.62	6.71	7.07	4.87

6	**R_6**	6.25	5.91	6.82	4.87
Mean		6.28	6.10	6.76	5.16
SEm± 0.13 CD at 5% 0.39					

Significant at 5% level

TABLE-4: Percent increase in mean dry weight (g) of 100 lac cells over control (2013-14 and 2014-15)

S.No.	**Replications**	**Mean dry weight (g) of 100 lac cells**			
		Treatments			
		T_1	**T_2**	**T_3**	**T_4**
1	**R_1**	5.95	5.76	6.74	5.32
2	**R_2**	6.14	6.32	6.36	5.19
3	**R_3**	6.76	5.77	7.16	5.67
4	**R_4**	5.98	6.12	6.41	5.02
5	**R_5**	6.62	6.71	7.07	4.87
6	**R_6**	6.25	5.91	6.82	4.87
Mean		6.28	6.10	6.76	5.16
Percent increase in weight over control		21.71	18.22	31.01	-------

TABLE-5: Moisture percentage in 100 lac cells

Moisture percentage in 100 lac cells			
Treatments	**Fresh**	**Dry**	**Moisture (%)**
T_1	7.57	6.28	17.04
T_2	7.31	6.1	16.55
T_3	8.11	6.76	16.65
T_4	6.35	5.16	18.7

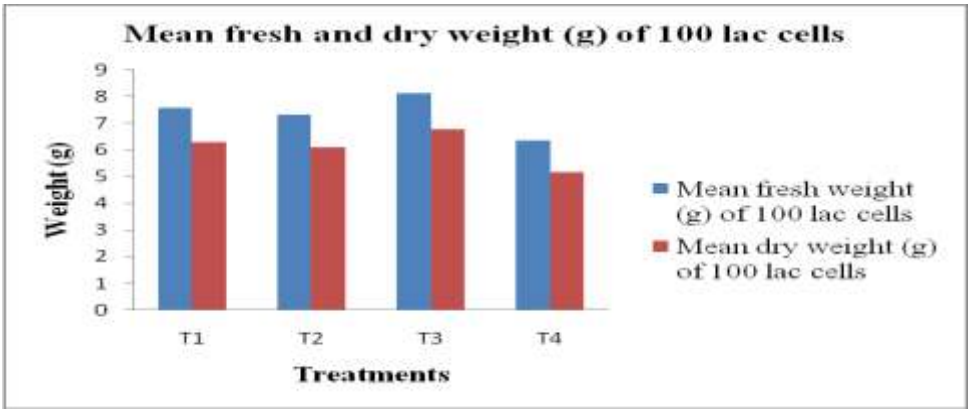

Fig- 1: Mean fresh and dry weight (g) of 100 lac cells