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Economic analysis of Rangeeni lac production on pigeon pea under different varieties

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Abstract
A two year field trial was conduct with 12 varieties of *C. cajan*. The two year pooled data on the mean weight of total pods and seed yield of *C. cajan* with lac insects was significantly highest 3307 g and 2023 g (Rs.202.3) in MA-3 over all the 12 varieties evaluated. The mean weight of fuel wood of *C. cajan* varieties 4.22 (Rs.21.1) in MA-3 to 2.56 (Rs. 12.8) in Amar. The mean weight of raw dry lac yield per plant from 291.33g (Rs.34.95) NDA-1 to 519.17 g (Rs.62.30) MA-3. The result revealed that the lac production increase the annual income of almost all the Lac growers has increased after adopting Lac production. Subsequent to the acceptance of lac production, there was enormous increase in the annual household income and empowerment has lead to a change in their household and socio economic status of the Lac growers.

Keywords: Brood lac, raw lac, seed weight, lac production

Introduction
Lac production is a livelihood option of both rainfed farmers and forest dependents. Lac production is generally a male dominated enterprise, but the ten members of women farmers' interest group SHG are producing Lac and demonstrated impressive growth. (Singh *et al*. 2019) [1]. In MP, Lac growers are investing their gains from lac production in child education, health, social ceremonies and agriculture, strengthening of local institutions, empowerment, and participation in the local election process has been visible in the village (Thomas, 2012; Patidar, 2011) [15, 20].

In Madhya Pradesh the small and marginal farmers constitute 51 percent of the farming community. Governments both at central and state level are working on ways and policies improve farm productivity and farmers profitability. However in a diverse agro-climatic conditions in Madhya Pradesh, the production system as well as crops cultivated are too diverse, to have a common program. Development managers and policy makers are looking for option and opportunities to double income across the country.

Farmer's income can be improved, if they grow cash crop along with their traditional crops. In Madhya Pradesh, the forest area is around 30 percent (FSI, 2019) [6] of its geographical area. Forest and agriculture are the two major land use patterns in M.P. (Singh *et al*., 2012) [16]. Minor forest produce and agriculture both can contribute significantly to improve farmer's income (ISFR, 2019) [8]. Among minor forest produce, lac is an important commonly produced in M.P. Lac production in the state approximately vary 60,000q to from 100000q annually (*Yogi et al.,* 2017) [21]. M.P. is the 3rd largest producer of lac in India (Jaiswal *et al.*, 2013) [10]. The enterprise was in revived in M. P. in 1997 (India: Madhya Pradesh Public Resource Management Program, 2007) [7].

Lac is a resinous secretion of minute lac insect *Kerria lacca* Kerr. It belongs to family Tachardiidae (Kerriidae), and order Hemiptera, there are two strains of lac insect *viz*. *Kusmi* and *Rangeeni*. *Kusmi* lac is grown on *Schleichera oleosa*, *Zizyphus mauritiana* and *Flemingia semialata* (Kumar *et al*., 2013*)* [3]. *Rangeeni* lac is grown on commercially *B. monospera*, and *Z. mauritiana* (Jaiswal *et al.,* 2015) [11]. There are over 400 host plants of lac insect one among them is *Cajanus cajan* (L.) Millisp.

C. cajan is cultivated on about 3.9 m ha in India (FAO, 2018) [5] and 0.32 m ha in Madhya Pradesh. *C. cajan* is one of the most popular pulse grown in the state. The annual production is 0.23 m tones and its productivity is 441 kg/ha (Anon, 2019) in Madhya Pradesh. *C. cajan* is grown by most of the small and marginal farmers in the Madhya Pradesh

(Bijalwan *et al.*, 2019) [3]. *C. cajan* beside been a good source of protein (Saxena *et al.*, 2010) [19], also provides fuel wood to the farmers (Kwesiga *et al.*, 2003) [12]. MP is the 3rd largest producer of *C. cajan* in India, and 3rd largest producer of lac in the country (*Shah et al., 2015*) [18]. *C. cajan* is also a good host of *K. lacca.* Thus, the state stands a good opportunity to improve the small and marginal's income of lac production is promoted on *C. cajan*. There are numerous local, improved as well as long duration *C. cajan* varieties available in the country (Lohot *et al.2018*) [14]. But the need is to find a suitable *C. cajan* for lac production which can be profitable to the farmers, with compromising the yield of their pulse crop.
In this context, the two year field evaluation of 12 *C. cajan* varieties for lac production was carried out in Balaghat. Balaghat is a prominent tribal district of MP, where migration of farmers and youth to neighbouring districts as well as Maharashtra, Andhra Pradesh and other state is very common.

Materials and Methods

The materials and methods followed the two year farmer's participatory field trial was conducted in Balaghat district MP for screening of *C. cajan* varieties for production of lac and seed lac is as below.

Experimental location

The field trial on 12 varieties of *C. cajan* was conducted in the farmer's field located in village Bamhani, Block Kirnapur, District Balaghat, Madhya Pradesh during the year 2015-16 and 2016-17.

Selection of *C. cajan* varieties

Rangeeni lac production was evaluated on the 11 *C. cajan* varieties (Bahar, Azad, MA-3, MA-6, PUSO-9, MAL-13, T-7, DA-11, NDA-2, NDA-1 and Amar). I obtained from Indian Institute of Pulses Research (IIPR) Kanpur, and a local variety of a farmer in Bamhani village, in Balaghat district.

Field Operations

a) Nursery raising of *C. Cajan*

1. **Filling of polythene bag with substrate**
   Black polythene bag of size 10x14 inch and 38 guage were used for the raising of *C. cajan* in nursery. In order to drain excess irrigation water, all the polythene bags were perforated with 10-12 holes before filling the substrate (medium for growth of the seedling).
2. **Preparation of substrate**
   Substrate was prepared by mixing equal quantity of light soil and well rotten FYM (Farmyard manure) in a ratio of 1:1, in the first week of May. The FYM was treated with *Trichoderma viride* at the rate of 5g per kg of FYM and kept under shade. The treated FYM was mixed thoroughly at weekly intervals for one month for the growth of *T. viride* prior to filling the polythene bag.
3. **Filling of substrate**
   The perforated polythene bags were filled with substrate upto three quarter of its volume, and arranged in 4 rows under shade.
4. **Sowing of *C. cajan***
   C. cajan seeds were treated with *T. viride*, *Rhizobium* and Phosphorous solubulizing bacteria (PSB) culture, before sowing. The treated seeds were spread on a polythene sheet and 3-4 seeds were sown in a substrate filled perforated Polythene bags, during the last week of May. They were then arranged in separate rows of each for the 12 *C. cajan* varieties and properly labelled. Watering was done at weekly intervals, till its transplantation in the main field.
5. **Germination and weeding**
   Polythene bags were irrigated regular intervals. Weeds were removed as and when required. Re-sowing was done where ever there was no germination.
6. **Nipping**
   The growing tip of the seedlings was nipped with fingers, when it attained a height of 6-7 inches. Nipping was carried at 10 days interval in the nursery. Nipping induced branching. Nipping of growing tip continued till the transplantation of the seedlings in the main field.

b) Main field

1. **Digging of pits**
   Field preparation was done with two ploughing operation by tractor drawn cultivator. It was followed by disc operation for breaking the soil clots. The layout of the experiment in field was prepared. Pits were digged of size 1x1x1 foot with the help of a pickaxe and spade in the month Jun. The spacing was maintained at a distance of 2 metres (plant to plant) and 1.5 metres (among treatments).The soil dug from the pit was kept on the side of the pits for natural sterilization.
2. **Nutrient management**
   Well rotten FYM, Diammonium phosphate (DAP), Zinc and Murate of Potash (MoP) as well as *T. viride*, *Rhizobium* and PSB were added to all the pits and mixed well with the soil before the transplantation of *C. cajan* seedling.
3. **Transplantation of *C. cajan* seedlings**
   All the seedlings of *C. cajan* were transplanted in the field during the first week of July, during both. The years of the experiment, as per the experimental layout in RBD format.
4. **Nipping**
   After transplantation, the plants were again nipped at 10 days interval till 1st week of October during both the years.

c) Broodlac inoculation

1. **Broodlac** Healthy broodlac with minimum signs of predator and parasite infestation were selected for its inoculation of the *C. cajan* plants. Broodlac weighing 10-20g was inoculated per *C. cajan* plant depending on the size of the plant (Thomas *et al*, 2015) [18]. Broodlac stick was tied with a twine on the main stem about one foot about the ground.
2. **Shifting**
   Broodlac was shifted carefully to different branches on the same plant after six days of inoculation. The purpose of shifting was to ensure uniform distribution of crawling larvae of K. lacca the brood on those branches which had no or less larval settlement. (Shah *et al*, 2015) [18] of lac insects.
3. **Phunki removal**
   The larvae of *K. lacca* leave Broodlac to settle on branches within 21 days, and the Broodlac on the plant without lac larvae is called Phunki. It is infact sticklac. The Phunki was removed after 21 days of Broodlac inoculation and scrapped to recover raw lac and in this process the predators of any in the Phunki are removed (Janghel, 2013) [9].

d) Spraying of pesticides

1. The pesticides solution (Cartap hydrochloride + Mancozeb) were sprayed on the *C. cajan* plants inoculated with *K. lacca* settlement, with the help of a Foot sprayer for management of predators and parasites of lac insect.
2. **Preparation of pesticide solution**
   The solution of pesticide was prepared by adding Cartap hydrochloride (@1g/litre of water and Mancozeb @ lg/litre of water) in small separate containers followed by brisk stirring with a piece of stick. Both the solutions were then poured in the tank of the sprayer followed by adding of 13 litres of clean water in to it. The solution in the tank of the sprayer was again stirred with the help of a stick to ensure proper mixing of the pesticides.
3. **Spraying schedule**
   The first spray was done after 25-30 days of Broodlac inoculation. The second spray was carried out in the month of December.
4. **Harvesting**

   Harvesting by hands picking of pods, when about 80 percent of the pods on the plant at carried maturity.

C. cajan

Harvesting were done on 12.01.2016 and 28.04.2016 during first year while on 28.12.2016 and 25.04.2017 during second year of the experimental trial. The pods were sun dried and weight was recorded. The pods were threshed and grain yield per plant was recorded in each treatment. The mean weight of 100 seeds of weight of each treatment was also recorded.

Lac

Lac yield per plant was recorded by scrapping the lac on the branches of *C. cajan* after the harvest. The branches with lac encrustation were shade dried and scrapped with a knife, while keeping a plastic sheet below. The raw lac yield was weighed to record lac production per plant. The 100 lac cell weight of each treatment were also recorded by weighing of 100 healthy lac cell after scraping it from the stick lac.

Fig 1: Seed, Lac and Fuel Wood

Results and Discussions

Production cost and net returns of Rangeeni Lac on *C. cajan* 2015-16 and 2016-17

The per plant production cost involved in the production of lac and under different varieties is divided into two, that is, the operational cost and the input cost. The economic analysis

shows that the different varieties have significant effects on yield and input.

There were three produces from the same plant i. e. lac, Seed and fuel wood. The selling price of lac (Rs. 120/kg) was calculated from village Bamhani, Block Kirnapur, District Balaghat, in October 2015-16 and 2016-17. The selling price of pigeon pea (Rs 100/Kg) from District Balaghat and fuel wood (Rs. 5/Kg). The mean seed yield per plant varied from 1434 g (Rs.143.4) NDA-1 to 2023 g (Rs.202.3) MA-3 in two hand pickings. The mean gross return per plant at the rate of Rs. 100 per kg seed varied from Rs 143.4 to 202.3. The mean Lac yield per plant varied from 291.33 g (NDA-1) to 519.17 (MA-3). The Selling rate of RAW lac in Balaghat during 2016-17 was 120 per kg. Thus, The return per *C. cajan* due to Lac production varied from Rs 34.95 (NDA-1) to Rs. 62.30 (MA-3). The mean yield of fuel wood Kg per plant varied from 2.56 (Amar) to 4.22 (MA-3). The value of fuel wood after the harvest of seed and lac forms. The *C. cajan* varied from 12.8 per plant in (Amar) to Rs.21.1 (MA-3). The fuel wood price was Rs 5 per kg. The overall total value from seed, lac and fuel wood per *C. cajan* ranged from Rs 213.03 (Amar) to Rs 285.7 (MA-3). The per *C. cajan* plant total returns from the lac, seed and fuel wood varied from Rs 194.25 (NDA-1) to 285.7 (MA-3).

Including the value (in Rs) reported by earlier workers like Sumit, Rahul, Shivam, Vishal, Ankit, Dhaneshwar. According to work Daheriya N. reported by there were three produces from the same plant i. e. Seed, lac and fuel wood. The selling price of lac (Rs. 280/kg) was calculated from village Janamkhari, Block Barghat, District Seoni, ine October 2015-16 and 2016-17. The selling price of pigeon pea (Rs 50/Kg) from JNKVV, District Jabalpur and fuel wood (Rs. 3/Kg). The mean seed yield per plant varied from 1238.34 g (T_8) to3169.33g (T_6) in two hand pickings. The mean gross return per plant at the rate of Rs. 50 per kg seed varied from Rs 61.92 to 158.64. The mean Lac yield per plant varied from 205.67 g (T_8) to716.67 (T_3). The Selling rate of RAW lac in Seoni during 2016-17 was 280 per kg. Thus, The return per *C. Cajan* due to Lac production varied from RS 57.59 (T_8) to Rs. 200.67(T_3). The mean yield of fuel wood per plant varied from 1480g (T_8) to 5390 (T_6). The value of fuel wood after the harvest of seed and lac forms. The *C. cajan* very drum 4.44 per plant in (T_8) to Rs.16.17 (T_6). The fuel wood price was Rs 3 per kg. The overall total value from seed lac and fuel wood per *C. cajan* ranged from Rs 123.94 (T_8) to Rs 319.02 (T_6). The per *C. cajan* plant total returns from the lac seed and fuel wood varied from Rs 340.80 to 123.94.

Table1: Economic analysis of Rangeeni lac production on pigeon pea under different varieties

Sr. no.	Economics of the *Rangeeni lac* production on pigeon pea (Rs) 2015-16 and 2016-17			
	Lac (Rs 120\kg)	Pigeon pea (Rs 100\kg)	Fuel wood (Rs 5\kg)	Total (Rs)
Local	385.83 (Rs. 46.29)	1680 (Rs. 168)	3.29 (Rs. 16.45)	230.74
Bahar	358.33 (Rs. 42.99)	1751 (Rs. 175.1)	3.09 (Rs. 15.45)	233.54
Azad	435.17 (Rs. 52.22)	1623 (Rs. 162.3)	3.47 (Rs. 17.35)	231.87
MA-3	519.17 (Rs. 62.30)	2023 (Rs. 202.3)	4.22 (Rs. 21.1)	285.7
MA-6	403.17 (Rs. 48.38)	1798 (Rs.179.8)	3.63 (Rs. 18.15)	246.33
PUSO-9	413.17 (Rs.49.58)	1761 (Rs. 176.1)	3.10 (Rs. 15.5)	241.18
MAL-13	319.17 (Rs. 38.30)	1684 (Rs.168.4)	3.46 (Rs. 17.3)	224
T-7	341.87 (Rs. 41.02)	1551 (Rs. 155.1)	3.26 (Rs. 16.3)	212.42
DA-11	358.50 (Rs. 43.02)	1601 (Rs. 160.1)	3.33 (Rs. 16.45)	219.57
NDA-2	384.67 (Rs. 46.16)	1635 (Rs. 163.5)	3.05 (Rs. 15.25)	224.91
NDA-1	291.33 (Rs. 34.95)	1434 (Rs.143.4)	3.18 (Rs. 15.9)	194.25
Amar	340.33 (Rs. 40.83)	1594 (Rs. 159.4)	2.56 (Rs. 12.8)	213.03

Conclusion

Thus the two year field screening of the 12 varieties of *C. cajan* for lac production reveals that.

a) Lac production can be successful proofed on *C. cajan* growing areas, provided farmers can irrigated the crop.
b) Lac production can be adopted on *C. cajan* without compromising its yield.
c) Protein and cash the two major constraints of small and marginal, it can be address by promoting lac production of *C. cajan*.
d) In Madhya Pradesh, *C. cajan* variety MA-3 is best suited for lac production, as it gives higher yield of both lac and *C. cajan* from the same plant simultaneously.

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References

1. Singh A, *et al*. Economic impact of lac production through women farmer's interest group. Int J Chem Stud. 2019;7(1):1141-1144.
2. Anonymous. Pulses revolution from food to nutritional security. DAC, Government of India; c2019.
3. Bijalwan A, Verma P, Dobriyal MJR, Patil AK, Thakur TK, Sharma CM. Trends and insights of agroforestry practices in Madhya Pradesh, India. Curr Sci. 2019;117(4):597-605.
4. Dehariya N. Study on Lac Production by *Kerria Lacca* (kerr) on *Cajanus cajan* (L) mill. Under varying cultivation condition in Shahpura, District Jabalpur, Madhya Pradesh. Awarded by 22/08/2023.
5. FAOSTAT. [Internet]. 2018 Feb 28. Available from: www.fao.org.
6. Forest Survey of India (FSI). [Internet]. 2019. Available from: http://timesofindia.indiatimes.com/articleshow/73037541.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst.
7. India: Madhya Pradesh Public Resource Management Program. Asian Development Bank Operations Evaluation Department. Program Number: PPE: IND: 29051 Loan Number: 1717-IND 1-124; 2007.
8. India State of Forest report (2019), Madhya Pradesh (ISFR). Published by Forest Survey of India (Ministry of Environment Forest and Climate Change) Kaulagarh road, P.O. IPE Dehradun - 248195, Madhya Pradesh. India-vol-ii-141-151; 2019.

9. Janghel S. Study on comparative efficacy of insecticides in Katki crop for predator management on Rangeeni lac crop on Zizyphus mauritiana in Malara village, Seoni District. M.Sc. Thesis. Jawaharlal Nehru Krishi Vishwavidalaya, Jabalpur, M.P; c2013.
10. Jaiswal AK, Pal G, Singh JP, Patel B. Growth analysis of lac production in Madhya Pradesh. Indian Forester. 2013;139(5):448-452.
11. Jaiswal AK, Singh JP. Butea monosperma and lac cultivation. Bulletin No. 07, ICAR- IINRG, Ranchi; c2015.
12. Kwesiga F, Akinnifesi FK, Mafongoya PL, Mc Dermot MH, Agumya A. Agroforestry research and development in Southern Africa during the 1990s: Review and challenges ahead. Agroforestry Systems. 2003;59:173-186.
13. Kumar A, *et al*. Lac insect host plants of India. Prospects of Scientific lac cultivation in India; c2013. p. 21-26.
14. Lohot VD, *et al*. Effect of lac culture on seed quality traits of Pigeonpea [*Cajanus cajan* (L.) Millsp.]. J Entomol Zool Stud. 2018;6(2):2293-2298.
15. Patidar N. Assessment of the role of Madhya Bharat Lac Utpadhak Sangh in dissemination of Lac production technology and its impact on Lac growers of Mediaraas village, Anuppur district, Madhya Pradesh. M.Sc. (Ag) Thesis, JNKVV, Jabalpur; c2011.
16. Singh AK, Jha RK, Gupta VB. Land Use Pattern and Forecasting Of Carbon Sequestration In Madhya Pradesh Forests. Int J Multidiscip Res. 2012;2:29-39.
17. Shah TH, Thomas M, Bhandari R. Impact of nutrient management in *Z. Mauritiana* (Lamb.) on the survivability of lac insect and the yield of Aghani crop of Kusmi lac. J Entomol Zool Stud. 2014;2(5):160-163.
18. Shah TH, Thomas M, Bhandari R. Lac production, constraints and management: A review. Int J Curr Res. 2015;7(3):13652-13659.
19. Saxena KB, Ravikoti VK, Sultana R. Quality nutrition through pigeonpea- A review. Int Crops Res Inst Semi-Arid Tropics; c2010.
20. Thomas M. Lac Cultivation for Improving Micro-Agro Eco System and Local Rural Economy in training programme on Advance in Agrotechnologies for Improving Soil, Plant and Atmosphere Systems, JNKVV; c2012. p. 288-289.
21. Yogi RK, Alok K, Jaiswal AK. Lac, Plant Resins and Gums Statistics 2015, At a Glance; ICAR-Indian Institute of Natural Resins and Gums, Ranchi (Jharkhand), India. Bull Tech No. 17/2017; c2017. p. 01-72.