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Impact of Organic Manure on Growth of *Pongamia Pinnata* Seedlings Developed Through Seed Germination and Transplantation in Pot Culture Conditions

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Abstract: An experiment carried out on *Pongamia pinnata* seedlings developed through seed sowing as well as transplantation under nursery condition has exhibited good growth promotion when treated with vermicompost and vermiwash. The results indicated that plant growth in terms of shoot height, root length, leaf area, R/S and biomass was enhanced under the treatment of organic manure as compared to the non treated control. Effect of vermiwash on growth of plant has also been higher as compared to the control. Data recorded on various growth parameters clearly indicated that seed grown plants exhibited better growth as compared to the transplanted one. However, the transplantation at early age improved the leaf biomass and leaf area as compared to the late transplantation.

Key words: *Pongamia pinnata*, vermicompost, tree, transplantation, vermiwash.

Introduction

Pongamia pinnata is a non edible medicinal tree species found in multiple geoclimatic conditions. It has high economic value due to oil production which is being used as a lubricant, water paint binder, pesticide, soap production and tanning industries [2,3,6,7]. It has also been endowed with anti-inflammatory, anti-plasmodial, anti-diarrhoeal, anti-ulcer and antioxidant activity [4,5,13]. It has been confirmed that the *Pongamia pinnata* has immense medicinal and economical values, yet the development of sustainable feedstock useful for the various purpose especially oil production is dependent on plant biomass [11]. Uses of organic manures and plant growth promoting microbes are quite imperative in maintaining their productivity and stability [8]. Vermicompost is vital organic manure and useful for the growth and development of various groups of plants of economic importance including forest trees species [9,10,12,14]. Hence, a preliminary experiment was carried out on seed grown plantlets of *Pongamia pinnata* along with the vermicompost and vermiwash under pot culture conditions.

Materials and methods

The experiment was carried out during May-October, 2015 under the green house conditions in poly bags contain 6.5 kg red laterite soil . Presoaked seeds were sown and allowed to be germinated and routine watering was done through sprinkler to maintain the moisture level. The experiment was set in three groups. (1) plants developed through seed sowing , (2) seedlings of 10 days old (early transplantation), (3) seedlings of 30 days old (late transplantation). Each group of plants were subjected to different treatments as follows (1) untreated control (2) added with vermicompost (250 g/pot), (3) added with vermiwash (250 ml/pot). Vermicompost and vermiwash was added twice during the experiment. Data on upper growth of experimental

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plants in different interval was recorded for shoot height, root length, biomass, leaf number, leaf area and nodule number in order to observe the impact of organic manure on different seedlings of *Pongamia pinnata* developed through seed sowing and transplantation .

Results and discussion

The experiment carried out on *Pongamia pinnata* supplemented with vermicompost and vermiwash separately under nursery conditions have exhibited promising impact of organic manure on growth and development of plants. Periodical Data depicted in table -1 revealed the substantial growth and development of plants in experimental conditions. Impact of vermiwash supplementation did not show good effect as compared to the vermicompost however, it was more effective over untreated control plants.

The prominent differences are evident in shoot height of control and seedlings supplemented with organic manure. The application of vermicompost and vermiwash exhibited maximum shoot height (78.0 ±6.7 and 70.0 ±4.8 cm) as compared to control in seed sown plants (Table 1) whereas addition of organic manure did not exhibit good growth in transplanted plants. Varied effect because of vermicompost and vermiwash was observed in leaf numbers and leaf area also . However, no significant difference was observed in the number of leaves of the plants those transplanted at 30 days of age. The leaf number and leaf area measured at 140 days of seedlings indicated gradual increment in growth of plants irrespective of seedling development process. However, seedlings developed directly through seed germination expressed better growth and development as compared to the transplanted one.

Addition of vermicmpost and vermiwash in seed grown plants resulted in enhancement of plant biomass and number of root nodule as compared to the control (Fig. 1,2,3). Root shoot ratio recorded for the experimental plants has been depicted in fig. 4. Role of vermicompost in providing nutrients to the plants and its indirect effect on biomass yield is clearly evident as the seed sown plants produced more shoot hight, biomass as compared to the unaided control.It is interesting to note that non treated (control) late transplanted seedlings showed higher root shoot ratio as compared to the those developed directly through seed sowing (Fig. 4). It is clearly evident that the transplanted seedlings requires more nutrients for establishment in new environment and indirectly enhanced the root growth. The high root shoot ratio indirectly correlated the nutritional deficiency for which root become more lengthier than the shoot biomass and which can be fulfilled by the exogenous supply of organic or inorganic fertilizers. Simultaneously, lower root shoot ratio in treated transplanted seedlings indirectly exhibited the supply of nutrient in rhizosphere vicinity

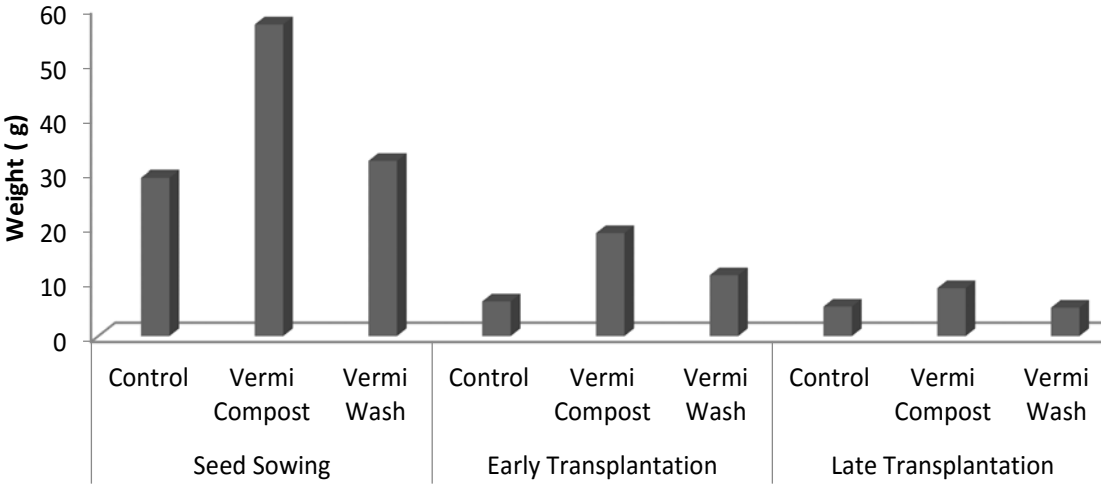

Fig. 1. Biomass (fresh) of *P. pinnata* grown under different treatments in pot culture condition (140 days)

Table 1. Growth performance of *Pongamia pinnata* seedling under different treatment.

Seedling development	Treatments	Shoot height (cm)			No. of leaves			Leaf area (mm^2)		
		90 Day	120 Day	140 Day	90 Day	120 Day	140 Day	90 Day	120 Day	140 Day
Seed Sowing	Control	24.0±8.6	37.8±15.8	64.0±4.2	24.0±7.9	33.0±12.0	33.0±7.6	4100.7±84.7	5886.4±109.0	6291.2±188.1
	Vermi Compost	29.6±7.8	46.9±14.9	78.0±6.7	24.0±4.6	40.0±6.6	56.0±17.8	5503.7±166.8	6949.8±164.9	7311.8±101.0
	Vermi Wash	28.1±7.9	41.3±12.7	70.0±4.8	21.0±6.7	36.0±6.1	38.0±6.7	5078.3±60.2	6650.0±244.4	6993.6±136.9
		12.2±1.6	16.8±3.7	29.0±4.6	9.0±2.6	13.0±5.0	28.0±5.5	1869.3±46.5	3571.6±148.9	4272.8±164.2
Early Transplantation	Control									
	Vermi Compost	14.8±5.2	21.1±6.5	48.0±5.9	15.0±4.1	18.0±8.4	40.0±9.4	2526.3±63.7	5079.6±197.2	5217.5±117.4
	Vermi Wash	17.0±4.5	20.7±6.1	45.0±3.3	13.0±4.5	16.0±4.1	31.0±4.0	1644.0±60.7	4921.4±100.7	7219.6±142.2
		10.3±1.7	15.8±5.4	27.0±2.3	7.0±1.3	16.0±6.0	26.0±3.4	1588.7±106.5	3600.0±215.7	4101.3±102.9
Late Trans plantation	Control									
	Vermi Compost	11.7±2.1	17.0±6.1	35.0±3.9	10.0±1.5	15.0±6.5	28.0±4.0	1744.7±156.5	5178.5±75.0	5553.3±222.7
	Vermi Wash	13.7±1.5	14.3±2.1	31.0±5.0	10.0±1.0	13.0±4.0	24.0±1.5	1787.7±204.6	4927.3±93.8	5254.3±124.8

± Standard deviation of 5 replicates

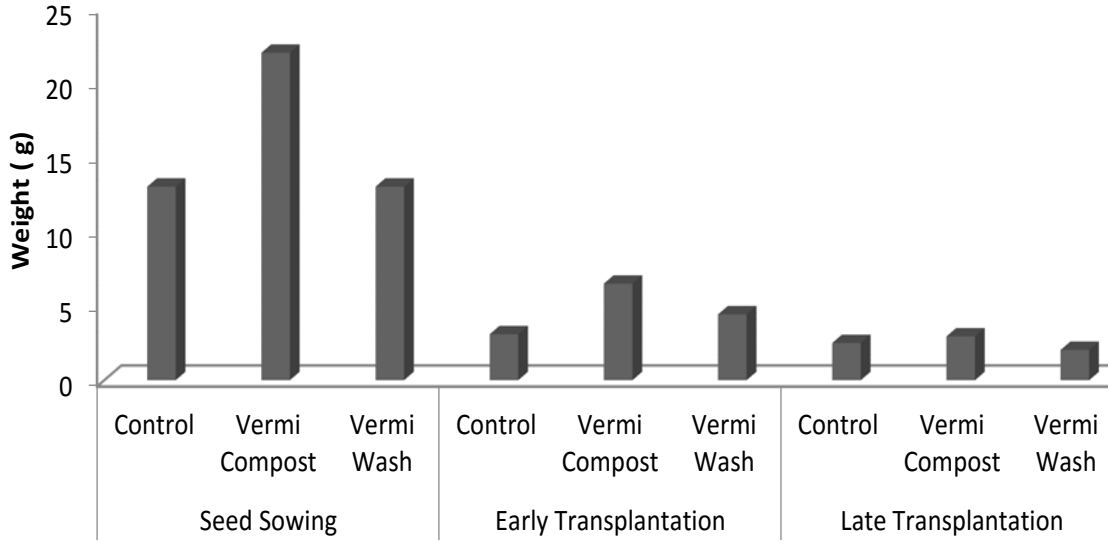

Fig. 2. Dry Biomass of *P. pinnata* grown under different treatments in pot culture condition (140 days)

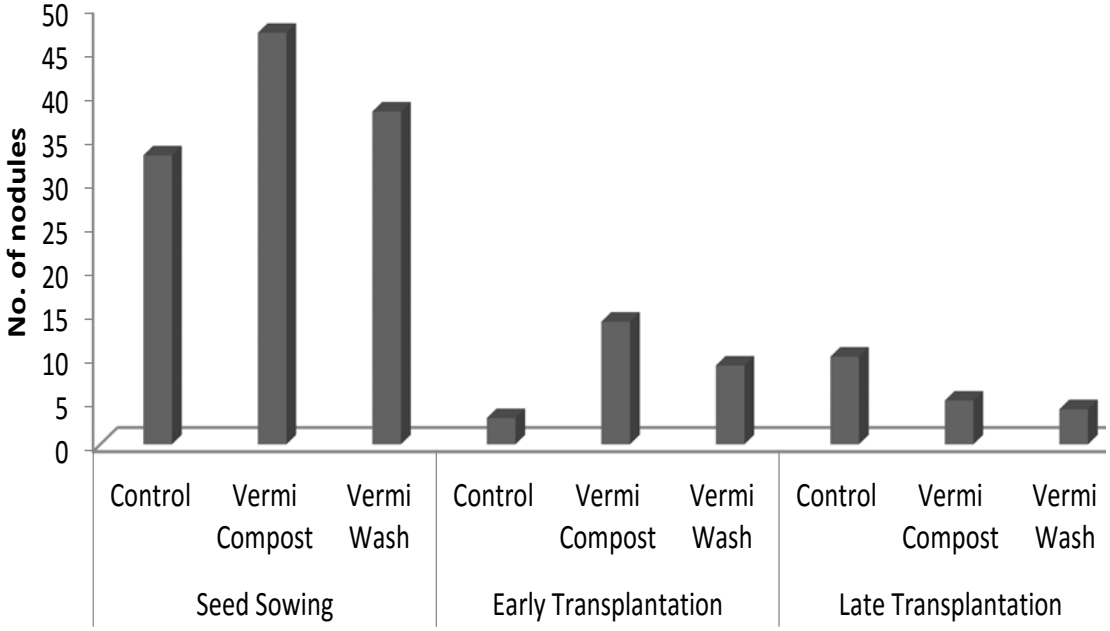

Fig. 3. Number of nodules of *P. pinnata* grown under different treatments in pot culture condition (140 days)

of experimental *Pongamia pinnata* due to the presence of vermicompost [1]. The growth enhancement of *Pongamia pinnata* in soil supplemented with organic manure in seed grown and transplanted seedlings is clearly evident in the present study (Fig. 5). Transplantation of infant seedlings to field along with the nutritional supplementation would be helpful in obtaining more biomass which is required for the various medicinal and oil production usage. However, more elaborative experimentations on nutrient supplementation and age of the seedlings are required to obtain better nursery package of practice.

Acknowledgments

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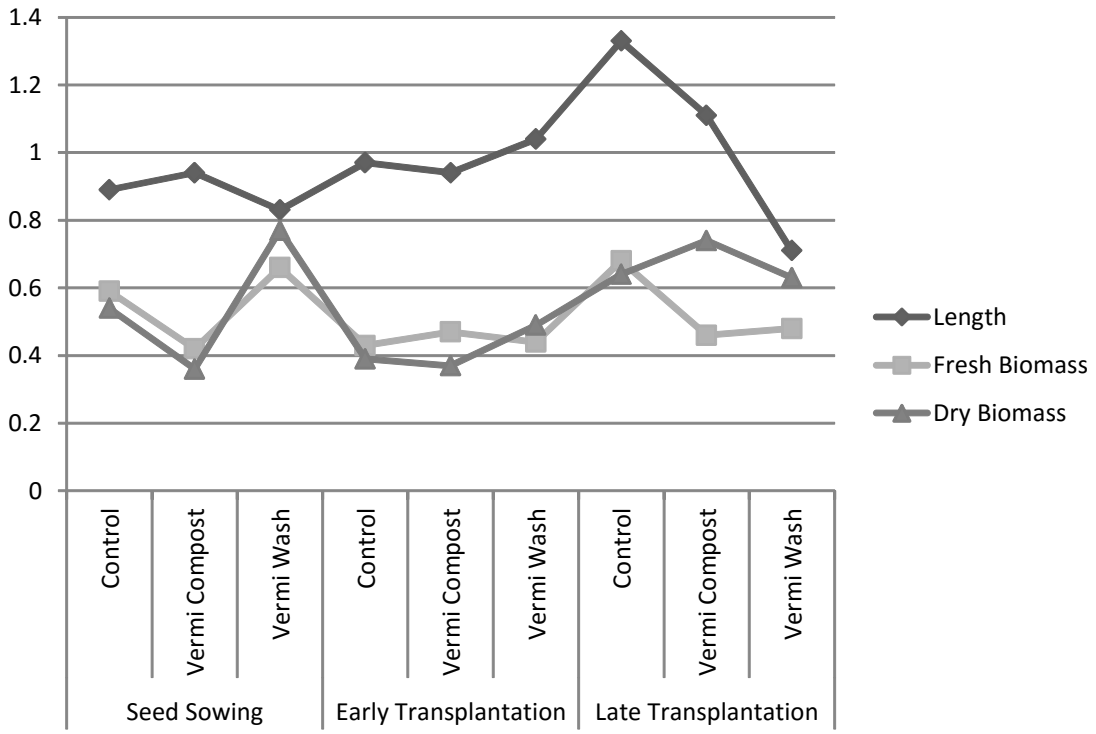

Fig 4. Root Shoot Ratio of *P. pinnata* grown under different treatments in pot culture condition (140 days)

Fig. 5: Pot culture experiment on seed grown and transplanted plants of *Pongamia pinnata*

Reference

1. **Andrews, M., Sprent, J.I., Raven, J.A., Eady, P.E. (1999).** Relationship between shoot and root ratio growth and leaf soluble protein concentration of *Pisum sativum*, *Phaseolus vulgaris*

and *Triticum aestivum* under nutrient deficiencies. Plant Cell and Environment. 22: 949-958.

2. **Bloom, A.J., Chapin III, T.S., Mooney, H. A. (1985).** Resource Limitation in plants- an economic analogy. Annual Review of Ecology and Systematic. 16: 363-392.
3. **Bobade, S.N. and Khyade, V.B. (2012).** Detail study on the Properties of *Pongamia pinnata* (Karanja) for the Production of Biofuel. Research Journal of Chemical Sciences. 2(7): 16-20.
4. **Brijesh, S., Daswani, P.G., Tetali, P., Rojatkar, S.R., Anita, N.H., Birdi, T.J. (2006).** Studies on *Pongamia pinnata* (L.) Pierre leaves: understanding the mechanism(s) of action in infectious diarrhea. Journal of Zhejiang University Science b, 7: 665-74.
5. **Chopade, V.V., Tankar, A.N., Pande, V.V., Tekade, A.R., Gowekar, N.M., Bhandari, S.R., Khandake, S.N. (2008).** Pongamia pinnata: Phytochemical constituents, traditional uses and pharmacological properties: A review. Int. J. Green Pharm., 2: 72-5.
6. **Digamber, R., More. and Mirza, M. Vaseem, B. (2013).** Fungiotoxic Properties of Pongamia pinnata(L) Pierre Extracts against pathogenic Fungi. International Journal of Advanced Biotechnology and Research. 4(4): 560-567.
7. **Meher, L.C., Vidya, S.D., Naik, S.N. (2006).** Optimization of Alkali-catalyzed transesterification of *Pongamia pinnata* oil for production of biodiesel. Bioresource Technology. 97: 1392-97.
8. **Nambiar, K.M. and Abrol, I.P. (1992).** Long term fertilizer experiments in India-An overview. Fertilizer News. 34: 11-26
9. **Prakash, P., Pant, K.S. and Aalok, Y. (2014).** Effect of tree spacing and organic amures on various growth parameters of *Calendula officinalis* L under *Grewia optiva* based agro-forestry system. International Journal of Farm Science. 4(2): 130-138.
10. **Sahoo, H.R., Sahoo, M., Baboo, M. and Gupta, N. (2015).** Effect of red laterite soil and vermicompost on growth and development of chilli and brinjal grown under polypot conditions. Tropical Plant Research. 2(3): 172-174.
11. **Sangwan, S., Rao, D.V. and Sharma R.A. (2010).** A review on *Pongamia pinnata* (L.) Pierre: A Great Versatile Leguminous Plant. Nature and Science. 8(11): 130-139.
12. **Shroff, R.S. and Devsthali, S. (1992).** Earth worm farming: Scope and limitation. Proceedings of National Seminar on Natural Farming (Eds.) L.L. Somani, K.L. Tatawal and B.L. Basu pp. 126-42
13. **Srinivasan, K., Muruganandan, S., Lal, J., Chandra, S., Tandan, S.K., Raviprakash, V. (2001).** Evaluation of anti-inflammatory activity of *Pongamia pinnata* leaves in rats. Journal of Ethanopharmacology.78: 151-57.
14. **Tandon, H.L.S. (1992).** Components of integrated plant nutrition. In H.L.S. Tandon (ed.). Organic manures, recyclable wastes and biofertilizer. Fertilizer Development and Consultation Organization. 204, Bhanot Corner 1-2, Pamposh Enclave, New Delhi, India.