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COMPARATIVE PERFORMANCE OF POTATO GROWN AS INTERCROP IN MANGO ORCHARD AND BAMBOO SETUM

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ABSTRACT Intercropping is an excellent system of cropping which ensure better utilization of resources and inputs if the selection of crops were made appropriately potato is short durational and shade loving crops with high efficiency of photosynthesis and biological fixation. This ensures their suitability for growing as intercrops under plantation. Intercropping of the potato ensures efficient resource and space utilization including improvement of soil and orchard nutrient status, reduction in fruit drop and enhancing fruit yield and quality. It also provides additional income to farmers and helps in maximization of land use. Present study was undertaken to compare the performance of potato intercrop in mango orchard intercropping system and bamboo setum intercropping system , also use of different fertilisers were done to observe the independent yield each treatment . The results of the studies clearly demonstrated that the intercropping of potato in mango orchard is a highly remunerative proposition towards doubling farmers' income as compared to bamboo setum. All the fertilizers tested were suitable however the best return was obtained by using vermicompost followed by farm yard manure.

KEYWORDS :

INTRODUCTION

Agroforestry system is a form of sustainable land use systems that combine tree with crop or animal husbandry simultaneously and sequentially [1]. Literature has shown that due to its economic, social and environmental benefits [2], agroforestry is the common experience that has been promoted throughout in the world [3-4]. It's also an instrument for diversifying production from a single land unit [5-6]. Literature shows, tree-based agroforestry systems significantly contribute in alleviating poverty [7]. Because, mixing trees with annual crops is an option for diversifying productions and increase the productivity of land, which in turn helps the farmer to overcome the crop failure due to climate change [8-9].

Intercropping is a technique of crop intensification in both space and time where in the competition between crops may occur during a part or whole of crop growth period. It has been a common practice followed by the farmers of India, Africa, Sri Lanka and West Indies [10]. Intercropping is an excellent system of cropping which ensure better utilization of resources and inputs if the selection of crops were made appropriately [11]. The basic idea of intercropping is not only that two or more crop species grown together can exploit the resources better than either of them grown separately, but also to cover inherent risk in agriculture and more so, under dry land condition which is buffer to some extent and is called as “biological insurance”[12]. By growing more than one crop at a time in the same field, farmers maximize water use efficiency, maintain soil fertility, and minimize soil erosion, which are the serious drawbacks of mono-cropping [13]. It also reduces seasonal work peaks as a result of the different planting and harvesting times of intercropping crops. Moreover, it could serve to increase output per unit area, particularly with low levels of external inputs since a mix of species makes better use of available nutrients and water in the soil [14]. This system gives higher yields in a given season and greater stability of yields in different seasons compared with sole cropping [15]. The intercrops not only generate an extra income but also this practice may help to check soil erosion through ground cover, improving physico-chemical properties of soils. Due to scarcity of land there is no scope for horizontal land expansion in the country. However, it could be manifold extended vertically considering different layer of agro-forestry system, which are applicable to small holding to provide maximum returns as land sustainability [16].

Mango is one of the most important and widely cultivated tropical fruits of the world. In India it is grown in an area of 23.78 lakh hectares with an annual production of 161.98 lakh tones [17]. This contributes to 37.8 per cent of total area and 18.6 percent of total production of fruit crops in India. On other hand Bamboo is an extremely versatile plant capable of providing ecological, economic and livelihood security to the people. Both mango and Bamboo reaches structural maturity within three to five years and the mean annual increment (MAI) of both the crops are higher than that of many other fast growing tree species. Bamboo generates plenty of oxygen, low light intensity and protects against ultraviolet rays and is also considered to be an atmospheric and soil purifier. Furthermore, it conserves water and greatly reduces soil erosion [18]. Thus, development of mango and bamboo based agroforestry systems in this context holds great promise. So the present study was undertaken to evaluate the benefit cost of inter cropping system, net profit and yield of potato grown as intercrop in mango orchard and bamboo setum also effect of fertilizer was observed on yield of intercrop.

MATERIAL AND METHODS

The experiment was conducted in the 10-year old mango mother orchard and bamboo setum located at Research cum Demonstration centre Garhkhtanga (Under Administrative control of Plantation Research and Evaluation circle of Ministry of Forest Environment and Climate Change, Government of Jharkhand) during Rabi seasons of 2016-2017. The soil of the experimental orchard was medium black clay loam of average fertility and well drained having p^H 7.5. The experiment was laid out in a randomized block design (RBD) with plot size 10m X 5m leaving 3 m space from the trunk of each tree. A sample plot of area 10m X 5m was demarked in the land containing mango and bamboo plantations respectively. Tuber crop, Solanum tuberosum (potato) was used as intercrop for mango orchards and bamboo setum and 4 fertilizers; namely: 1. Vermicompost, 2.Chemical fertilizer, 3.Khalli, 4.Farmyard manure were used in each plot considered as eight treatments (Table1). Equal amount of seeds (5 kg each for the given plot size) were sown in the established plots of mango and bamboo setum. Uniform Fertilizer operations were regularly practiced in every 15 days. The economic produce of potatoes from each plots were harvested and quantified per hectare of mango mother tree orchard and bamboo setum.

Economics of mango based and bamboo based intercropping system was worked out taking into account the prevailing cost of inputs like labour, seeds, manures and fertilizers, pesticides and sale price of produce during year 2016-17. Hence the cost of cultivation was calculated. The gross return was calculated by multiplying the yield (t/ha) of different treatments with prevailing market price per quintal and net returns was worked out by deducting the cost of cultivation from gross return. The benefit-cost ratio (B: C) of intercropping systems were worked out to know the most remunerative and

profitable intercropping system using the formula given below:

$$\text{B:C ratio :: } \frac{\text{Gross return from intercropping system}}{\text{Cost of cultivation of intercropping system}}$$

Yield and economics of cultivation of potato in both the intercropping system have been also evaluated according to different practiced treatments as shown in table 3.

RESULT AND DISCUSSION

The data on yield and economics of cultivation revealed that the yield of intercropped crop that is potato differed significantly in different intercropping system (Table 2) as well in yield also varied in each treatment (Table 3). The maximum yield (10 ton/hectare) was recorded in mango orchard intercropping system while in bamboo setum intercropping system (4.8 ton/ hec) yield is recorded. Considering the treatments, maximum yield was recorded in T1 (3.4 ton/hec) followed by T4 (2.8 ton/hec) and T2 (2 ton/hec).the lowest yield was recorded in T7 (0.8 ton/hec) which was at par with T6 (1 ton/hec). It is also noted that high recorded yields are from mango orchard intercropping system while low are from treatments done in bamboo setum intercropping system. The highest gross returns (300000 Rs./ha), net returns (183230 Rs./ha) and BC ratio (2.6) were realized with potato intercrop in mango orchard intercropping system which was significantly superior than bamboo setum intercropping system which recorded gross returns (144000 Rs./ha), net returns (27230 Rs./ha) and BC ratio (1.2) . This was due to higher intercrop yield in mango orchard intercropping system. These findings are in consonance with the results of Kar (2012) [19]. Wide variation in yield may be due to no. of buds in one sapling and bud size (potato size) as in bamboo setum intercropping buds formed were less in number and tiny in size as compared to buds formed in mango orchard intercropping system.

Table 1: Agro-techniques adopted for intercropping in both intercropping system

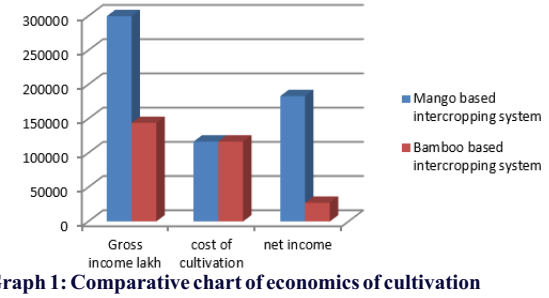
Treatment		Intercropping System	Crop	Spacing (Cm)	Seed Rate Rs/Kg	Seed Rate (Ton/Ha)	Fertiliser (Kg/Ha)
Vermicompost	T1	Mango based intercropping system	Potato	10 X 6	22	5	110
Chemical fertiliser (NPK)	T2						100:80:100
Khalli	T3						80
Cow Dung	T4						120
Vermicompost	T5	Bamboo based intercropping system				5	110
Chemical Fertiliser	T6						100:80:100
Khalli	T7						80
Cow Dung	T8						120

Table 2: Yield and economics of cultivation

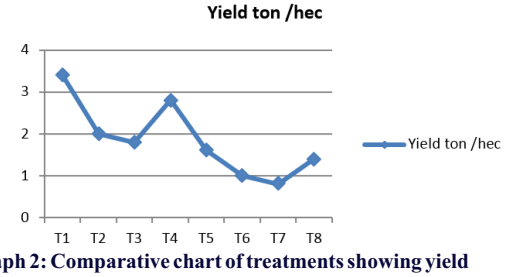
Intercropping System	Yield Ton/ hec	Sale Price (Rs./Kg.)	Gross Income (Rs)	Cost Of Cultivation (Rs/Hec)	Net Income (Rs/Hec)	B:C Ratio
Mango based intercropping system	10	30	300000	116770	183230	2.6
Bamboo based intercropping system	4.8	30	144000	116770	27230	1.2

Table 3: Treatment wise Yield and gross income of cultivation

Treatment	Yield (ton /hec)	sale price (Rs)	Gross income (Rs)
T1	3.4	30	102000
T2	2		60000
T3	1.8		54000
T4	2.8		84000
T5	1.6		48000
T6	1		30000
T7	0.8		24000
T8	1.4		42000



Graph 1: Comparative chart of economics of cultivation



Graph 2: Comparative chart of treatments showing yield

The present investigation indicated that intercropping tuber crop, Potato as intercrop in the mango orchard and bamboo setum during Rabi season provided very good yield and income. All the fertilizers tested were suitable however the best return was obtained by using vermicompost followed by farm yard manure. The results of the studies clearly demonstrated that the intercropping of potato in mango orchard is a highly remunerative proposition towards doubling farmers' income. This study will help the farmers/scientists to select the appropriate intercropping systems. However, further studies are necessary for inclusion of various other intercrops for location and soil specific recommendations and to confirm the long term effect of intercropping.

REFERENCE

1. FAO (2013). Advancing Agroforestry on the Policy Agenda: A Guide for Decision-Makers. In G. Buttoud, in collaboration with O. Ajayi, G. Detlefsen, F. Place and E. Torquebiau.
2. Agroforestry Working Paper no. 1. Rome.Abrha BG (2016). Potential Effects of Agroforestry Practiceson Climate Change Mitigation and Adaptation Strategies: AReview. Journal of Natural Sciences Research, 6 (15).
3. Akinnifesi FK, Silashe G, Ajayi OC, Chirwa PW, Kwesiga FR,Harawa R (2008). Contributions of agroforestry research anddevelopment to livelihood of smallholder farmers in SouthernAfrica: 2. Fruit, Medicinal, Fuelwood and Fodder Tree Systems,Agricultural Journal, 3 (1): 76 – 88.
4. Mbow C, Smith P, Skole D, Duguma L, Bustamante M (2014).Achieving mitigation and adaptation to climate change throughsustainable agroforestry practices in Africa. Current Opinion inEnvironmental Sustainability, 6: 8-14.International Journal of Sustainability Management and Information Technologies 2019; 5(1): 8-14 13
5. Casey JF, (2004). Agroforestry adoption in Mexico: usingKeynes to better understand farmer decision-making. Journalof Post Keynesian Economics, 26 (3), 505-521.
6. Dwivedi RP, Kareemulla K, Singh R, Rizvi RH, Chauhan J(2007). Socio-Economic Analysis of Agroforestry Systems inWestern Uttar Pradesh, 7: 18–22.
7. Garrity DP (2004). Agroforestry and the achievement of theMillennium Development Goals; Agroforestry Systems, 61: 5–17.
8. Bishaw B, Neufeldt H, Mowo J, Abdelkadir A, Muriuki J,Dalle G, Assefa T, Guillozet K, Kassa H, Dawson IK,Luedeling E (2013). Farmers' strategies for adapting to andmitigating climate variability and change through agroforestryin Ethiopia and Kenya. Forestry Communications Group,Oregon State University, Corvallis, Oregon.
9. Linger E (2014). Agro-ecosystem and socio-economic role ofhome garden agroforestry in Jabithenan District,North-Western Ethiopia: implication for climate changeadaptation. SpringerPlus, 3: 154.
10. Andrews, D. J. and Kassam, A. S. (1976). Importance of multiple cropping in world food supplies (In) multiple cropping (Parendick, R. I. and Sanchez) Triplet (Eds.) Pub.27. American Society of Agron, pp. 1-10.
11. Singh, S. S.; Singh A. K. and Sundaram, P. K. (2014). Agro technological options for upscaling agricultural productivity in eastern indo gangetic plains under impending climate change situations: A review. J. of Agrisearch, 1(2): 55-65.
12. Ayyer, A. J. Y. N. (1963). Principles of crop husbandry in India, Bangalore press, pp.406.
13. Hoshikawa, K., 1991. Significance of legumes crops in intercropping, the productivity and stability of cropping system. pp. 173-176. In: C. Johanson, K.K. Lee and K.L. Saharawat, (eds.). Phosphorus Nutrition of Grain Legume in the Semi-Arid Tropics. ICRISAT.
14. Kotschi, J., A. Adelhelon, R. Waters-Bayer and U. Huesle, 1986. Ecofarming in Agricultural Development. Verlag Josef Margraf Scientific Books, Berlin.
15. Willey, R.W. (1979). Intercropping, its importance and research work part-I. Competition and yield advantages. Field crop abstract, 32(1): 1-10.
16. Singh, R.P. and Osmen, M. 1987 Agroforestry system for small holdings. International Workshop on Agroforestry for Rural Needs, Vigyan Bhawan, New Delhi, February 22-26.
17. NHB. 2012. Indian Horticulture Database 2012. National Horticulture Board, Ministry of Agriculture, Government of India.
18. Amneth, R. R. 1996. The role of bamboo on the social, cultural and economic life of the Philippines. Bamboo People Env. 4 : 70-78.
19. Kar, S. 2012. Performance of Inter Cropping of Vegetables in Mango (Mangifera Indica) Variety Amrapali workshop on Natural Resource Conservation : Emerging Issues & Future Challenges 48 : 581-583