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Production potential of some winter vegetables under edible bamboo- *Dendrocalamus asper*

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Abstract: The feasibility of cultivation of winter vegetables under bamboo was assessed on the basis of their growth and yield. Recently *Dendrocalamus asper*, an edible and exotic bamboo species has been introduced in India. In the present study four-years-old plantation of *D. asper* raised through tissue culture was intercropped with potato (*Solanum tuberosum*), tomato (*Lycopersicon esculentum*) and pea (*Pisum sativum*). Vegetable crops showed variable performance under bamboo as compared to control. Among three winter vegetable crops, pea was found most compatible with *D. asper*.

Keywords: Agroforestry, bamboo, *Dendrocalamus asper*, intercropping, vegetable.

INTRODUCTION

Bamboo is a group of most useful and fastest growing woody plants with a growth rate ranging from 30 to 100 cm per day in growing seasons. On account of extensive rhizome-root system and accumulation of leaf mulch, bamboo serves as an efficient agent in preventing soil erosion, conserving moisture, reinforcement of embankments and drainage channels, *etc.* Additionally, quality of strength, light weight and flexibility make bamboo a viable alternative to tropical timbers which are in short supply for furniture and building material industries. Asia accounts for majority (90%) of the international trade in bamboo shoots and the bulk of this is produced in Thailand, Taiwan, China and Indonesia, while Japan is a major importer. For centuries young succulent bamboo shoots hold high esteem as an edible delicacy in the tribal community of north-eastern and eastern India. Now, it is gaining popularity in Indian restaurants. Recently, the National Bamboo Mission of India gave emphasis on the production and processing of bamboo shoots. The Planning Commission, Government of India, estimates highlight that the bamboo shoot market in India was worth around Rs. 5 crores in 2001 and with a potential of 25 per cent growth per annum it would capture a market worth of Rs. 300 crores by 2015. Bamboo shoots carry the potential of value added economic activity and provide employment and income generation at rural and community level through

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cultivation and processing. The list of edible bamboo species in northeastern India, their edible shoot production, nutritional value and traditional food products prepared from shoots were well documented by Singh (2006). *Dendrocalamus asper,* an edible and exotic bamboo species has been introduced in India in the last decade. Though growing of intercrops under bamboo has widely been suggested to ensure income from agroforestry system (Jha and Lalnunmawia, 2003; Krishnankutty, 2004; Vishwanath *et al.,* 2007), no detailed study has been done so far on *D. asper* based agroforestry system in eastern India. The present experiment was, therefore, planned to identify and screen suitable winter vegetables cultivation under *D. asper* plantation.

MATERIALS AND METHODS

A field study was conducted at the Forest Research Centre, Mandar (latitude 23°28′N longitude 85°06′E and altitude 767 m.s.l) receiving average annual rainfall of 1400 mm. Tissue culture raised bamboo (*D. asper*) plantlets were planted at 5 × 5 m spacing in 2003. Experiment consisted of growing three vegetables during winter season in this bamboo plantation after 4 years and one control *i.e.*, without bamboo. The crops were replicated thrice in a randomized block design with plot sizes of 4 × 4 m. All the crops were raised with recommended package of practices both in agroforestry and monoculture. No separate dose of fertilizer was applied to bamboo.

Solar radiation reaching the crop surface was measured with the help of Lux Meter. The values of light are expressed in the form of incidental solar radiation (%) in reference to radiation received at the crop surface in control plots. The comparative performance of vegetable crops is expressed in terms of per cent relative yield obtained within bamboo plantation with yield obtained in control. Yield of vegetables under bamboo plantation was calculated on the basis of production of vegetables in purely crop growing plots *i.e.*, 4 × 4 m under bamboo plantation excluding the bamboo growing area. Some growth and yield attributing traits of crops were recorded at the time of crop harvest on the basis of randomly selected ten plants from each replication.

RESULTS AND DISCUSSION

The results show that on account of competition for growth resources, yield of potato and tomato decreased when cultivated under bamboo (Table 1). It was mainly due to decreased light availability to crops under bamboo. The data presented in Table 3

Table 1. Mean yield (t/ha) of winter vegetables under *D. asper* plantation

Vegetable	Under bamboo		Control
	Yield	Per cent relative yield	Yield
Potato	6.25	55.6	11.25
Tomato	5.61	29	19.20
Pea	5.33	106.4	5.01

clearly indicate that under bamboo there was reduction in availability of light. On the other hand, bamboo root weight per unit area was higher in the plots of these two crops than the pea plots (data not shown). The reduction in the yield of potato was due to reduced plant height and reduced number of tubers per plant, whereas in tomato, reduction in plant height, number of fruits/plant and fruit weight caused poor yield (Table 2). Nandal and Hooda (2005) also reported that traits responsible for lower yield under poplar were tubers/plant and weight/tuber in potato.

Unlike potato and tomato, the yield of pea increased six per cent under bamboo plantation in comparison to control. For confirmation of result, the experiment should be repeated for more years. Previous study showed that the yield of wheat under poplar based agroforestry increased in the first year, whereas from second year onwards it started decreasing as compared to control (Nandal and Hooda, 2005).

In general, yield of all crops except pea decreased when cultivated within bamboo plantation as compared to control condition. It is due to increased competition for growth resources like sunlight, moisture and nutrients in bamboo plots than control plots. Decrease in yield of agricultural crops has been reported in poplar based (Karnataka, 1996; Nandal and Hooda, 2005), shisham based (Nandal and Singh, 2001) and eucalypts based (Rai *et al.*, 1990) agroforestry systems.

Among three vegetables studied, performance of pea is the best. Probably this is the

Table 2. Effect of *D. asper* on the growth and yield attributes of vegetable crops

Growth and yield attributing traits	Under bamboo	Control
Potato		
Plant height (cm)	36.2	40.0
Tubers/plant	5.1	8.9
Weight/tuber (g)	12.5	11.6
Tomato		
Plant height (cm)	59.3	61.5
Fruits/plant	6.8	10.7
Weight/fruit (g)	13.1	28.8
Pea		
Plant height (cm)	72.8	70.5
Pod weight/plant (g)	14.2	13.4

Table 3. Incidental solar radiation under *D. asper* during winter season

Time	Per cent of control
10 AM	62.3
12 Noon	80.2
2 PM	61.4
4 PM	55.6
Average	64.9

first report on edible bamboo intercropped with winter vegetables. However, there are few reports where agricultural crops were cultivated under bamboo during summer and rainy seasons. Shanmughavel and Peddappaiah (2000) recommended intercropping of soybean and turmeric in initial stages of *B. bambos* plantations and Vishwanath *et al.* (2007) assessed that bamboo intercropped with ginger was financially more viable than monoculture of bamboo or ginger.

CONCLUSION

Generally, intercropping is difficult in plantations of bamboo due to fast and luxuriant growth of culms. But, in well managed bamboo plantations where culms are regularly harvested, shade tolerant species can be cultivated in beds between bamboo rows. As bamboo matures, light availability to intercrops is reduced in the subsequent years. From the present study, it can be concluded that at least up to the initial five years winter vegetables, specifically pea may be intercropped within bamboo plantations.

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