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Intercropping Studies in Guava Orchard

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Abstract: *Guava (Psidium guajava, L.) is one of the most popular fruit trees grownat tropical and subtropical countries. It is commonly called poor man's fruit.Guava fruit is the cheapest and richest source in vitamin "C" as well as it contains small amounts of vitamin A, B, carbohydrates, oils and proteins. It contains antioxidant factors and can control systolic blood pressure. It is good source of roughage and help in removal of constipation. In India it is cultivated almost throughout except higher hills.*

Guava is mainly planted at 6X6cm spacing, where there is an ample scope for growing of short duration crops during the initial years. The vacant space between the plants should be judiciously used for growing of leguminous crops like cowpeas, Guar, gram and mung, etc. The experiment was conducted to study the effect of different types of agricultural crops on guava growth under guava based agri-horti system at research farm of CCS Haryana Agriculture University, Hisar. The experiment was conducted in complete randomized block design with four treatments which were replicated five times. Treatments wereGuar + Guava (T_1), Cowpea + Guava (T_2), Mungbean+ Guava (T_3) and Guava alone (T_4). Initial soil pH 7.88 and EC 1.09 ds/m were recorded (1:2 ratio). Results show that intercropping with mungbean increased guava growth as compared to other crops (cowpea and guar) as well as mono cropping. Intercropping in general improved height and diameter of guava trees as well as improve the nutrient status of soil over mono-cropping.

INTRODUCTION

Agri-horti system is an improved cropping system in which maximum utilization of natural resources markedly increases the return per unit area per unit time. Farmers realize the problem of no economic returns in the initial stage of fruit tree orchards till thetree starts bearing fruits. There is ample scope to utilize the introduction of the fruit treeduring the initial 5 to 6 years by growing arable crops (Gill and Bisaria, 1995). The beneficial effects of organicmatter from forest trees on the physical and chemical properties of the soil, and on cropperformance, are well documented (Tian *et al.*, 1993; Sanchez *et al.*, 1996).). In agri-horti system, trees and agricultural crops are combined together and they compete with each other for growth resources such as light, water and nutrients. The resource sharing in component crops may result in complementary or competitive effect depending upon nature of species involved in the system.Intercropping isone of the techniques of land utilization for optimumproduction (Bhattanagar *et al.*, 2007).

Psidium guajava L. is one of the fast growing fruit tree species, which is being promoted for cultivation in the farmers field in Haryana state. Guava is mainly planted at 6X6 cm spacing, where there is an ample scope for growing of short duration crops during the initial years. The vacant space between the plants should be judiciously used for growing of leguminous crops like cowpeas, Guara, gram and moong, etc.

Mungbean (*Vigna radiata* L.) is an important pulse crop of *kharif* season in India. The optimum sowing time ensures the complete harmony between the vegetative and reproductive phases on one hand and the climatic rhythm on the other and help in realizing the potential yield (Singh and Dhingra, 1993). The climate change and global warming has deleterious effects on crop production in terms of period of maturity and yieldIts seed contains 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash (Potter and Hotchkiss, 1997).

Guar or cluster bean (*Cyamopsis tetragonolobu*) is grown in many countries as a vegetable food, fodder and green manure crop. It is an important drought hardy crop and can grow well in areas having 400 900 mm rainfall.

Cow pea (*Vigna unguiculata*)is a multipurpose legume providing grain, forage and also improve the

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soil fertility. It has very high nutritive value and high palatability. In the fresh form, the young leaves, immature pods and seeds are used as vegetable, while several snacks and main meal dishes are prepared from the grain.

MATERIALS AND METHODS

The experiment was carried out at the Horticulture Farm of CCSHAU,Hisar, Haryana which is situated at 29° 10′ latitude, 75° 46′ longitude and altitude of 215.2 m . The experiment was conducted to study the effect of different types of agricultural crops on guava growth under guava based agri-horti system at research farm of CCS Haryana Agriculture University, Hisar. The intercrop were grown in the inter row spacing leaving 1 m radial space under tree basin in the center. The experiment was conducted in complete randomized block design with four treatments which were replicated five times. Treatments were Guar + Guava (T_1), Cowpea + Guava (T_2), Mungbean+ Guava (T_3) and Guava alone (T_4). Initial soil pH 7.88 and EC 1.09 ds/m were recorded (1:2 ratio).The fertilizer application was done with fixed doses of nitrogen at 150 kg/ha and phosphorus at 65 kg/ha and potassium at 65 kg/ha. All the nutrients were applied as basal and the sources of N, P and K were urea, DAP and MOP, respectively.

Growth attributes that is, plant height, dry matter accumulation per plant and yield attributes i.e, number of pods per plant, pod length, number of grains per pod, test weight, and grain yield were measured.The height and spread were measured with scale and canopy volume by using the formula

$$(2/3\ \pi\ r^2\ h)$$

Where r is radius {1/2(spread N-S+E-W)}/2 and h is height of the tree. The leaf samples were collected and prepaired by the procedure suggested by Chapman (1964). Nitrogen was estimated by using Micro-Kjeldahl's method (Jakson, 1973).Phosphorus content in plant parts was determined by following spectrophotometry method (Jackson, 1973).Potassium content in plant parts was determined by using Flame photometric methods (Jackson, 1973).

RESULTS AND DISCUSSION

Plant height (cm): Plant height of all the inter crops increased progressively over time. Cow pea has maximum plant height from starting to harvest (17.12 cm to 117.4 cm) (Table 1)

Dry matter accumulation: Accumulation of dry matter increased progressively over time attaining the highest amount at physiologically maturity in all field crops (Table 1). The rate of increase, however varied depending on the growth stage. Dry matter (g/plant) was the highest in case of cowpea. This might be due to better exploitation of growth resources as better height.

Yield and yield attributes: Population density influenced all yield attributes except seed size. Seed yield is the function of pods per plant, number of seeds per pod and test weight. Pod length is usually a crop and varietal character and varies depending on the environmental condition. Pod length by itself does not contribute directly to the yield, but there is often a close relationship between the number of seeds per pod and pod length. In table 2highest number of pods per plant was recorded in guar crop while minimum in cowpea. Highest pod length of cow pea (9.16 cm) recorded followed by mungbean (5.64 cm) and guar (3.53 cm).number of grains per pod indirectly depend on pod length, so in cow pea maximum number of grain recorded. Test weight is the result of the seed size, so those crops having bigger seed size, have test weight more. This is also observed in study and 117.47 g test weight of cowpea was recorded while 52.28 g of mungbean and 31.02 g of guar. Grain yield is the result of the combination of all yield attributes. Maximum grain yield of cowpea (900 kg/ha) was recorded, followed by mungbean (625 kg/ha) and guar (485 kg/ha).

Growth of tree crop: Intercropping interact positively to guava tree as it improved the height (16.21%, 17.99% and 22.72%) for cowpea, guar and mungbean respectively (table 3). It is assumed that the adding of fertilizers and irrigation to intercrops might have ameliorated the status of nutrient and moisture in orchard which inturn enhanced tree growth. Jose *et al.* (2004) also reported that deeper roots of trees act as a safety net by capturing nutrients that leach below the rooting zone of the crops and recycle them back into the system by tree component. Other studies revealed that yield are influenced by edaphic factors (Deen *et al.*, 1998 and Padmapriya and Chezhiyan, 2009). Cowpea was proved to be a slightly better intercrop as compared to guar and munbean as for as tree canopy concern.

Leaf mineral composition: The leaf nutrient content of guava leaves under different intercropping treatments is greatly influenced (Table 4). There was a significant reduction in leaves N and P contents under different intercropping treatments as compared to control (fallow), which were also at par with each other treatments. The maximum nitrogen content 1.83% and minimum 1.72% in guar. The maximum

phosphorus content 0.178% was observed in control and minimum 0.128% in intercropping of cowpea treatment. Maximum potassium content was recorded in gaur (2.02%) intercropping treatment while minimum in mungbean (1.91%) intercropping treatment. Aulakh *et al.,* 2004 also reported lower leaf N,P and K content as compared to control with every intercropping treatment in pre-bearing kinnow orchard.

CONCLUSION

Growing of pulses as intercrops in non-bearing guava orchard improved the growth (height and canopy volume). Farmers can get some additional output during the non bearing period of guava orchard. Cowpea was proved to be a slightly better intercrop as compared to guar and mungbean as for as tree canopy concern.In intercropping, nutrient content of guava leaves reduced.

Table 1
Growth response of crops under guava based agri-horti system

Crops	*Plant height (cm)*			*Dry matter accumulation (g/plant)*		
	30 DAS	*60 DAS*	*At harvest*	*30 DAS*	*60 DAS*	*At harvest*
Guar	13.84	40.41	96.76	6.51	12.11	15.47
Mungbean	12.85	34.32	59.14	6.31	11.86	15.85
Cowpea	17.12	53.74	117.4	6.99	12.29	15.91

Table 2
Yield response of crops under guava based agri- horti system

Crops	*No of pods/plant*	*Pod length (cm)*	*No. of grain/pod*	*Test weight (g)*	*Grain yield (kg/ha)*
Guar	52.44	3.53	7.03	31.02	485
Mungbean	22.43	5.64	5.6	52.28	625
Cowpea	16.07	9.16	9.52	117.47	900

Table 3
Growth performances of guava with various crops in guava based agri-horti system

Crops	*Tree height (cm)*		*% Change*	*Girth (cm)*		*% Change*	*Tree canopy volume (cm³)*	
	Before crop	*After crop*		*Before crop*	*After crop*		*Before crop*	*After crop*
Guar	95.1	115.96	17.99	6.2	6.91	10.25	1913.12	2890.24
Mungbean	109.13	130.24	22.72	5.75	6.53	13.96	1888.25	2909.89
Cowpea	92.47	119.65	16.21	6.1	7.09	11.95	1800.69	3165.75
Fallow	102.08	111.23	8.23	6.98	7.64	8.64	2602.74	3397.70

Table 4
Effect of different intercrops on leaf nutrients content in guava

Treatments	*N %*	*P %*	*K %*
Guar	1.72	0.132	2.02
Mungbean	1.86	0.135	1.91
Cowpea	1.83	0.128	1.96
Fallow	2.05	0.178	2.02
CD at 5%	0.20	0.013	0.06

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