

INFLUENCE OF FORAGE INTERCROPPING SYSTEMS ON QUALITATIVE AND QUANTITATIVE TRAITS OF MANGO CV. AMRAPALI, UNDER RAINFED CONDITION OF RAJASTHAN

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(Received : 10 September 2021; Accepted : 29 September 2021)

SUMMARY

The present experiment was conducted with a view to study the suitability and profitability aspects of different intercrops for mango orchard cv. Amrapali in order to get additional income. There were 7 different treatments viz., Mango + cowpea, Mango + soybean, Mango + cluster bean, Mango + pigeonpea, Mango + maize, Mango + black gram and control (clean cultivation) had taken. The fruit yield of mango with intercrops was higher. The highest number of fruits per plant, yield per plant and yield per hectare was found when companion intercropping system of soybean, followed by cowpea, and black gram. It was observed that the yield parameter of mango increases when intercrop with leguminous crops. Similarly, several physical characteristics like fruit diameter, length and fruit weight increase significantly and found highest when intercropped with Soybean. The chemical analysis of mango fruits revealed that the TSS, total sugar percentage and ascorbic acid found to increased non-significantly among the treatments and found higher when inter-cropped with soybean and titratable acid noticed higher in control. The highest annual returns obtain when mango inter-cropped with maize followed by cluster bean and cowpea.

Key words : Mango, Amrapali, intercrop and legumes

Mango (*Mangifera indica* L.) is an important commercial crop covering more than 40 per cent of the total area under fruit crop in the country. It is the choicest and most popular fruit among the people of orient and is designated as the 'King of Fruits' (Purseglove, 1972) Various limiting factors like lack of flower induction, alternate bearing, flower and fruit drop, malformation, adverse climate and occurrence of insect-pest and diseases are involved in lower orchard efficiency. Therefore, the present experiment was conducted with a view to study the suitability and profitability aspects of different intercrops for mango orchard cv. Amrapali. Intercropping in mango orchards was earlier studied by different researchers. (Rajput *et al.*, 1989) has advocated intercrops in mango orchard in order to get additional income (Singh *et al.*, 2012) studied the effect of intercrops like cowpea, french bean, arhar, soybean, lentil, chick pea and black gram in mango and observed higher mango yield in mango-cowpea system followed by mango-lentil system and least in sole crop (Swain, 2014) studied the effect of intercrops (mango ginger, turmeric, cow pea, tomato, French bean, ragi, niger, upland paddy) in eastern ghat high land zone of Odisha on mango performance and observed that the mango-guava-cowpea intercropping system exhibited better performance in relation to vegetative growth and fruit yield, closely followed by mango-guava french bean

system. Similarly, (Sarkar *et al.*, 2004), (Ratha and Swain, 2006), (Raut *et al.*, 2006), (Tiwari and Baghel, 2014) has also reported the beneficial or non-detrimental effect of intercrops on mango plants. Overall, it was observed that the fruit yield of mango with leguminous intercrops like cowpea, lentil, French bean etc. was higher than that without inter-crops. The higher yield of the mango with leguminous intercrops was due to improved availability of soil nutrients probably caused by nitrogen fixation from air to soil by intercrops, reduction in soil and nutrients erosion from orchard floor due to obstruction created by intercrops, application of fertilizers for intercrops, and incorporation and decomposition of intercrop residues in soil of the orchard. In other hand, the non-leguminous intercrops benefitted the main crop through creating a better micro-climate that might help in improving fruit yield of mango.

The experiment was conducted in a four-year-old mango (cv. Amrapali) orchard at fruit demonstration block, Vidyabhawan Krishi Vigyan Kendra, Badgaon. VBKVK is located in the Badgaon Block of Udaipur District in South-West Rajasthan. The geographical boundaries of the District extend from 23°45' to 24°8' North Latitudes and from 73°9' to 74°35' East Longitudes.

Veneer grafted mango plants of cv Amrapali on local stalk were planted in Clay-loamy soil at a

TABLE 1
Effect of forage intercropping on plant growth and fruit yield of mango cv. Amrapali (average of 2 years)

Treatment	Percent plant height increase	No. of fruit/Plant	Yield/Plant (kg.)	Yield (q/ha)
Mango + cowpea	17.5	154.6	38.8	155.2
Mango + soybean	17.8	155.8	39.5	158.4
Mango + cluster bean	16.6	146.1	37.8	151.2
Mango + pigeonpea	15.8	145.4	37.2	148.8
Mango + maize	14.5	142.2	36.1	144.4
Mango + black gram	17.0	152.1	37.5	150.6
Control (Clean cultivation)	10.6	141.50	35.6	142.4
C.D. (0.05)	NS	NS	NS	NS

spacing of at 5×5 m during 2015-16. Total 224 Mango plants cv. Amrapali were used for study. There were seven different treatments *viz.*, Mango + cowpea, Mango + soybean, Mango + cluster bean, Mango + pigeonpea, Mango + maize, Mango + black gram and Control (Clean cultivation) had taken for the experiment to evaluate maximum land efficiency and Influence of intercropping systems on qualitative and quantitative traits of Mango cv. Amrapali.

The experiment was laid out in randomized block design with four replications. A unit of 56 mango trees was a replication. Eight trees were taken for each treatment in each replication. The intercrops were sown one meter away from the turn leaving an area of 2 m² around each tree. The experiment was laid out for two years observation. During this experiment uniform cultural operations were given to all the trees which were taken for the study and for intercrops as per recommended. fruit length, fruit diameter, fruit weight. Different observation *viz.*, percent plant height increase, no. of fruit/Plant, fruit yield, fruit size etc. were recorded at harvest in both the years and were statistically analysed. Physico-chemical analysis was done on ten randomly selected mature fruits from each replication.

The results from the effect of different intercrops revealed that quantitative and qualitative

traits increased with the intercrops combination with the main crop as compared to control. From this current investigation it was seen that the growth of the mango plants, in respect of plant height 17.8% (highest), volume etc. was slightly improved due to growing of different intercrops in between of the mango plants. The improved growth in mango plants were due to the types of inter crops (legume) grown in between plants. However, growth parameters were non-significant and the results are accordance with the findings of (Tiwari and Baghel, 2014). It was also seen (Table 1) that the yield parameter of fruits was non-significantly increase. The highest number of fruits per plant (155.8), yield per plant (39.50 kg) and yield per hectare (158.4 q) was found when companion intercropping system of soybean, followed by cowpea, and black gram. Minimum number of fruits per plant (142.2), yield per plant (36.10 kg) and yield per hectare (144.4 q) were recorded from the mango plants with intercropping system of maize. From this investigation, it was observed that the yield parameter of mango increases when intercropped with leguminous crops. Increasing of yield may explained due to legumes have capacity to of fixing atmospheric nitrogen that added to the soil and thereby main crop may get additional nitrogen. Similar findings were also observed by (Sanchez *et al.*, 1991).

The qualitative parameters of mango fruits revealed that several physical characteristics like fruit diameter, length and fruit weight increase significantly and found highest when intercropped with Soybean (6.48 cm, 9.15 cm and 257.53 g, respectively) Table 2, followed by cowpea and cluster bean and they were statistically at par among themselves. Fruit quality of mango was not affected (more or less) by different intercrops grown in interspaces. Similar findings were also reported by (Ghosh, 2001) in guava.

The chemical analysis of mango fruits from intercropped plot (Table 2) revealed that the TSS, total

TABLE 2
Effect of forage intercropping on qualitative traits of mango cv. Amrapali (average of 2 years)

Treatment	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	TSS (°Brix)	Total sugars (%)	Ascorbic acid (mg/100 g)	Titrateable acidity (%)
Mango + cowpea	255.97	9.12	6.45	19.75	17.75	22.70	0.13
Mango + soybean	257.53	9.15	6.48	19.76	18.12	22.72	0.12
Mango + cluster bean	257.23	9.10	6.45	19.72	17.73	22.68	0.13
Mango + pigeonpea	251.85	9.04	6.43	19.70	17.72	22.63	0.14
Mango + maize	248.87	9.02	6.42	19.64	17.69	22.64	0.16
Mango + black gram	246.55	9.08	6.42	19.65	17.71	22.61	0.15
Control (Clean cultivation)	251.59	8.98	6.41	19.63	17.65	22.59	0.17
C.D. (0.05)	NS	NS	NS	NS	NS	NS	NS

TABLE 3
Economic analysis of forage intercropping in mango cv. Amrapali orchard (average of 2 years)

Treatment	Grain/fodder yield of intercrop (q/ha)	Value of intercrop (Rs./ha)	Yield of mango/ha (q/ha)	Value of mango (Rs./ha)	Total gross return from Mango+intercrop (Rs./ha)
Mango + cowpea	200.00	90000	155.2	395760	485760
Mango + soybean	14.65	43218	158.4	403920	447137
Mango + cluster bean	250.00	112500	151.2	385560	498060
Mango + pigeonpea	21.28	103208	148.8	379440	482648
Mango + maize	260.00	416000	144.4	368220	784220
Mango + black gram	9.48	61620	150.6	384030	445650
Control (Clean cultivation)	0.00	00	142.4	363120	363120

sugar percentage and ascorbic acid found non significantly increased among the treatments and found higher when intercropped with soybean (19.76°Brix, 18.12% and 22.72 mg/100g respectively) Followed by cowpea and cluster bean. Similarly, the percent titratable acid noticed higher in control (0.17%) followed by maize (0.16%) and black gram (0.15%). Similar results were also reported by Kanwar *et al.* (1993). The cost analysis of the crops in present investigation is shown in Table 3. The highest annual returns were obtained when mango was intercropped with maize (784220 INR/ha) followed by cluster bean (498060 INR/ha) and cowpea (485760 INR/ha).

CONCLUSION

The current investigation was to evaluate maximum land efficiency and influence of forage intercropping systems on different qualitative and quantitative traits of Mango cv. Amrapali. The findings of current experiment revealed that the yield and other physio-chemical parameter of mango had increased (more or less) with all intercrops and higher when intercropped with leguminous crops like Soybean cowpea, cluster bean etc. Similarly, maximum annual returns were fetched when mango intercropped with all investigated crops. However, the highest returns were recorded when mango intercropped with maize, cowpea, cluster bean and black gram.

ACKNOWLEDGEMENTS

The authors are thankful to the Vidyabhawan Krishi Vigyan Kendra, Badgaon, for facilitating assistance.

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