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Research Article

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Agro-forestry system of Guava (*Psidium guajava*) and sweet potato (*Ipomoea batatas* L) for fruits, tubers and green fodder production.

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Abstract

The field experiment was conducted during two consecutive years of 2002-03 and 2003-04 at village *Rajpura* of Mainpuri districts in the catchments area of *Isan* river, it is a tributary of river *Ganga*, under National Agricultural Technology Project for making the model to sandy clay loam soil. The main objective was to increase the yield of fruits of guava, tubers yield of sweet potato and green fodder yield from sweet potato. The four treatment *i.e*., guava + sweet potato-12 rows of vines planted between two rows of guava at spacing of 40 cm, guava + sweet potato-10 rows of vines planted between two rows of guava at spacing of 50 cm, guava + sweet potato-8 rows of vines planted between two rows of guava at spacing of 60 cm and guava fruits yield collected with survey from vicinity area of experimental site were tested. The adjustment of 10 rows and 8 rows of sweet potato gave at par yield of by 11.15 q/ha and 11.20 q/ha, respectively. The adjustment of 12 rows of sweet potato between two rows of guava slightly reduced the fruits yield of guava (10.65 q/ha). The fruits yield from pure orchard of guava recorded through survey by 12.60 q/ha, which was higher in comparison to other tested treatments. The adjustment of 10 rows of sweet potato vines between two rows of guava gave highest yield of sweet potato tubes by 280.00 q/ha, followed by 8 rows of sweet potato vines adjusted between two rows of guava (275.50 q/ha). The lowest tubers yield of sweet potato by 263.37 q/ha was recorded under the adjustment of 12 rows of sweet potato vines between two rows of guava. The highest system productivity by 291.15 q/ha was recorded under plantation of 10 rows of sweet potato vines in two rows of guava. The 12 rows adjustment of sweet potato vines in two rows of guava yielded higher green fodder yield by 272.00 q/ha.

Keywords: Agro-forestry, Fodder yield through vines, Survey yield of guava, Sweet potato, Sweet potato vines.

Introduction

Sweet potato is a very important crop of India but it is now widely distributed through out of World, where the climate conditions are favorable. Sweet potato is a subsidiary food crop and efficienit calorie supplier. Its food and vitamin value can be compared with that of rice (Mudaliar, 1950). If mixed with *atta* (flour) makes nutrition's and palatable chapattis. It's even string roots, stems and leaves make as excellent fodder for cattle. Watt ad Merrill (1964) indicated that sweet potato contain water 68.5 gms, protein 1.8 gms, fat 0.7 gms, carbohydrates 27.9 gms, Fibre 1.0 gms, Vit A 7700 I.U., Vit B group 0.46 gms, Nicotinic acid 0.6 mgm, Pantothenia acid 0.93 mgm, Vit C 22 mgm, Vit E 40 mgm, K 530 mgm, Ca 30 mgm, Mg 12 mgm, Fe 0.7 mgm, P49 mgm, S 15 mgm, Cl 85 mgm per 100 gms fresh edible portion. Though it is a drought resistant crop, yet is most susceptible to frost and soil temperature of 50ºF or below, it will damage the crop considerably. Plenty of sunshine and moderate rainfall with warm nights and days for 4 month are best suited for it.

Since sweet potato is soil covering crop and its vines spread horizentaly, therefore, suited best for filler crop between vacant spaces of guava rows. The vicinity area of Gangetic river and its tributaries of *Isan* is famous for growing of the best guava. Previously, the cultivation of guava confined as pure orchard but the sank size of holding stressed to the farm families for companion cropping. The pure cultivation of guava in orchards is an old practice but the size of holding sank due to increased human demography. Therefore, companion cropping with guava may widely be accepted by resource poor farm families, residing in the vicinity of *Isan* river. Therefore, the flexible plan for agro-forestry system was made and under taken, is the subject matter of this manuscript.

Materials and Methods

The field trial was laidout during two consecutive years of 2002-03 and 2003-04 at village *Rajpura* of Mainpuri districts in the catchments area of *Isan* river, it is a tributary of river *Ganga*, under **National Agricultural Technology Project** for making the model to KVKs. The main objective was to increase the yield of guava fruits and tubers yield of sweet potato and check the soil erosion during rainy season. The experimental soil was sandy clay loam, having pH 8.1, organic carbon 0.31%, total nitrogen 0.03%, available P_2O_5 8.6 kg/ha and available K_2O 198 kg/ha, therefore, the analyzed data of soil displayed low fertility status of plant nutrients. The pH was determined by electrometric glass electrode method (Piper, 1950), while organic carbon was determined by colorimetric method (Datta, *et al.,* 1962). Total nitrogen was analyzed by Kjeldahl's method as described by Piper (1950). The available phosphorus and potassium were determined by Olsen's method (Olsen *et al*., 1954) and Flam photometric method (Singh, 1971), respectively. The farming situation of the experimental area was irrigated. The four treatments listed in Table-1were tested. The cultivars ***Pusa*** white of sweet potato was planted in the first fortnight of July in vacant spaces of two rows of guava L-49 orchards, which were already established by participated farmers. The vines cutting of 30 cm, having 3 to 5 nodes was used in propagation of sweet potato. The cut vines planted on ridges. Cut vines were stored under shade for two days prior planting in the main field to promote root initiation better. The middle portion buried and both ends exposed. Sweet potato harvested after 115-120 days of planting when tubes reached to marketable size. When leaves become yellow, it was fit for harvesting. The green vines were used for feeding to the cattle's of farm families.

Results and Discussion

The pooled results of two years have been given in Table-1 and discussed here under appropriate heads:-

Table-1: Fruits yield of guava, root yield of sweet potato and fodder yield of sweet potato under different agro-forestry system.

S. N.	Agro-forestry system	Yield (q/ha)		System productivity (q/ha)	Fodder yield from sweet potato (q/ha)	Overall productivity (q/ha)
		Fruits of Guava	Tubers of sweet plant			
1.	Guava + sweet potato-12 rows of vines planted between two rows of guava at spacing of 40 cm.	10.65	263.37	274.02	272.00	546.02
2.	Guava + sweet potato-10 rows of vines planted between two rows of guava at spacing of 50 cm.	11.15	280.00	291.15	250.00	541.15
3.	Guava + sweet potato-8 rows of vines planted between two rows of guava at spacing of 60 cm.	11.20	275.50	286.70	245.00	531.70
4.	Guava fruits yield-yield collected with survey.	12.60	-	12.60	-	12.60

(A) Fruits yield of guava: Results given in Table-1 clearly indicated that the all planting systems of sweet potato between two rows of guava was found almost similar but adjustment of 10 and 8 rows of sweet potato gave at par fruits yield by 11.15 q/ha and 11.20 q/ha, respectively. The adjustment of 12 rows slightly reduced the fruits yield of guava (10.65 q/ha). The dense adjustment of plant population of sweet potato with 12 rows was responsible for reduction of fruits yield of guava due to more uptake of plant nutrients from soil. The yield of fruits of pure guava displayed the higher yield, which was recorded through the survey from the area of pure orchards at primary stage (12.60 q/ha). Similar results have also been reported by Singh (2007), Singh (2011), Singh *et al.* (2011) and Singh *et al.* (2016).

(B) Tubers yield of sweet potato: Perusal of data make it clear that adjustment of 10 rows of sweet potato vines between two rows of guava gave highest tubers yield by 280.00 q/ha, followed by adjustment of 8 rows of sweet potato between two rows of guava (275.50 q/ha). Guava + sweet potato-12 rows of sweet potato planted between two rows of guava at spacing of 40 cm produced tubers yield by 263.37 q/ha, which was lowest yield of sweet potato tubers. These findings are in agreements with those reported by Singh (2007), Singh (2011), Singh *et al.* (2011) and Singh *et al.* (2016).

(C) System productivity: The highest system productivity by 291.15 q/ha was recorded under 10 rows of sweet potato planted between two rows of guava at spacing of 50 cm closely followed by adjustment of 8 rows of vines sweet potato planted between two rows of guava at spacing 60 cm. The maximum rows adjustment of 12 between two rows of guava at spacing of 40 cm gave the lowest system productivity as 274.02 q/ha. Similar results have also been reported by Singh (2007), Singh (2011) and Singh *et al*. (2016).

(D) Fodder yield from sweet potato: Before the harvesting of tubers, vines cutting were done for animal feeding. The 12 rows adjustment in two rows of guava produced higher fodder yield by 272.00 q/ha, which was higher in comparison to other two tested treatments. The adjustment of 10 rows and 8 rows of sweet potato between two rows of guava gave fodder yield by 250.00 q/ha and 246.00 q/ha, respectively. The adjustment of higher and lower rows of sweet potato between guava rows were responsible for higher and lower yield of fodder from the vines of sweet potato.

(E) Overall productivity (q/ha): Total productivity was recorded in term of sum of fruits yield of guava, tuber yield of sweet potato and fodder yield of sweet potato. The highest overall productivity was recorded by 546.02 q/ha from the adjustment of 12 rows of sweet potato between two rows of guava, closely followed by adjustment of 10 rows of sweet potato between two rows of guava (541.15 q/ha). The adjustment of 8 rows of sweet potato between two rows of guava produced the total productivity by 531.70 q/ha. The lowest productivity by 12.60 q/ha recorded from pure cropping of guava, which was recorded through survey of experimental area in comparison to other tested treatments.

Conclusion and Recommendation

The agro-forestry system of guava + sweet potato-10 rows of vines plated between two rows of guava at spacing of 50 cm gave highest fruits yield of guava, tubers yield of sweet potato and highest system productivity. Therefore, farm families may be advocated for adoption of this system of agro-forestry and harvest the fruits from newly generated technology of agro-forestry.

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