



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2018; 6(4): 519-522

© 2018 IJCS

Received: 09-05-2018

Accepted: 10-06-2018

**MK Desai**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

**MJ Dobriyal**

Associate Professor, Department  
of Silviculture and Agroforestry,  
College of Forestry, NAU,  
Navsari, Gujarat, India

**MB Tandel**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

**SM Patel**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

**JG Pathak**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

**VM Prajapati**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

**Correspondence****MK Desai**

Assistant Professor,  
Department of Silviculture and  
Agroforestry, College of  
Forestry, NAU, Navsari,  
Gujarat, India

## Effect of pruning and intercrops on Jatropha and Sapota under Sapota-Jatropha based Horti-Silvi system

**MK Desai, MJ Dobriyal, MB Tandel, SM Patel, JG Pathak and VM Prajapati**

**Abstract**

The investigation on “Effect of pruning and intercrops on Jatropha and Sapota under Sapota-Jatropha based Horti-Silvi system” was carried out at Agronomy Farm (Block-E), Navsari Agricultural University, Navsari, Gujarat, during *Kharif* 2015 and 2016. The experiment was comprised of nine treatments with four replications in Randomized Block Design. Castor (*Ricinus communis* L.) and Babchi (*Psoralea corylifolia* L.) were grown as intercrops in eleven years old plantation of Sapota [*Manilkara achras* (Mill.) Fosberg] planted at 10 x 10 m spacing, with nine year old plantation of Jatropha (*Jatropha curcas* L.) which was planted at 2.5 x 2.5 m spacing. In Jatropha pruning operation was done at 3ft (100% pruning) and 5ft (50% pruning) height from the ground level. The observations on growth and yield of tree crop and its attributes were recorded during the course of investigation under study. In pooled analysis of effect of pruning and intercrops, crown spread East-West (2.16 m and 2.10 m), crown spread North-South (2.21 m and 2.14 m), number of branches per plant (20.75 and 20.38), fruit yield per plant (0.346 kg and 0.340 kg) and fruit yield per hectare (355.63 kg and 348.13 kg) of Jatropha were noted significantly maximum in 50% pruned jatropha with intercrops as compared to 100% pruned and unpruned jatropha with and without intercrop under Sapota-Jatropha based Horti-Silvi system. However, plant height (2.64 m and 2.62 m) was noted significantly maximum in unpruned jatropha with intercrops while basal diameter was found non-significant. In case of sapota, plant height, basal diameter, crown spread East-West & North-South and number of branches per plant were found non-significant. While, significantly maximum fruit yield per plant (45.25 kg) and fruit yield per hectare (4083.75 kg/ha) were recorded in T<sub>6</sub>: unpruned jatropha with babchi as compared to 100%, 50% pruned and unpruned jatropha without intercrop under Sapota-Jatropha based Horti-Silvi system.

**Keywords:** Sapota, Jatropha, growth and yield parameters, pruning, intercrops

**Introduction**

India's forest cover is about 21.54% and tree cover accounts for 2.85% of the total geographical area of the country whereas in Gujarat forest and tree cover is 14,757 sq. km and 8,024 sq.km, respectively (Anonymous, 2017) [3]. Current trends of forest management in country are aim at transforming forest area a germplasm and biodiversity conservatory along with a significant carbon sink. Indian forest policy states that around one third of total geographical area of the country should be under forest cover and to achieve this target Agroforestry interventions like agrisilviculture, agrihorticulture, silvi-pastoral, hortisilviculture are the feasible options to bring new areas in agricultural landscape under tree vegetation in the present scenario.

Sapota or sapodilla [*Manilkara achras* (Mill) Fosberg] belongs to family sapotaceae, popularly known as chiku. It is commercially cultivated for fruits in India and other countries of Central America. In India, the area under sapota cultivation is about 1,48,000 ha with an annual production of 12,15,000 MT (Anon., 2007b) [2]. In Gujarat sapota occupies about 25,833 ha with an annual production of 2,49,951 MT while in South Gujarat, the area under sapota is 10,925 ha with an annual production of 97,233 MT. (Anon., 2007a) [1]. Jatropha (*Jatropha curcas* L.) commonly known as physic nut or Ratanjot belong to family Euphorbiaceae. It is commonly grown as village hedges, roadside plantations and live fencing. Jatropha produces seeds with an oil content of 37% which can be combusted as fuel and insecticide without being refined. Castor (*Ricinus communis* L.) or *Eranda* or castor bean or castor-oil-plant is a perennial flowering plant in the spurge family, Euphorbiaceae.

Babchi (*Psoralea corylifolia* L.) is a medicinally valued annual herb growing throughout the plains of India.

In south Gujarat Sapota is traditionally grown at wider spacing of 10 meter which provides large interspaces for intercropping. Though, *Jatropha* is grown in interspaces of sapota but still leave gaps for intercropping in initial stages of sapota orchard which can be judiciously be utilised by growing remunerative medicinal crops. There is paucity of agroforestry work on integration of horti-silvi- medicinal crops in India. Therefore, development of suitable agroforestry system for horticultural, silvicultural and medicinal crops was felt essential to increase the production per unit area and net income of the farmer. Hence, the present study was undertaken to know the effect of pruning and intercrops on *Jatropha* and Sapota under Sapota-*Jatropha* based Horti-Silvi system.

### Material and Methods

The investigation on “Effect of pruning and intercrops on *Jatropha* and Sapota under Sapota-*Jatropha* based Horti-Silvi system” was carried out at Agronomy Farm (Block-E), Navsari Agricultural University, Navsari, Gujarat, during *Kharif* 2015 and 2016. The experiment was comprised of nine treatments *viz.*, T<sub>1</sub>- 100% Pruned *Jatropha* with Castor, T<sub>2</sub> - 100% Pruned *Jatropha* with Babchi, T<sub>3</sub>- 50% Pruned *Jatropha* with Castor, T<sub>4</sub>- 50% Pruned *Jatropha* with Babchi, T<sub>5</sub>- Unpruned *Jatropha* with Castor, T<sub>6</sub>- Unpruned *Jatropha* with Babchi, T<sub>7</sub>- 100% Pruned *Jatropha* without intercrop, T<sub>8</sub>- 50% Pruned *Jatropha* without intercrop and T<sub>9</sub>- Unpruned *Jatropha* without intercrop with four replications in Randomized Block Design (RBD). The experiment was conducted in eleven years old plantation of Sapota [*Manilkara achras* (Mill.) Fosberg] planted at 10 x 10 m spacing, with nine year old plantation of *Jatropha* (*Jatropha curcas* L.) which was planted at 2.5 x 2.5 m. Castor and Babchi were intercropped at a spacing of 110 x 70 cm and 50 x 50 cm, respectively for the present study. The experimental field was brought to fine tilth by ploughing, clods crushing and harrowing with the tractor. Then experimental field was leveled and plots were prepared as per the details of experiment. In this experiment, *Jatropha* were pruned at about 3 feet (100% pruning) and 5 feet (50% pruning) height from the ground level uniformly one week before sowing of the intercrop only in those plots where intercropping in pruned trees as main plot treatments were laid out in the field. Well decomposed Farm Yard Manure was applied uniformly to the entire experimental plot at the rate of 20 t/ha and 10 t/ha for Castor and Babchi, respectively. Phosphorus was applied in the form of single super phosphate to the each plots at the rate of 25 kg/ha (for Castor) and 60 kg/ha (for Babchi). Potash was applied in the form of murate of potash uniformly to the each plots at the rate of 30 kg/ha (for Babchi). Nitrogen was applied in two splits doses first half dose of nitrogen (60 kg/ha for Castor and 30 kg/ha for Babchi) was applied as basal dose at the time of planting and remaining second half dose of nitrogen (60 kg/ha for Castor and 30 kg/ha for Babchi) was applied in the form of urea after 45 days after sowing. Phosphorus and potash were applied at the time of planting. Crop was irrigated immediately after each application of fertilizer. Seeds of Castor and Babchi as per experimental details (inter crop) were planted at the spacing 110 x 70 cm and 50 x 50 cm, respectively. Immediately after planting a light irrigation was given to the crop for better establishment of seeds in the field. Depending upon the soil moisture condition, the irrigation was provided at 10 to 15 days intervals. Weeding and hoeing were done at

15 days intervals to keep plot clean and weed free. Necessary plant protection measures were adopted. No serious pest and diseases were observed on this crop during the cropping period. The plant height, basal diameter, crown spread (East-West and North-South direction), number of branches, fruit yield were recorded and analysed as per the procedure described for RBD (Panse and Sukhatme, 1967) [8]. Standard error of means *i.e.* SE<sub>m</sub>(±) and Critical Difference (CD) were calculated at 5% level of significance and compared the treatments means, wherever ‘F’ test was found significant.

## Results and Discussion

### Growth and yield of *Jatropha*

The data pertaining to various growth and yield parameters of *Jatropha* as affected by pruning and intercrops are presented in Table – 1. It is evident from data presented in Table – 1 that the basal diameter was found non-significant while plant height (2.64 m and 2.62 m) was noted significantly maximum in unpruned *jatropha* with intercrops. Moreover, plant height, crown spread (E-W) & (N-S), number of branches per plant, fruit yield per plant and fruit yield per hectare were reported significantly maximum in Sapota-*Jatropha* based Horti-Silvi system as compared to Sapota-*Jatropha* grown without intercrop. In case of 100%, 50% pruned and un-pruned *Jatropha*, the growth and yield parameter recorded significantly maximum in 50% pruned *Jatropha* as compared to 100% pruned and un-pruned *Jatropha*. Under Sapota-*Jatropha* based Horti-Silvi system crown spread East-West (2.16 m and 2.10 m), crown spread North-South (2.21 m and 2.14 m), number of branches per plant (20.75 and 20.38), fruit yield per plant (0.346 kg and 0.340 kg) and fruit yield per hectare (355.63 kg and 348.13 kg) of *jatropha* were noted significantly maximum in 50% pruned *jatropha* with intercrops castor and babchi as compared to 100% pruned and unpruned *jatropha* with and without intercrops. The minimum crown spread East-West (1.76 m), crown spread North-South (1.80 m), number of branches per plant (9.63), fruit yield per plant (0.244 kg) and fruit yield per hectare (191.25 kg) of *jatropha* were recorded in T<sub>9</sub>. Unpruned *jatropha* without intercrop. The probable reason for more growth of *jatropha* under 50% pruned treatment is availability of more buds as compared to unpruned and over pruning. Secondly, it might be due to availability of water and nutrients which was applied to intercrop during cropping period. Some related results were reported by Patil *et al.* (2006) [9] and Chamar (2008) [6]. Similar results were earlier reported by Saroj *et al.* (2003) [11] in Ber with Indian Aloe, Rajmani (2009) in Maize with Sapota-*Jatropha*, Arya *et al.* (2010) [4] in Aonla, Ber and Karaunda with Mustard, Brinjal and Bean, Kumar *et al.* (2010) [7] in medicinal crop with Papaya, Arya *et al.* (2011) [5] in Ber integrated model.

### Growth and yield of Sapota:

The data regarding to various growth and yield parameters of Sapota as affected by intercrops are presented in Table – 2. It can be seen from data presented in Table – 2 that the plant height, basal diameter, crown spread (E-W) & (N-S), number of branches per plant were found non-significant. Whereas, significantly maximum fruit yield per plant (45.25 kg) and fruit yield per hectare (4083.75 kg) of Sapota were reported significantly maximum in T<sub>6</sub>: Unpruned *jatropha* with Babchi under Sapota-*Jatropha* based Horti-Silvi system as compared to Sapota-*Jatropha* grown without intercrop. The minimum fruit yield per plant (36.63 kg) and fruit yield per hectare (3348.75 kg) of Sapota were noted in T<sub>8</sub>: 50% pruned

jatropha without intercrop. The probable reason for more growth and yield under Sapota-Jatropha based Horti-Silvi system is availability of water and nutrients which was applied to intercrop during cropping period. Some Kin results were earlier reported by Saroj *et al.* (2003) [11] in Ber with

Indian Aloe, Rajmani (2009) in Maize with Sapota-Jatropha, Arya *et al.* (2010) [4] in Aonla, Ber and Karaunda with Mustard, Brinjal and Bean, Kumar *et al.* (2010) [7] in medicinal crop with Papaya, Arya *et al.* (2011) [5] in Ber integrated model.

**Table 1:** Effect of pruning and intercrops on growth and yield parameters of Jatropha under Sapota-Jatropha based Horti-Silvi system

Treatments	Plant height (m)	Basal diameter (cm)	Crown spread (m) (E-W)	Crown spread (m) (N-S)	No. of branches per plant	Fruit yield (kg/plant)	Fruit yield (kg/ha)
T <sub>1</sub>	2.18	14.70	1.88	1.94	14.63	0.323	312.50
T <sub>2</sub>	2.25	14.89	1.89	1.92	15.25	0.327	319.25
T <sub>3</sub>	2.41	14.19	2.16	2.21	20.38	0.340	348.13
T <sub>4</sub>	2.29	14.53	2.10	2.14	20.75	0.346	355.63
T <sub>5</sub>	2.64	14.49	1.79	1.91	9.88	0.270	235.88
T <sub>6</sub>	2.62	14.50	1.79	1.89	10.50	0.263	220.00
T <sub>7</sub>	2.13	13.59	1.80	1.82	16.63	0.277	246.38
T <sub>8</sub>	2.40	13.85	1.83	1.88	19.25	0.293	267.50
T <sub>9</sub>	2.54	13.78	1.76	1.80	9.63	0.244	191.25
S.Em. <sub>±</sub> (T)	0.05	0.33	0.04	0.04	0.40	0.008	9.70
C.D. @ 5% (T)	0.15	NS	0.12	0.12	1.14	0.02	27.47
S.Em. <sub>±</sub> (TXY)	0.08	0.51	0.07	0.07	0.61	0.013	14.71
C.D. @ 5% (TXY)	NS	NS	NS	NS	NS	NS	NS
C.V.%	6.73	7.09	7.06	6.70	8.03	8.70	10.60
T <sub>1</sub> - 100% Pruned Jatropha with Castor	T <sub>4</sub> - 50% Pruned Jatropha with Babchi			T <sub>7</sub> - 100% Pruned Jatropha without intercrop			
T <sub>2</sub> - 100% Pruned Jatropha with Babchi	T <sub>5</sub> - Unpruned Jatropha with Castor			T <sub>8</sub> - 50% Pruned Jatropha without intercrop			
T <sub>3</sub> - 50% Pruned Jatropha with Castor	T <sub>6</sub> - Unpruned Jatropha with Babchi			T <sub>9</sub> - Unpruned Jatropha without intercrop			

**Table 2:** Effect of pruning and intercrops on growth and yield parameters of Sapota under Sapota-Jatropha based Horti-Silvi system

Treatments	Plant height (m)	Basal diameter (cm)	Crown spread (m) (E-W)	Crown spread (m) (N-S)	No. of branches per plant	Fruit yield (kg/plant)	Fruit yield (kg/ha)
T <sub>1</sub>	5.00	19.09	5.09	5.18	16.13	43.75	3827.50
T <sub>2</sub>	5.04	19.60	5.11	5.25	16.50	44.50	3953.75
T <sub>3</sub>	5.19	19.19	5.14	5.18	16.38	43.75	3942.50
T <sub>4</sub>	5.11	18.68	5.09	5.19	16.63	45.00	4018.75
T <sub>5</sub>	5.10	18.70	5.13	5.10	16.00	43.00	3833.75
T <sub>6</sub>	5.15	18.51	5.16	5.21	15.88	45.25	4083.75
T <sub>7</sub>	4.95	18.34	5.03	5.08	15.75	38.13	3496.25
T <sub>8</sub>	4.89	18.26	5.05	4.99	15.38	36.63	3348.75
T <sub>9</sub>	4.89	18.26	4.99	5.06	15.63	38.13	3424.38
S.Em. <sub>±</sub> (T)	0.10	0.40	0.10	0.11	0.55	1.15	95.13
C.D. @ 5% (T)	NS	NS	NS	NS	NS	3.24	270.66
S.Em. <sub>±</sub> (TXY)	0.16	0.61	0.16	0.17	0.83	1.73	145.85
C.D. @ 5% (TXY)	NS	NS	NS	NS	NS	NS	NS
C.V.%	6.32	6.50	6.26	6.73	10.41	8.22	7.74
T <sub>1</sub> - 100% Pruned Jatropha with Castor	T <sub>4</sub> - 50% Pruned Jatropha with Babchi			T <sub>7</sub> - 100% Pruned Jatropha without intercrop			
T <sub>2</sub> - 100% Pruned Jatropha with Babchi	T <sub>5</sub> - Unpruned Jatropha with Castor			T <sub>8</sub> - 50% Pruned Jatropha without intercrop			
T <sub>3</sub> - 50% Pruned Jatropha with Castor	T <sub>6</sub> - Unpruned Jatropha with Babchi			T <sub>9</sub> - Unpruned Jatropha without intercrop			

## Conclusion

From the above findings, it is concluded that, significantly maximum plant height of Jatropha was registered in unpruned jatropha with intercrops as compared to 100%, 50% pruned and unpruned jatropha without intercrops. Basal diameter of jatropha found non-significant. Under Sapota-Jatropha based Horti-Silvi system crown spread East-West, crown spread North-South, number of branches per plant, fruit yield per plant and fruit yield per hectare of jatropha were noted significantly maximum in 50% pruned jatropha with intercrops as compared to 100% pruned and unpruned jatropha with and without intercrops. Moreover in case of sapota plant height, basal diameter, crown spread East-West, crown spread North – South, number of branches per plant were found non-significant. Significantly maximum fruit yield per plant and fruit yield per hectare of Sapota under Sapota-Jatropha based Horti-Silvi system were recorded in T<sub>6</sub>: Unpruned jatropha with Babchi as compared to 100%,

50% pruned and unpruned jatropha without intercrop. The different growth parameters of Jatropha and Sapota were slightly improved in Castor and Babchi intercropped as compared to without intercropped. Furthermore in case of pruning, 50% pruned Jatropha reported more growth and yield as compared to 100% pruned and unpruned Jatropha. On the basis of present study it is recommended that growing of intercrops in pruned jatropha under Sapota or Sapota-Jatropha based Horti-Silvi system maximizes the land utilization and increases overall productivity of the land. It also provides additional income to the farmers.

## References

1. Anonymous. District wise area and production department of horticulture, Gujarat state, 2007a.
2. Anonymous. National horticulture board database, 2007b. <http://apeda.com/TradeJunction/Statistics/India-Export.Statistics.aspx>.

3. Anonymous. State of Forest Report, FSI, Dehradun, MoEF, New Delhi, 2017.
4. Arya A, Awasthi OP, Singh J, Arya CK, Pandey SBS, Vasishtha *et al.* Growth and yield of tree fruits and annual crops under integrated model in arid region of Rajasthan. *Indian J Forestry.* 2010; 33(1):77-80.
5. Arya R, Awasthi OP, Jitendra S, Singh IS, Manmohan JR. Performance of component crops in tree-crop farming system under arid region. *Indian J Hort.* 2011; 68(1):6-11.
6. Chamar MR. Performance of *Jatropha curcas* L. under different pruning intensities and fertilizer levels under irrigated conditions in south Gujarat. M. Sc. (Forestry) Thesis submitted to ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, 2008.
7. Kumar R, Prasad J, Chandra R, Vishwanath. Flowering, yield and quality of papaya (*Carica papaya*) in intercropping. *Current Advances Agricultural Sciences,* 2010; 2(2):127-128.
8. Panse VG, Sukhatme PV. *Statistical Methods for Agricultural Workers,* I.C.A.R., New Delhi, 1967.
9. Patil SJ, Mutanal SM, Shahapurmath GB, Manikeri IM. Effect of pruning and nutritional levels on growth of *Jatropha (Jatropha curcas* L.) under rainfed condition. *Ind. J Agroforestry.* 2006; 8(2):5-9.
10. Rajmani Kumar. Evaluation of intercropping of maize grown under horti-silviculture system of agroforestry in south Gujarat conditions. M.Sc. (Agroforestry) thesis submitted to the ASPEE College of Horticulture and Forestry, N.A.U. Navsari, 2009.
11. Saroj PL, Dhandar DG, Sharma BD, Bhargava R, Purohit CK. Ber based Agri-Horti System: A sustainable land use for Arid Ecosystem. *Indian J Agroforestry.* 2003; 5(1&2):30-35.