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Performance of okra as influenced by tree spacing and organic manures under *Melia composita* based Agrisilviculture systems

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Abstract
An agroforestry experiment was conducted to investigate the effect of tree spacing and various combinations of organic manures on the performance of okra under 13-year-old *Melia composita* plantation with three spacing *viz.*, S_1 (8m × 5m), S_2 (8m × 4m), and S_0 (sole crop) at the experimental farm of College of Forestry, Dr. Y S Parmar University of Horticulture and Forestry, Nauni (Solan), during the year 2019. The treatment combinations of organic inputs were as; T_1: 100% General recommended dose of fertilizer (NPK), T_2: 50% Rec. DN through FYM + 50% Rec. DN through VC, T_3: 50% Rec. DN through FYM + 50% Rec. DN through GM, T_4: 50% Rec. DN through VC + 50% Rec. DN through GM, T_5: 50% Rec. DN through FYM + 50% Rec. DN through VC + Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}), T_6: 50% Rec. DN through FYM + 50% Rec. DN through GM +Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}), and T_7: 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}). T_8: 1/3rd Rec. DN through FYM +1/3rd Rec. DN through Goat manure +1/3rd Rec. DN through VC +Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}). The results revealed that the okra crop (var. P-8), intercropped with *M. composita*, reported lower growth parameters as well lower yield as compared to the sole cropping system. On the other hand, irrespective of spacing, different combinations of organic manures showed that the application of 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut was the best combination for the growth and yield of okra. The economic analysis revealed that the net returns (Rs. 177672 ha^{-1}) were higher under wider spacing (8m × 5m) of *M. composita* as compared to the sole cropping system. Hence, wider spacing (8m × 5m) of *M. composita* can be suggested for intercropping of okra under *M. composita* based Agroforestry system.

Keywords: Agroforestry, *Melia composita*, Okra, Jeevamrut, Yield

Introduction
Agroforestry is an agricultural technique that has been labeled as "the future of agriculture" for growing food crops and trees in the same land. It is widely practiced in the Himalayan region particularly; the Indian Himalayas represent 18 per cent of India's land area. The Indian Himalayas hold a special place among the mountain ecosystems of the world. This region is not only important from the climate point of view and as a provider of life, giving water to a large part of the Indian subcontinent, but it also harbours a great diversity of flora, fauna, human communities, and cultural diversity. Agroforestry plays a key role in the Indian economy by way of tangible and intangible benefits. Agroforestry has high potential for simultaneously satisfying three important objectives *viz.*, protecting and stabilizing the ecosystems, producing a high level of output of economic goods, and improving income and basic materials to the rural population. It has, on the one hand, helped in the rehabilitation of degraded lands and, on the other, increased farm productivity. Okra *(A. esculentus* L. Moench) is an important vegetable crop of the Malvaceae family, native to Africa or Asia. It is grown year-round in the country. However, due to certain environmental limitations, only a few varieties are cultivated during the rainy season. It is grown for its fibrous pods and the fruits are harvested when immature and eaten as a vegetable. They are an excellent source of carbohydrates, proteins, fats, vitamins, and minerals (Akintoye *et al.*, 2011) [2]. Besides its common use as a vegetable, it has also been used for various purposes such as coffee additives and paper making (Moekchantuk and Kumar, 2004) [11]. The mucilage is also suitable for medicinal and industrial applications (Akinyele and Temikotan, 2007) [3]. Okra is popular in India because of easy cultivation, dependable yield, and adaptability to varying moisture conditions.

M. composita Willd. (Syn. *M. dubia* Cav.), commonly known as Malabar neem, is an indigenous, fast-growing, multipurpose, short rotation, and useful timber species that has emerged as one of the most appropriate tree species for various agroforestry systems. It is being planted either in block plantation or along the farm boundary within the agroforestry system. The industrial and ecological importance of *M. composita* has allowed farmers to take large scale plantations with different intercrops (Parthiban *et al*., 2009) [12]. In the mid- Himalayan range, it is being preferred by the farmers to meet for fodder in scarcity, fuel, charcoal, tool handles, and making agricultural implements. The wood is also used for packing cases, plywood, ceiling planks, building purposes, agricultural implements, pencils, matchboxes, splints, and furniture. As of late, large scale plantations are accomplished for the pulpwood and paper industries which necessitated the intercropping of crops under the *M. composita.*

Materials and Methods

The present experiment was conducted at the experimental farm of Agroforestry, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during the Kharif season of 2018 and 2019. The experimental site is located in the mid-hill zone of Himachal Pradesh at 30° 51' N Latitude and 76° 11' E Longitude, with an elevation of 1200 m above mean sea level having a slope of 7-8 per cent. It is situated 15 km southeast of Solan town and represents the transitional zone between the subtropical and sub temperate region of the state of Himachal Pradesh. The area receives an annual rainfall which varies from 1000-1400 mm and about 75 percent of it is received during the monsoon period (June-September). The average annual temperature is 17.4ºC. The soil of the area belongs to the Typic Eutrochrept subgroup as per the soil taxonomy of the USDA. The soil is gravelly sandy loam in texture and the pH of the top layer of the soil (15 cm) is neutral and containing high organic matter.

This experiment was comprised of two structural and functional components *viz.*, *M. composita* Willd**.** as woody perennial and okra as intercrops in the agrisilviculture system. Besides, the impact of NPK and different combinations of farmyard, vermicompost, and goat manure with Jeevamrut on the performance of okra crop, growing along with and without *M. composita* were studied. The experiment was designed for the intercropping of okra (var. P-8 with *M. composita*, which was planted in 2006 with three spacing of S_1 (8m × 5m) and S_2 (8m × 4m) while S_0 as open field. The experiment was conducted in Randomized Block Design (Factorial) with eight treatments and three replications. The treatments for okra crop includes- T_1 (100 % General recommended dose of fertilizer-NPK), T_2 (50% Rec. DN through FYM + 50% Rec. DN through VC), T_3 (50% Rec. DN through FYM + 50% Rec. DN through GM), T_4 (50% Rec. DN through VC + 50% Rec. DN through GM), T_5 (50% Rec. DN through FYM + 50% Rec. DN through VC + Jeevamrut two times-15 and 30 DAS @ 500 L ha^{-1}), T_6 (50% Rec. DN through FYM + 50% Rec. DN through GM +Jeevamrut two times-15 and 30 DAS @ 500 L ha^{-1}) T_7 (50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut two times-15 and 30 DAS @ 500 L ha^{-1}) and T_8 (1/3rd Rec. DN through FYM + 1/3rd Rec. DN through GM + 1/3rd Rec. DN through VC + Jeevamrut two times-15 and 30 DAS @ 500 L ha^{-1}). The growth and yield traits of okra such as plant height, number of fruits per plant, fruit length, fruit diameter, and yield were recorded before the final harvest by randomly selecting 5 plants in each replication and treatment. The numbers of fruits in individual selected plants were counted at every picking and finally, these were added to obtain the mean number of fruits per plant. Yield per plot (5.4 sq.m) was worked out by multiplying okra yield per plant with the total number of plants in respective plots which was further converted into yield per hectares and expressed in q/ha. While converting, 20 per cent area was considered for the construction of channels and paths in the field.

Statistical Analysis

The data of the present study were statistically analyzed by analysis of variance (ANOVA) for Factorial Randomized Block Design by using R 4.0.0 statistical computing software. Wherever the effects exhibited significant at 5 per cent level of significance, the critical difference (CD) was calculated.

Results and Discussion

Year-wise and pooled analysis of data has been introduced in Tables 1,2,3,4 and 5.

The pooled analysis of two years (2018 and 2019) data on growth and yield parameters of okra as sole crop and under different spatial arrangements of *M. composita* showed that the maximum plant height (141.47cm), number of fruits (13 plant^{-1}) fruit length (13.66 cm), fruit diameter (16.15 mm) and yield (112.67 q/ha) were recorded in open field condition (S_0/sole cropping) whereas, minimum plant height (117.16 cm), number of fruits (7.85 plant^{-1}) fruit length (11.44 cm), fruit diameter (14.01 mm), yield (65 q ha^{-1}), were recorded under closer spacing *i.e.* 8m × 4m (S_2). While under wider (S_1) spacing of *M. composita* okra responded significantly better. It appears to be because of less accessibility of light beneath the tree canopy of *M. composita* as compared to open field conditions. The probable reason might be less availability of light under *M. composita* which might have resulted in lower growth and yield traits. Similar reduction in growth and yield contributing attributes of intercrops in agroforestry were reported in past by Ummah (2012) [18], Habib *et al.* (2012) [7], Rani *et al.* (2015) [16] under Poplar based agroforestry system, Rajalingam *et al.* (2016) [14] and Bhusara *et al.* (2018) [5] for *A. esculentus* under different spacing of *M. composita*.

On the other hand, among different combinations of organic manures, pooled analysis of two years data revealed that the higher plant height (137.08 cm), number of fruits (12.39 plant^{-1}), fruit length (14.16 cm), fruit diameter (16.86 mm), and yield (106.28 q ha^{-1}) were recorded with the application of 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut two times-15 and 30 DAS @ 500 L ha^{-1} (T_7) whereas, minimum plant height (118.89 cm), number of fruits (8.67 plant^{-1}) fruit length (10.48 cm), fruit diameter (13.54 mm), and yield (74.37 q ha^{-1}) were recorded with the application of 50% Rec. DN through FYM + 50% Rec. DN through VC (T_2). The results obtained in the present study pointed out that *A. esculentus* responded well to the application of organic manures. In general, the treatment with 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut had significantly greater values for yield and other growth traits of *A. esculentus*. Ganiger *et al.* (2012) also pointed out that the application of 100% RDN equivalent nutrient through FYM + poultry manure recorded significantly higher yield parameters of bell pepper. The increase in plant height in the plots treated with organic manures and jeevamrut under tree canopy and in the open condition may be due to improvement in the physicochemical properties of the soil, increase in nitrogen content, increases in microbial diversity (Arancon *et al*., 2004; Kar *et al*., 2019a) [4, 9]. In agreement with Agbede *et al.* (2012) [1], Uka *et al.* (2015) [17], and Rani *et al.* (2019) [15], growth and yield attributes performed better with organic amendments such as vermicompost, poultry manure, farmyard manure, sheep and goat manure.

The net revenues from the *A. esculentus* - *M. composita* based agrisilviculture system and as sole cropping system, were assessed and the results of the pooled analysis are introduced in Table 6. Pooled data of two years revealed that the most (Rs. 162528.57 ha^{-1} yr^{-1}) noteworthy net income was obtained from S_1 (8m × 5m), trailed by (Rs. 152517.36 ha^{-1} yr^{-1}) sole cropping (open condition) though most minimal (Rs. 104627.80 ha^{-1} yr^{-1}) net incomes were obtained from S_2 (8m × 4m). On the other hand, among various treatments, the most elevated net incomes (Rs. 185286.12 ha^{-1} yr^{-1}) were obtained from treatment T_7 (with the application of 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut) though most minimal (Rs. 91517.60 ha^{-1} yr^{-1}) net incomes were acquired from T_2 (application of 50% Rec. DN through FYM + 50% Rec. DN through VC). Results are following the findings of Patil *et al.* (2012) [13], they concluded that the net returns and B: C ratio were significantly higher under the wider spacing (5m × 4m) of *M. azedarach*. Jilariya *et al.* (2019) [8] reported net returns of Rs. 336360 ha^{-1} from *M. composita* based Silvi-medicinal system which is higher than the present investigation. Meena (2015) [10] also reported average net returns of Rs. 79,652 ha^{-1} from ber based Horti-pasture system. Dutt and Thakur (2004) [6] reported that net returns were comparatively more under agroforestry systems by combining *Ocimum sanctum* and *Tegetes minuta* with poplar at different spacing in comparison to mono-cropping.

Table 1: Effect of tree spacing and organic manures on plant height of okra under *Melia composita* based agrisilviculture and sole cropping systems.

Plant height (cm)														
	2018				2019					Pooled data				
Spacing Treatment	**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**
T_1	128.33	119.33	140.17	129.28	T_1	129.00	121.00	141.33	130.44	T_1	128.67	120.17	140.75	129.86
T_2	124.67	99.00	131.33	118.33	T_2	126.33	100.03	132.00	119.46	T_2	125.50	99.52	131.67	118.89
T_3	125.33	113.00	135.33	124.56	T_3	127.33	104.33	134.33	122.00	T_3	126.33	108.67	134.83	123.28
T_4	127.33	118.00	137.67	127.67	T_4	128.67	116.67	138.67	128.00	T_4	128.00	117.33	138.17	127.83
T_5	129.00	121.83	139.33	130.06	T_5	133.33	121.83	145.00	133.39	T_5	131.17	121.83	142.17	131.72
T_6	131.03	122.67	141.67	131.79	T_6	136.20	122.67	150.67	136.51	T_6	133.62	122.67	146.17	134.15
T_7	134.83	124.00	143.67	134.17	T_7	140.00	124.33	155.67	140.00	T_7	137.42	124.17	149.67	137.08
T_8	133.00	122.83	142.33	132.72	T_8	139.33	123.00	154.33	138.89	T_8	136.17	122.92	148.33	135.81
Mean	129.19	117.58	138.94	128.57		132.53	116.73	144.00	131.09		130.86	117.16	141.47	
CD (0.05)					CD (0.05)					CD (0.05)				
T		3.72			T		4.15			T	2.76	Y		1.38
S		2.28			S		2.19			S	1.69	Y × T		3.91
T × S		6.44			T × S		7.18			T × S	4.79	Y × S		2.39
												Y × T × S		NS

T_1: 100% General recommended dose of fertilizer (NPK). **T_2**: 50% Rec. DN through FYM + 50% Rec. DN through VC. **T_3:** 50% Rec. DN through FYM + 50% Rec. DN through GM. **T_4**: 50% Rec. DN through VC + 50% Rec. DN through GM. **T_5**: 50% Rec. DN through FYM + 50% Rec. DN through VC + Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}). **T_6**: 50% Rec. DN through FYM + 50% Rec. DN through GM +Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}). **T_7**: 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1}). **T_8**: 1/3rd Rec. DN through FYM +1/3rd Rec. DN through Goat manure +1/3rd Rec. DN through VC +Jeevamrut two times (15 and 30 DAS @ 500 L ha^{-1})

* **Rec**. = Recommended * **DN** = Dose of Nitrogen * **DAS**= Days after Sowing * **FYM**= Farmyard Manure * **VC**= Vermicompost * **GM**= Goat Manure.

Table 2: Effect of tree spacing and organic manures on number of fruits (plant^{-1}) of okra under *Melia composita* based agrisilviculture and sole cropping systems.

Number of fruit plant^{-1}														
	2018				2019					Pooled data				
Spacing Treatment	**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**
T_1	10.33	7.33	13.00	10.22	T_1	11.33	7.67	13.33	10.78	T_1	10.83	7.50	13.17	10.50
T_2	8.00	6.33	10.67	8.33	T_2	9.00	7.00	11.00	9.00	T_2	8.50	6.67	10.83	8.67
T_3	9.00	6.67	11.33	9.00	T_3	10.67	7.00	11.67	9.78	T_3	9.83	6.83	11.50	9.39
T_4	9.33	7.00	12.00	9.44	T_4	11.00	7.33	12.33	10.22	T_4	10.17	7.17	12.17	9.83
T_5	10.67	7.67	13.33	10.56	T_5	11.67	8.00	13.67	11.11	T_5	11.17	7.83	13.50	10.83
T_6	11.00	8.00	13.67	10.89	T_6	12.33	8.67	14.00	11.67	T_6	11.67	8.33	13.83	11.28
T_7	11.67	9.67	14.67	12.00	T_7	13.33	10.00	15.00	12.78	T_7	12.50	9.83	14.83	12.39
T_8	11.33	8.33	14.00	11.22	T_8	12.67	9.00	14.33	12.00	T_8	12.00	8.67	14.17	11.61
Mean	10.17	7.63	12.83	10.21	Mean	11.50	8.08	13.17	10.92	Mean	10.83	7.85	13.00	
CD (0.05)					CD (0.05)					CD (0.05)				
T		0.37			T		0.34			T	0.25	Y		0.12
S		0.23			S		0.21			S	0.15	Y × T		NS
T × S		0.64			T × S		0.58			T × S	0.43	Y × S		0.21
												Y × T × S		NS

Table 3: Effect of tree spacing and organic manures on fruit length of okra under *Melia composita* based agrisilviculture and sole cropping systems.

Fruit length (cm)														
2018					2019					Pooled data				
Spacing Treatment	**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**		**S_1**	**S_2**	**S_0**	**Mean**
T_1	12.46	11.00	13.17	12.21	T_1	12.67	11.19	13.50	12.45	T_1	12.56	11.09	13.33	12.33
T_2	10.33	9.33	10.83	10.17	T_2	10.67	9.90	11.83	10.80	T_2	10.50	9.62	11.33	10.48
T_3	11.00	10.67	12.37	11.34	T_3	11.48	10.48	12.85	11.60	T_3	11.24	10.57	12.61	11.47
T_4	12.17	10.83	13.00	12.00	T_4	12.50	11.00	13.00	12.17	T_4	12.33	10.92	13.00	12.08
T_5	12.92	12.00	13.40	12.77	T_5	12.82	12.18	13.57	12.86	T_5	12.87	12.09	13.48	12.81
T_6	13.05	12.04	14.40	13.16	T_6	13.20	12.33	14.50	13.34	T_6	13.13	12.19	14.45	13.25
T_7	13.47	12.50	15.83	13.93	T_7	14.07	12.90	16.17	14.38	T_7	13.77	12.70	16.00	14.16
T_8	13.19	12.17	14.67	13.34	T_8	13.50	12.50	15.48	13.83	T_8	13.35	12.33	15.07	13.58
Mean	12.32	11.32	13.46	12.37	Mean	12.61	11.56	13.86	12.68	Mean	12.47	11.44	13.66	
$CD_{(0.05)}$					$CD_{(0.05)}$					$CD_{(0.05)}$				
T	0.53				T	0.32				T	0.31	Y		0.15
S	0.32				S	0.20				S	0.19	Y × T		NS
T × S	NS				T × S	0.56				T × S	0.54	Y × S		NS
												Y × T × S		NS

Table 4: Effect of tree spacing and organic manures on fruit diameter (mm) of okra under *Melia composita* based agrisilviculture and sole cropping systems.

Fruit diameter (mm)														
2018					2019					Pooled data				
Spacing Treatment	S_1	S_2	S_0	Mean		S_1	S_2	S_0	Mean		S_1	S_2	S_0	Mean
T_1	14.79	13.19	15.50	14.49	T_1	15.03	14.07	15.83	14.98	T_1	14.91	13.63	15.67	14.74
T_2	13.08	12.50	14.83	13.47	T_2	13.59	12.74	14.50	13.61	T_2	13.34	12.62	14.67	13.54
T_3	13.67	12.48	14.85	13.67	T_3	14.50	13.15	14.85	14.17	T_3	14.08	12.81	14.85	13.92
T_4	14.67	13.00	15.00	14.22	T_4	14.50	13.67	15.33	14.50	T_4	14.58	13.33	15.17	14.36
T_5	15.15	14.18	15.57	14.97	T_5	15.48	14.83	16.23	15.51	T_5	15.31	14.51	15.90	15.24
T_6	15.53	14.33	16.50	15.45	T_6	15.52	14.85	16.83	15.73	T_6	15.52	14.59	16.67	15.59
T_7	16.05	14.93	18.17	16.38	T_7	16.65	16.57	18.81	17.34	T_7	16.35	15.75	18.49	16.86
T_8	15.83	14.50	17.81	16.05	T_8	16.24	15.17	17.83	16.41	T_8	16.04	14.83	17.82	16.23
Mean	14.85	13.64	16.03	14.84	Mean	15.19	14.38	16.28	15.28	Mean	15.02	14.01	16.15	
$CD_{(0.05)}$					$CD_{(0.05)}$					$CD_{(0.05)}$				
T	0.55				T	0.52				T	0.37	Y		0.19
S	0.34				S	0.32				S	0.23	Y × T		0.53
T × S	NS				T × S	NS				T × S	0.64	Y × S		0.32
												Y × T × S		NS

Table 5: Effect of tree spacing and organic manures on fruit yield (q ha^{-1}) of okra under *Melia composita* based agrisilviculture and sole cropping systems.

Yield (q ha^{-1})														
2018					2019					Pooled data				
Spacing Treatment	S_1	S_2	S_0	Mean		S_1	S_2	S_0	Mean		S_1	S_2	S_0	Mean
T_1	89.56	61.11	112.67	87.78	T_1	98.2	63.9	115.6	92.6	T_1	93.89	62.50	114.11	90.17
T_2	69.33	52.78	92.44	71.52	T_2	78.0	58.3	95.3	77.2	T_2	73.67	55.56	93.89	74.37
T_3	78.00	55.56	98.22	77.26	T_3	92.4	58.3	101.1	84.0	T_3	85.22	56.94	99.67	80.61
T_4	80.89	58.33	104.00	81.07	T_4	95.3	61.1	106.9	87.8	T_4	88.11	59.72	105.44	84.43
T_5	92.44	63.89	115.56	90.63	T_5	101.1	66.7	118.4	95.4	T_5	96.78	65.28	117.00	93.02
T_6	95.33	66.67	118.44	93.48	T_6	106.9	72.2	121.3	100.1	T_6	101.11	69.44	119.89	96.81
T_7	101.11	80.56	127.11	102.93	T_7	115.6	83.3	130.0	109.6	T_7	108.33	81.94	128.56	106.28
T_8	98.22	69.44	121.33	96.33	T_8	109.8	75.0	124.2	103.0	T_8	104.00	72.22	122.78	99.67
Mean	88.11	63.54	111.22	87.63	Mean	99.7	67.4	114.1	93.7	Mean	93.89	65.45	112.67	
$CD_{(0.05)}$					$CD_{(0.05)}$					$CD_{(0.05)}$				
T	3.22				T	2.84				T	2.10	Y		1.05
S	1.97				S	1.74				S	1.29	Y × T		NS
T × S	5.57				T × S	4.92				T × S	3.64	Y × S		1.82
												Y × T × S		NS

Table 6: Effect of tree spacing and organic manures on net income from okra and radish under *Melia composita* based agrisilviculture and sole cropping systems.

Net Returns (Rs. ha^{-1} yr^{-1})				
Abelmoschus esculentus				
Spacing Treatment	**S_1 (8m × 5m)**	**S_2 (8m × 4m)**	**S_0 (Sole cropping)**	**Mean**
T_1	142539.89	90993.29	127292.57	120275.25
T_2	104578.54	70531.94	99442.33	91517.60
T_3	150397.43	90934.16	130816.78	124049.46
T_4	154939.65	95198.60	142581.22	130906.49
T_5	162106.32	94587.49	156970.11	137887.97
T_6	189869.65	121934.16	181122.33	164308.72
T_7	205245.21	150504.16	200109.00	185286.12
T_8	190551.88	122338.60	181804.56	164898.35
Mean	162528.57	104627.80	152517.36	

Summary and Conclusion

Based on outcomes of the present investigation, it tends to be inferred that among different spacing, irrespective of treatments, sole cropping (S_0) performed significantly better while the wider spacing of 8m × 5m performed better when contrasted with the closer spacing of (8m × 4m) of *M. composita*. On the other hand, irrespective of spacing, the application of 50% Rec. DN through VC + 50% Rec. DN through GM + Jeevamrut two times was the best combination for the growth and yield of okra. However, the net returns obtained from the system as a whole was higher under the wider spacing of *M. composita* as compared to the sole cropping system. Hence, wider spacing (8m × 5m) of *M. composita* can be suggested for intercropping.

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