

Research **P**aper

Article history : Received : 13.01.2014 Revised : 04.05.2014 Accepted : 16.05.2014

Members of the Research Forum

Associated Authors: ¹Department of Spices and Plantation Crops, K.R.C. College of Horticulture, Arabhavi, BELGAUM (KARNATAKA) INDIA

Author for correspondence : H.C.VIKRAM Department of Plantation Crops and Spices, College of Horticulture, Kerala Agricultural University, Vellanikkar, THRISSUR (KERALA) INDIA

Email : vikram.hc@gmail.com

Performance of ginger in cashew plantation (as intercrop) compared to sole cropping

H.C. VIKRAM AND N.K. HEGDE¹

ABSTRACT : A field investigation was undertaken during 2011-12 to assess the performance of ginger under cashew plantation as intercrop compared to sole cropping in open area. The experiment was laid out in cashew plantation spaced at 6 m × 6 m by utilizing of 16 m² (4 m × 4 m) area and replicated thrice. Ginger was also grown as sole crop in open area under similar management conditions. Growth of ginger as intercrop in cashew plantation was significantly higher for plant height, pseudostem diameter, number of tillers and leaf area index at 180 DAP. Significantly higher fresh weight of rhizome (137.77 g/ clump), number secondary rhizome (21.05) and clump size (97.40 cm²) was recorded under sole cropping compared to intercropping (103.16 g/ clump, 14.83 and 90.56 cm², respectively) in cashew plantation. Interception of PAR (Photosynthetically Active Radiation) by ginger crop at 150 days after planting (DAP) as intercrop in cashew plantation was 25774 Lux compared to 29200 Lux in open area.

KEY WORDS : Cashew, Ginger, Intercropping, PAR

HOW TO CITE THIS ARTICLE : Vikram, H.C. and Hegde, N.K. (2014). Performance of ginger in cashew plantation (as intercrop) compared to sole cropping. *Asian J. Hort.*, **9**(1) : 187-189.

ashew (Anacardium occidentale L.) is one of the important commercial plantation and foreign exchange earning crops of the country. Cashew gained importance in hills and plains due to its wide range of climatic and soil adaptability. Available inter space in the perennial crops can be utilized for cultivation of tuber crops, vegetables and annual spices etc. During initial years of plant growth pine apple, papaya, tapioca and vegetable are suggested in cashew plantations of Dakshina Kannada district (Rao and Yadukumar, 1991). Intercropping in perennial plantation is one of the major forms of multiple cropping for increasing the profit and intensifying the plant populations per unit area in available land. In intercropping system, productivity is improved either by efficient interception of available solar energy or by having crop of greater radiation use efficiency (Anonymous, 1979). The climatic conditions of transitional zone of northern Karnataka including Belgaum district (zone-8) is suitable for ginger cultivation. Hence, a scientific approach was made to assess the comparative performance of ginger intercropped in cashew plantation and as sole crop in open area.

RESEARCH METHODS

A study was conducted at Horticultural Research Station,

Kanabargi, Belgaum district, Karnataka during 2011-2012. Kanabargi is situated in northern transition tract (Zone-8) of Karnataka with an annual mean rain fall of 1250 mm and soil of the tract is medium red sandy loamy. Ginger variety Humanabad Local was grown in three replications both under cashew (variety- Vengurle-4) planted in 1992 (as intercrop) and in open area (as sole crop) in a plot of $16 \text{ m}^2 (4\text{m} \times 4\text{m})$ in the interspace of four cashew trees. Statistical comparison was worked out to find out the statistically significance of results between intercrop and sole crop based on paired 't' test. Observations on growth and yield attributes were recorded on ginger at monthly interval upto 150 DAP. Interception of photosynthetically active radiation (PAR) at noon was studied with the help of digital photometer (Lux meter). Intercepted PAR was calculated by deducting reflected radiation (Q_p) and radiation reaching soil surface (Q_s) with total radiation (Q_T) . Recommended cultivation practices were followed for both intercrop and sole crop as per the package of practice of University of Agricultural Sciences, Dharwad (Anonymous, 2009).

RESEARCH FINDINGS AND DISCUSSION

Observation on the growth parameters of ginger viz.,

IC SC t-value 1. Plant height (cm) 8.69 7.77 2.16 2. Pseudostern 6.63 6.54 0.25 3 No of tillers per 103 0.53 10.60* 4. No. of leaves per 2.33 3.43 3.23* 5. Leaf area index 0.05 0.03 2.82* 6. Dry weigh: of ** ** ** Mole plant (g) 1C - Intersrop; SC * DAP - Days after slarring: 1C - Intersrop; SC * Significent at 5 per cent level of probability SC St. No.	IC S0 7.7 gft (cm) 8.69 7.7 en 6.63 6.5 (mm) 6.63 6.5 lers per 1.03 0.5 aves per 2.33 3.4 aves per 2.4 4 aves per	IC SC 8.69 7.77 6.63 6.54 1.03 0.53 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.33 3.43 2.105 0.03 1.10 Intersorphility 1.10 Intersolphility 1.10 Intersolphility	SC t- 7.77 6.54 0 0.53 10 3.43 3 3.43 3 3.43 3		IC SC value IC 26.40 23.60 3.71* 20.63 7.85 7.11 1.99 3.39 7.85 7.11 1.99 3.39 7.85 7.11 3.64* 2.33 7.80 8.46 4.58* 12.33 7.80 8.46 4.58* 12.33 - 0.43 0.42 1.31 1.29 ** ** ** ** ** - Sole crop; (Table t value at P-0.05 is 2.77) ** ** ** abbad Local as intererop in cash ew plantat ** ** **	SC i-value 0 23 60 3.71* 5 7.11 1.99 2 1.11 3.64* 0 8.46 4.58* 3 0.42 1.31 ** ** ** ** 0.42 1.31 ** ** ** ** ** ** Jocal as intererop in cash er Jocal as intererop in cash er	value 3.71* 1.99 4.58* 4.58* ** ** ** **	IC SC i-value IC SC i-value IC 26.40 23.60 3.71* 40.63 38.48 0.53 45.84 7.85 7.11 1.99 8.39 7.61 1.62 9.69 7.85 7.11 1.99 8.39 7.61 1.62 9.69 7.80 8.46 4.58* 12.33 1.64 3.02* 47.66 7.80 8.46 4.58* 12.33 14.40 6.20* 17.06 7.80 8.46 4.58* 12.33 14.40 6.20* 17.06 7.80 8.46 4.58* 12.31 1.26 0.16 3.50 6.43 0.42 1.31 1.29 126 0.16 3.50 ** ** ** ** ** ** ** ** ** ** ** ** ** ** 7.80 0.42 1.31 126 0.16 3.50	SC 7.61 7.61 14.40 14.40 1.26 **	t-value 0.53 1.62 6.2)* 6.2)* ** **	1C 45.84 9.69 4.16 17.06 **	3.63 3.63 3.47 3.47 ***	t-value 1.50 3.13* 6.18* 6.18* **	IC 54.42 10.85 7.20 7.35 7.35 36.33	8C 48.05 5.13 5.74 21.65 23.66	t-value 327* 660* 287* 287* 278*
 Plant height ((Pseudosten diameter (mm Pseudosten diameter (mm Ne. of tillers r clump Ne. of fleaves plant Leaf area inds Leaf area inds Leaf area inds DAP - Days after plant ((DAP - Days after plant Significent at S per visit Sr. No. Yield and Sr. No. Yield 	cm) 8.6 ber 6.6 per 1.6 per 2.2 cm 1.6 cm	69 7.5 63 6.5 03 0.4 33 3.4 33 3.4 .* * .* * .* * .* * .* * .* * .* * .*	77 54 54 6 53 11 5		26.40 7.85 7.80 7.80 801e erop: (** Ret	23.60 7.11 1.11 8.46 8.46 0.42 ** ** ** ** **	3.7]* 1.99 3.64* 4.58* ** ** ** **	40.63 8.39 2.33 12.33 1.29 ** ** t	38.48 7.61 1.64 14.40 1.26 ***	0.53 1.62 3.02* 6.2)* ** **	45.84 9.69 4.16 17.06 3.50 **	- Set Billion and	1.50 3.13* 6.18* 0.13	54.42 10.85 19.46 7.35 36.33	48.05 9.65 5.13 21.63 5.74 5.74	327* 357* 660* 287* 2.78*
 Pseudostern mm diameter (mm Ne of tillers f Ne of tillers f Ne of tillers f Leaf area inds Leaf area inds Leaf area inds Leaf area inds DAP - Days after plant (§ DAP - Days after plant (§ Significent at 5 per viel Significent at 5 per viel) per 2.2 per 2.2 ca 0.0 ca 0.0 cent level o cent level o d and yield	63 6.5 03 0.4 33 3.4 05 0.4 05 0.4 1C - Inte of probabil	54 54 53 1- 53 1- 643 3 ersrop: liiy inger var		7.85 1.72 7.80 43 ** Sole crop; (** Ret	7.11 1.11 8.46 0.42 ** ** Table t val corded only	1.99 3.64* 4.58* 1.31 1.31 ** ** vat harves y at harves	8.39 2.33 12.33 1.29 ** ** t t t	7.61 1.64 14.40 1.26 **	1.62 3.02* 6.2)* 0.16 **	9.69 4.16 17.06 3.50 **		3.13* 3.57* 6.18* 0.13	10.85 7.20 7.35 36.33	9.65 5.13 5.74 5.74 28.66	357* 660* 287* 2.78*
 No. of tillers plump No. of leaves No. of leaves No. of leaves Leaf area inde Significent at 5 per inde Significent at 5 per index Significent at 5 per index 	per 1.0 per 2.2 ca 0.0 e % g) urring cent level o dand yield	03 0.5 33 3.4 05 0.4 .* * .* * .* * .* .* attributes	53 10 43 3 03 2 irstop; lity ingervar		1.72 7.80 0.43 ** Sole crop; (** Ret	1.11 8.46 0.42 ** Tatle t val corded only	3.64* 4.58* 1.31 ** ** vat harves y at harves	2.33 12.33 ** ** t t t t	164 14.40 1.26 **	3 (12* 6.2)* ** **	4.16 17.06 3.50 **		3.57* 6.18* **	7.20 19.46 7.35 36.33	5.13 21.63 5.74 28.66	660* 456* 287* 2.78*
 A. No. of leaves J plant Leaf area inde Leaf area inde Bry weigh: of whole plant (g DAP - Days after pla \$ significant at 5 per (at 2) Table 2 : Yield and x Sr. No. Yiel 	per 2.3 ca 0.6 g) g) ming cent level o cent level o dand yield	33 3.4 05 0.6 * * TC - Inte of probabil	43 3 03 2 lity ingervar		7.80 (.43 ** Sole crop; (** R ct	8.46 0.42 ** Table t val corded only	4.58* 1.31 ** ** ve at P-0.0 y at harves	12.33 1.29 ** t t	14.40 1.26 **	6.2)* 0.16 ** \$0le crop i	17.06 3.50 **	16	6.18* 0.13 **	19.46 7.35 36.33	21.63 5.74 28.66	456* 287* 2.78*
 Leaf area inde Dry weigh: of whole plant (§ DAP - Days after plant (§ Significent at 5 per (Table 2 : Yield and Niel 	ex 0.0 g) unting cent level o cent level o d and yield	0.5 0.0 * * * IC - Inte of probabil utes of gi attributes	03 23 ersrop; lity inger var		(.43 ** Sole crop; (** Ret Ret Dad Loteal:	0.42 ** Table t vali Corded only	1.31 ** ve at P=0.0 y at harvesi y in cas ho	1.29 ** 05 is 2.77) t w plantat	1.26 ** ion and as	0.16 ** \$0le crop i	3.50 **		0.13 **	7.35 36.33	5.74 28.66	2.87* 2.78*
 6. Dry weigh: of whole plant (g DAP - Days after plats * Significant at 5 per (and x Table2 : Yield and x Sr. No. Yiel 	g) g) urring cent lavel o vield attrib d and yield	* * IC – Inte of probabil utes of gi attributes	:* erarop; lity s		** Sole crop; (** Red brd Loreal:	** Takle t val corded only	** ve at P-0.(y at harvesi op in eashe	** 05 is 2.77) t ew plantat	** ion and as	** sole crop i	** **		*	36.33	38.66	* 8 1 1
DAP – Days after plat * Significant at 5 per (Table2 : Yield and N Sr. No.	ming cent level o yield attrib d and yield	IC – Inte of probabil utes of gi attributes	arsrop; lity inger var		Sole crop; (** Rec bad Local:	Fakle t val Sorded only As interero	ve at P-0.(/ at harvest	05 is 2.77) t ew plantat	ion and as	sole crop i	n openare					
										ntercrop	dor:		Sole crop		+value	lue
I. Fresh	Fresh weight of thizome (g/clump)	chizome ((g/clump)	-						103.16	16		137.77		2.83*	*
2. Num	Number of primary rhizone per clump	nary rhizon	me per cl	dum						2.88	∞		3.83		4.71*	ž.
3. Num	Number of secondary rhizome per clump	əndary rhiz	zome per	clump						14.83	33		21.05		2.94*	*
4. Clum	Clump size (cm ²)	1 ²)								90.56	26		97.40		3.71*	*
5. Fresh	Fresh rhizəme yield per plot (kg/ 15 $\mathrm{m^2})$	yield per p	olot (kg/ 1	6 m²)						10.62	52		13.10		3.26*	6* C
6. Fresh	Fresh rhizome yield (q'ha)	yield (q/ha	(E							66.45	15		81.66		3.29*	*
7. Harv	Harvest index (%)	(%)								78.93	33		84.20		336*	6*

H.C. VIKRAM AND N.K. HEGDE

Asian J. Hort., 9(1) June, 2014: 187-189 Hind Agricultural Research and Training Institute

Table 3 : Mean interception of PAR (Lux) by ginger as intercrop under cashew plantation and in open area as sole crop									
Davis often alenting		Ginger as intercrop				Ginger as sole crop			
Days after planting	QT	Q _R	Qs	QI	QT	QR	Qs	QI	
30	34820	1940	8210	23804	37640	2630	9560	25084	
60	36914	2220	9610	24670	40974	2750	14420	25854	
90	44920	3120	15370	26030	47150	3670	16580	26900	
120	45850	3960	13670	28020	45850	3960	13670	28220	
150	40474	3140	3140	25774	43470	3720	10250	29200	
Mean	202978	14380	50000	128298	215084	16730	64480	135258	
Q _T - Radiation at the top of the canopy,		Q _R - Reflect	ed radiation,	Qs - Radiation at ground le		vel, Q _I - Intercepted radiation			

 Q_T - Radiation at the top of the canopy, Q_R - Reflected radiation, $Q_I = Q_T - Q_R - Q_S$

plant height, pseudostem diameter, numbers of tillers per clump and number leaves per plant are presented in Table 1. At 60 and 150 DAP ginger under both intercropping in cashew plantation and sole cropping in open area was reported statistically significant. Number of tillers per clump and number of leaves per plant were statistically significant throughout the stage of plant growth. At 150 DAP ginger grown under intercropping produced significantly higher plant height (54.42 cm) and number of tillers per clump (7.20) when compared to corresponding data in open area as sole crop (48.05 cm and 5.13, respectively). Pseudostem diameter was significantly higher in intercrop under cashew plantation compared to sole crop, whereas number of leaves per plant was significantly higher in sole cropping at all the stages of growth compared to intercropping in cashew plantation. In ginger higher plant height and number of tillers per clump in tamarind based intercropping situation compared to open area under Arabhavi conditions is also reported by Kumar (2004). In the present study leaf area index values of ginger was significantly higher under intercropping in cashew plantation when compared to sole cropping in open area. Ginger grown under cashew plantation recorded significantly higher leaf area index (7.35) compared to sole cropping (5.74) at 150 DAP. Similarly Shankar and Swamy (1998) obtained higher LAI in ginger under reduced light conditions when grown as intercrop with mango.

Significantly higher fresh weight of rhizome per clump (137.77 g), number secondary rhizome (21.05) and clump size (97.40 cm²) was recorded under sole cropping compared to cashew based intercropping (103.16 g/ clump, 14.83 and 90.56 cm², respectively) in ginger. Yield of ginger under sole cropping was significantly higher (81.66 q/ ha) when compared to intercropping (66. 45 q/ ha) in cashew plantation (Table 2). Whereas higher harvest index was recorded under sole cropping with ginger (78.93 %). Higher yield of ginger in open area may be due to higher light interception, less competition for nutrient and moisture. Similar results were also reported by Jaswal *et al.* (1993), Jayachandran *et al.* (1992) and Kumar (2004) under different intercropping system.

Interception of Photosynthetically active radiation (QI) was higher in sole cropping (29200 Lux) compared to intercropping (25774 Lux) at 150 DAP (Table 3). Kasturibai *et al.* (1991) also reported about the reduction in light intensity reaching canopy of intercrops due to interception by coconut canopy. Hegde *et al.* (2000) also reported that, interception of PAR by ginger was maximum in open area compared to areca based intercropping with ginger.

REFERENCES

Anonymous (1979). Multiple cropping in coconut and arecanut gardens. Ed. Nelliat, E.V. and Bhat, K.S., Central Plantation Crop Research Institute. *Technical Bull*, **3**: 54.

Anonymous (2009). Totagarike Belegala Sudharita Besaya Kramagalu (Kannada). Univ. Agri. Sci., Dharwad, pp. 104-108.

Hegde, N.K., Sulikeri, G.S. and Ratnam, B.P. (2000). Distribution of photosynthetically active radiation (PAR) and performance of ginger under arecanut shade. Proceedings of Centennial Conference on Spices and Aromatic Plants, September 2000, pp. 107-112.

Jaswal, S.C., Mishra, V.K. and Verma, K.S. (1993). Intercropping ginger and turmeric with poplar (*Populus deltoids*). Agroforestry Systems, **22** (2): 111-117.

Jayachandran, B.K., Meerabai, M., Mammen, M.K. and Mathew, K.P. (1992). Influence of shade on growth and productivity of turmeric. *Spice India*, **3** (4): 2-9.

Kasturibai, K.V., Voleti, S.R., Ramdasan, A. and Kailasam, C. (1991). Growth and dry matter production in the component crops under high-density multispecies cropping system. *J. Plantation Crops*, 18: 151-155.

Kumar, R.D. (2004). Intercrop studies in tamarind (*Tamarindus indica* L.) plantation. M.Sc. Thesis, University of Agricultural Sciences, Dharwad, KARNATAKA (INDIA).

Rao, E.V.V.B. and Yadukumar, N. (1991). Directions of cashew research in India with specific reference to Dakshina Kannadda district. Proc. of seminar on cashew development in Karnataka, Mangalore, 9p.

Shankar, C.R. and Swamy, M.S. (1998). Influence of light and temperature on leaf area index, chlorophyll content and yield of ginger. *J. Maharashtra Agri. Univ.*, **13** : 216-217.

