Table 2. The yield of *Terminalia ivorensis* after 9 *y* years of establishment in Michael Okpara college of Agriculture, Umuagwo

Diameter class (*cm*)	Frequency number	Mean diameter (*cm*)	Mean height (*m*)	Mean basal area (m^2)	Mean volume (m^3)	Yield per 0.4 *ha* (m^3)	Yield per *ha* (m^3)
5 - 9.9	23	7.5	7.8	0.004	0.187	4.38	10.95
10 - 14.9	74	12.5	11.8	0.012	0.085	6.29	15.73
15 - 19.9	64	17.5	13.8	0.024	0.199	12.74	31.85
20 - 24.9	18	22.5	15.7	0.019	0.129	3.2	8.0
25 - 29.9	11	27.5	15.1	0.059	0.535	5.89	14.73
Mean (Total) =	190	16.1	14.0	0.0204	0.171	32.5	81.26

The high increment in yield in the last three years (1986 - 1989) was as a result of silvicultural operations. Within this period, the plantation was cleaned and thinned. It is hoped that further thinning there would increase the spacing to 5 × 5 *m* as recommended by Sanders (1953). This would undoubtedly induce increase in girth.

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A NOTE ON ALLELOSPOLY AND TREE AGE UP TO WHICH INTERCROPPING IS FEASIBLE

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A multitude of benefits has been imputed to the agroforestry system of intercropping with trees (Lechner & Neumann 1966, Hesmer 1970). But owing to growing competition from the trees for light, water, and nutrients, intercropping without yield penalty is feasible only during the early growing period of the tree (King 1968). This effect has been termed allelospolly (Szezpanski 1977). Several studies have shown that with increasing age, the intercrop invariably sustains yield loss (Maghembe & Redhead 1982, Redhead *et al.* 1983). We carried out intercropping studies for three multipurpose trees, namely *Eucalyptus tereticornis, Casuarina equisetifolia* and *Leucaena leucocephala,* to determine their precise ages when allelospoly effect occurred.

The studies were carried out at the Forestry Research Station, Mettupalayam, India (11° 19'N; 76° 56'E; 300 *m* a.s.l.) from 1983 to 1986. The three multipurpose tree species

were laid out in a split-plot design within the main plot and 11 arables (*vide* Table 1) in the subplot. Monocrops served as controls.

Table 1. Details of agricultural crops

Common name	Latin name	Cultivar	Spacing (*m*)
Sunflower	*Helianthus annuus* L.	Modern Elite	45 × 20
Cotton	*Gossypiun hirsutum* L.	MCU 9	60 × 30
Greengram	*Vigna radiata* (L) Wilczek	CO.4	30 × 10
Sesamum	*Sesamum indicum* L.	CO.24	45 × 15
Cowpea	*Vigna unguiculata* (L)	CO.1	30 × 10
Soybean	*Glycine max* (L)	CO.1	30 × 10
Turmeric	*Curcuma longa* L.	local	30 × 15
Maize	*Zea mays* L.	Ganga 5	60 × 30
Blackgram	*Vigna mungo* (L)	CO.4	30 × 10
Groundnut	*Arachis hypogaea* L.	POL.2	15 × 15

Nine-*mth*-old containerised seedlings of the tree species were planted at 4 × 1 *m* spacing in 8 × 8 *m* plots. The arables were raised in the interspaces successively and six crops were raised for 32 *mth* after planting the trees. For cotton and turmeric only five and three successions respectively were raised. Economic yield of arables was assessed at harvest. Results were subjected to an analysis of variance and differences between ages for each crop tested (t-tests) for significance [($p < 0.05$) Panse & Sukhatme (1967)].

The tree age at which the intercrops sustained yield loss varied with the crop as well as the tree. By and large, no yield reduction was evident up to ten months after planting except with cotton, blackgram and sunflower (Table 2). This is consistent with reports by several workers of normal yield of intercrops in the first year (Maghembe & Redhead 1982, Anonymous 1984, Shah 1987). Cotton declined in yield by about 9.0% ten months after planting when conjoined with *C. equisetifolia* and *L. leucocephala,* but with *E. tereticornis* yield reduction was evident only 21 months after planting. Similarly, blackgram combined with *E. tereticornis* and sunflower conjoined with *L. leucocephala* exhibited yield loss ten months after planting.

Further, with successive cropping there was a concomitant decrease in yield, the overall reduction for all crops, except turmeric, being 12.1, 20.7, 28.1 and 34.8% in 15, 20, 25 and 32 months after planting. Sorghum was reported to sustain a yield reduction of 41.8 and 50.2% in the second and third year, respectively, when intercropped with various trees (Anonymous 1984). Yield of maize interplanted with *Eucalyptus melliodora* was 1280 *kg* ha^{-1} in the first year, 100 *kg* ha^{-1} in the second year and the crop failed to flower in the third year (Redhead *et al.* 1983). Wheat yields which were comparable to monocropping in the first year diminished by 73% in the second year and totally failed in the third year (Gupta 1986). Compared to the quantum of yield loss reported by these workers, that obtained in the present study is relatively less. The one crop which manifested no deleterious response to the competition imposed by the developing tree canopy was cowpea. It did not decline in yield up to 32 months after planting when conjoined with *C. equisetifolia*; up to 20 months after planting with *E. tereticornis*; and up to 15 months after planting with *L. leucocephala.* Next to cowpea, greengram showed no yield loss up to 25 months after planting with *C. equisetifolia.*

Comparing the effect of the three trees, *C. equisetifolia* proved less competitive and permitted intercropping for a comparatively longer period, the exception being for cotton. Yield of cotton was inhibited ten months after planting by this tree species as well as *L. leucocephala.* But, *E. tereticornis* proved to be a complementary partner for cotton,

as yield inhibition in its case was evident only 21 months after planting. At the other extreme, *L. leucocephala* restrained the yield of most crops in 15 months after planting, excepting maize. As already indicated sunflower and cotton were inhibited by this tree species in ten months after planting. However, maize, which exhibited reduced yield in 15 months after planting when combined with *C. equisetifolia* and *E. tereticornis* did so only 20 months after planting with *L. leucocephala.* It is concluded that performance of crops intercropped with the multipurpose trees is disparate, and that cowpea with *C. equisetifolia,* cotton with *E. tereticornis* and maize with *L. leucocephala* can be intercropped for a longer period than other crops.

Table 2. Yield of 11 arables as influenced by age of three multipurpose trees ($g\ ha^{-1}$)

Crop	Age of trees (months after planting) 5					10				
	MC	CE	ET	LL	M	MC	CE	ET	LL	M
Su	17.6	18.1	17.5	17.3	17.6	16.9	17.1	16.8	16.1	16.7
Co	15.6	15.9	16.3	14.8	15.6	16.7	15.1	16.0	15.2	15.7
Gg	10.8	11.1	10.7	10.5	10.7	10.3	10.5	10.2	9.6	10.1
Se	12.6	11.9	11.8	12.2	12.1	11.7	11.7	11.5	12.1	11.7
Sm	46.3	45.6	46.0	47.0	46.2	45.7	46.0	43.7	44.1	44.9
Cp	12.6	11.7	12.1	12.3	12.1	12.1	10.9	11.2	10.4	11.1
Sb	17.4	16.9	16.7	17.1	17.0	16.6	15.7	16.0	16.0	16.1
Tu	-	-	-	-	-	100.8	111.3	100.0	96.5	101.4
Ma	49.6	50.2	49.0	51.1	49.9	48.5	47.9	48.2	49.2	48.4
Bg	7.4	7.5	7.6	7.3	7.47	7.6	7.7	7.3	7.4	7.52
Gn	27.7	28.8	27.3	27.0	27.7	26.8	26.7	27.2	26.7	26.8
	15					20				
	MC	CE	ET	LL	M	MC	CE	ET	LL	M
Su	17.1	15.4	14.2	12.5	14.8	15.0	13.4	12.4	10.5	12.8
Co	15.4	13.3	14.5	10.8	13.5	14.8	11.6	12.6	9.0	12.0
Gg	10.5	9.6	9.4	8.3	9.45	10.2	9.0	8.3	6.6	8.53
Se	12.1	11.5	9.5	8.15	10.3	11.3	9.4	8.0	7.0	8.94
Sm	48.1	43.7	35.7	40.7	43.1	44.9	37.6	31.4	33.0	38.8
Cp	11.9	11.4	10.6	9.1	10.7	11.7	10.2	9.4	8.4	9.9
Sb	15.9	14.8	15.0	13.1	14.7	16.2	13.8	12.9	11.3	13.5
Tu	-	-	-	-	-	96.3	126.5	72.6	50.7	86.5
Ma	51.5	45.2	44.5	47.3	47.1	49.8	43.0	38.4	42.8	43.5
Bg	7.3	7.4	6.5	5.6	6.71	7.1	6.4	5.5	4.9	5.99
Gn	27.0	23.6	23.6	20.0	23.5	26.2	21.8	21.2	18.1	21.8
	25					32				
	MC	CE	ET	LL	M	MC	CE	ET	LL	M
Su	14.7	12.0	11.0	8.90	11.6	14.5	10.9	9.00	7.31	10.2
Co	13.0	8.4	10.1	7.2	9.6	-	-	-	-	-
Gg	10.0	8.2	6.6	5.9	7.7	9.8	6.7	6.0	4.8	6.8
Se	10.5	8.1	7.0	5.9	7.9	10.1	7.1	6.00	5.0	7.06
Sm	43.8	33.8	27.5	29.6	36.0	43.3	28.5	22.8	24.8	32.5
Cp	12.0	9.5	8.5	6.9	9.24	11.2	8.4	7.0	5.5	8.02
Sb	15.9	12.7	16.6	9.7	12.4	15.4	11.2	9.8	7.9	11.1
Tu	-	-	-	-	-	88.5	65.7	31.4	23.6	52.3
Ma	48.6	33.6	31.0	38.4	37.8	45.3	30.4	28.5	34.0	34.5
Bg	6.7	5.4	4.5	3.7	5.18	6.5	4.7	3.8	3.2	4.56
Gn	25.0	20.7	18.4	15.6	19.9	24.7	18.6	17.0	13.2	18.3

	Mean				CD		
	MC	CE	ET	LL	Tree	Age	T & A
Su	15.9	14.4	13.4	12.1	0.20	0.24	0.48
Co	15.1	12.8	13.9	11.4	0.46	0.56	1.15
Gg	10.2	9.2	8.5	7.6	0.58	0.70	1.41
Se	11.3	9.95	8.96	8.42	0.72	0.88	1.77
Sm	44.6	41.2	38.4	36.7	0.88	1.09	2.20
Cp	11.9	10.3	9.8	8.79	1.15	1.41	2.84
Sb	16.2	14.1	13.6	12.5	0.73	0.89	1.80
Tu	95.2	101.5	79.4	56.9	4.21	5.16	10.3
Ma	48.9	41.7	39.9	43.7	1.73	2.28	4.58
Bg	7.13	6.51	5.93	5.38	0.92	1.13	2.26
Gn	26.2	23.3	22.4	20.1	1.49	1.83	3.67

Su - sunflower, Co - cotton, Gg - greengram, Se - sesamum, Sm - sorghum, Cp - cowpea, Sb - soybean, Tu - turmeric, Ma - maize, Bg - blackgram, Gn - groundnut; MC - monocropping, CE - *C. equisetifolia*, ET - *E. tereticornis*, LL - *L. Leucocephala*, M - Mean

In intercropping systems, competition for light is more pronounced than that for moisture or nutrients (Dhillon *et al.* 1982). The high reduction of 92.0% observed in yield of maize conjoined with *E. melliodora* was ascribed primarily to insufficient light (Redhead *et al.* 1983). The drop in yield by the arables in the present study is possibly due to excessive shading by the trees.

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A NOTE ON THE EFFECT OF FELLING INTENSITY ON A STAND OF BAMBOO, *GIGANTOCHLOA SCORTECHINII*

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Bamboo is important for its multiple use to the rural folk. It is found in forest fringes and on logged over forest areas in Malaysia. Bamboo grows in clumps, and each may have from two to 160 culms (each bamboo) depending on the species and locality factors (Chandra 1975). It is important to ensure that systematic and regular exploitation increases the production of bamboo stock (Mohammad 1931, Numata 1979, Liese 1985).