

Impact of creeping vegetable cover crops on weed flora composition during the early growth of *Hevea* (Natural rubber) saplings in a tropical rain forest zone

I K Okore* and F A Akpobome*

Received 31 March 2008; Accepted 26 June 2008

Abstract

*Weed management is amongst the most expensive agronomic practice in immature rubber plantation. Field experiment was conducted during the rainy seasons of 2004 and 2005 at the Rubber Research Institute of Nigeria. The purpose was to assess the impact of some creeping economic vegetable crops (vegetable cowpea – *Vigna unguiculata* L. Walp. ssp. *sesquipedallis*, *Egusi melon* – *Cucumeropsis manni* Naud., *Fluted pumpkin* – *Telfairia occidentalis* Hook. F and *Pumpkin* – *Cucurbita pepo*) compared to the conventional cover crop (*Centrosema pubescens*) on weed flora composition when grown with rubber saplings. The experiment was laid out in a randomized complete block design with four replications. Weed flora comprising of 33 species under 17 plant families was observed across the field. *Panicum maximum*, *Elusine indica*, *Brachiaria lata* and other grass and sedge species dominated in the conventional cover crop plots. While ephemeral weed species like *Talinum triangulare*, *Peporomia pellucida*, *Acalypha ciliata* and other broad leaf weeds dominated in creeping vegetable crop plots, except the *Telfairia* plot which had weed flora closely similar to those of the conventional cover crop plots. The weed spectrum, density and dry matter weight were significantly lower in the *Curcubita pepo* and *Cowpea* plots compared to the conventional cover crop plots. The effect of the cover crops on the plant height and stem girth did not differ significantly within the first 12 months. Thus, it could be said that with the exception of the *Telfairia occidentalis*, the creeping vegetable crops could be of importance for the control of noxious weed flora in immature rubber.*

Key word: density, growth performance, intercrop, species, spectrum

Introduction

Regions of optimum natural rubber production lie within the equatorial belt of the low land humid tropics. The

climatic conditions (adequate rainfall distribution, less fluctuation in temperature and relative humidity) throughout the year in the region promote

*Rubber Research Institute of Nigeria, P. M. B 1049, Benin City, Edo State, Nigeria.

Weed flora composition under creeping vegetables

the luxuriant growth of weeds of diverse species.

The preponderance of weed does not only interfere with the crop's utilization of above and below ground resources, but also with agronomic practices, especially during the first few years of plantation establishment (Kuan *et al.*, 1993; Esekade *et al.*, 2004). However, the extent of interference and damages varies with species. Kuan (1993), classified various weed species found in immature rubber plantation into beneficial, acceptable or tolerable and noxious ground covers, based on their effect on the young rubber and field management.

Studies (Teoh *et al.*, 1982; Esekade *et al.*, 1996) have shown the cost effectiveness of chemical weed control in immature rubber fields relative to manual. However, total reliance and/or repeated application of herbicides does not only result in rapid up surge of some more deleterious and chemical resistance species (Teoh *et al.*, 1982), but also constitute environmental hazard (Moss and Rubin, 1993).

The use of leguminous cover crops as live mulch in weed control in rubber plantations has been found to be environmentally friendly and economically viable among large estate holder. To the smallholder farmers who accounts for over 75% of the global natural production (IRSG, 2000), the

incorporation of leguminous cover crops into their cropping system is still unacceptable. This is mainly due to lack of any monetary or physical benefits in terms of food supply or else.

There are some economic creeping vegetable crops of the humid tropical origin that possess similar growth characteristics like most of the commonly used creeping legumes in plantation crop management, except for nitrogen fixation. Documented evidence of the economic values of some of the creeping vegetable crops could be found in Schipper (2000). Clay and Oberle (1996), Akinyemi *et al.* (1997) and Nwagwu *et al.* (2000) have in separate locations and studies reported on the weed control efficacy of some creeping vegetable cover crops in arable crop field when used as live mulch. There are paucity of information on the use of creeping vegetable crops of economic importance in the control of weed in rubber plantations. Since the work of Kuan (1993) has shown that degree of damage and interference of weed in immature rubber plantation depends on the species composition, it is the objective of this study to assess the impact of some creeping vegetable cover crops (Egusi melon, pumpkin, Telfairia and vegetable cowpea) on weed floral composition relative to the conventional cover crop (*Centrosema pubescens*) during the first 14 months of *Hevea* plantation establishment.

Materials and Methods

Field experiment was carried out during the raining seasons of 2004 and 2005 at the Rubber Research Institute of Nigeria, Iyanomo. Iyanomo is near Benin City and lies between latitude 6° 00' and 7° 00' N and longitude 5° 00' and 6° 00' E. The rainfall pattern is bimodal with an annual average of 2516mm and a mean maximum and minimum temperatures of 31.5 and 23.6° C, respectively. The soil is acid, derived from coastal plain and it is described as being very deep and well drained Typic Kandiuult – an Ultisol (Ojo-Atere *et al.*, 1987). The surface soil (0 - 20 cm depth texture is loamy sand with low level of exchangeable bases (Table 1).

Land preparation for the experiment involved manual clearing of the three-year old vegetation followed by burning. Each plot measured 136.68m² with six stands of budded stumps (NIG 801 clones) being planted at the spacing of 6.7 x 3.4m. The treatments consisted of rubber saplings inter planted with:

- a). Vegetable cowpea - *Vigna unguiculata* L. Walp. ssp *sesquipedallis*,
- b). Egusi melon - *Cucumeropsis manni* Naaud.
- c). Fluted pumpkin - *Telfairia occidentalis* Hook. F.
- d). Broad leaved Pumpkin - *Cucumbita pepo*

Table 1. *The physico-chemical properties of the soil of the experimental site at 0-20cm depth*

Parameters	Values
pH (H ₂ O)	5.38
pH (Kcl)	4.62
Organic C (%)	1.32
Total N (%)	0.12
Available P-Bray ¹ (mg kg ⁻¹)	2.70
Total exchangeable bases and acidity (Cmol kg ⁻¹)	1.73
Total exchangeable acidity (Cmol kg ⁻¹)	0.11
Particle size distribution (%)	
Sand	82
Silt	7
Clay	11
Textural class	Loamy sand

Weed flora composition under creeping vegetables

These intercrops were compared to the conventional rubber sole (with *Centrosema pubescens*). The experiment was laid out in a randomized complete block design with four replications, thus occupying a total land area of 0.23ha.

The creeping vegetable crops were planted at the onset of rains (April) each year at the spacing of 1m x 1m and at 1m away from each rubber stand. The rubbers (budded stumps) were introduced three weeks later following the stabilization of rains. Manual hand picking of weeds from each plot was carried out once (at four weeks) after planting of the cover crops.

At two, four and six months after planting of the budded stump in 2004 and at similar periods after the second season (2005) planting of cover crops, weed samples were collected. The weed sampling in 2005 coincided with the 10, 12 and 14 months after planting of the budded stumps.

Weed samples in each sampling period were taken from 1m x 1m quadrats systematically laid down at five different spots in each plot for the determination of weed spectrum and density. At the Laboratory, weed samples were separated by species and identified. The composition of the weed flora across the various treatments, was analyzed by calculating the average relative abundance

of each species for each year using the mean of the sample period as:

Relative abundance = (relative density + relative frequency)/2. (Derken *et al.*, 1993). Where,

Relative density = number of individuals of a given species within the quadrats per treatment divided by the total number of individuals of all the species within the plot and.

Relative frequency = proportion of quadrats in which the species occur per plot divided by the total frequency values of all the species.

Dry matter weight of the weeds was determined after being oven dried at 85⁰ C for 46hrs. The weed spectrum and density were determined by counting the number of individual weed species and number of weed stands, respectively per quadrat. The effect of the creeping vegetable crops on the *Hevea* sapling was determined by measuring the height and stem girth (10cm above the bud union) of the plants at two, four, six, nine, twelve and fifteen months after planting. Data collected on weed density, dry matter and spectrum, and *Hevea* growth performance across the treatments were separately analyzed and means compared using the LSD test at 5% level of probability.

Result

Effect of creeping vegetable crops on weed species composition, spectrum, density and biomass (dry matter weight):

Weed communities made up of 33 species under 17 plants families were observed across the treatments throughout the study period. Majority (mainly grasses and sedges) was found in the conventional cover crop plots (Table 2). The relative abundance of individual species differed widely with the type of creeping vegetable crop planted across the sampling periods.

The weed species that had the highest relative abundance value in the conventional cover crop plot were *Panicum maximum* and *Brachiaria lata* during the initial six months after planting (2004), while species like *Elusine indica* and *Optismenus bumanic* were the most prevalent between the 10th and 14th MAP. The result from rubber/*telfairia* plots followed similar trend, except that the relative abundance value of *Cyprus rotundus* with a mean value of 25.7% between the second and sixth MAP, exceeded those of *Brachiaria lata* as observed in the conventional cover crop plots at the initial six MAP. Generally, the relative abundance of majority of weed species observed in this study dropped at the 4th and 12th MAP and later increased slightly at the 6th and 14th MAP in that order.

Across the creeping vegetable cover crop treatments, with the exception of the *Telfairia* plots, the weed species that had the highest relative abundance value were *Talinum triangulare*, *Chromoleana odorata* and *Acalypha cillata* (Table 2). However, between the 10th and 14th MAP samplings period, *Chromoleana odorata* was no longer recorded. High relative abundance values for other weed species like *Commelina diffusa* and *Braciaria diffusa* were recorded in the Rubber/*Cucurbita pepo* and Rubber/*Telfairia* plots in that order.

As shown in Table 3, the number of weed species per quadrat (spectrum) was significantly higher in conventional cover crop plots relative to those in Rubber/Cowpea and Rubber/*Cucurbita pepo* at two and four months after planting (MAP) sampling periods. At the period of six and 14 MAP, all the creeping vegetable cover crop plots recorded a significantly lower weed spectrum relative to the conventional cover crop plot.

The effect of the creeping vegetable cover crop on weed density relative to the conventional one is presented in Table 4. The weed density (number/m²) narrowed significantly between the conventional cover crop plots and those of the creeping vegetable crops except for the plots under *Telfairia*, which did not differ significantly from the conventional at the second and fourth

Weed flora composition under creeping vegetables

MAP. However, from the sixth MAP, the values observed from the *Telfairia* plots were significantly lower compared to the conventional cover crop plots. The effect of the cover crop on weed dry matter (Table 5) mirrored those of the weed density, with the exception of the values recorded at 14th MAP. At that period (14th MAP), the weed dry matter weight recorded in the Rubber/ conventional cover crop and those of Rubber/*Telfairia* and Rubber/Melon, did not differ significantly.

Effect of creeping vegetable crops on the performance of Hevea saplings:

The effect of the creeping vegetable cover crops compared to conventional one, on rubber sapling height did not differ significantly during the first nine months of growth. From the 12th month, rubber sapling grown with either cowpea or *Curcubita pepo* had significantly higher heights relative to the conventional cover crop plot (Table 6). The result on the effect of the treatments on the plant stem girth followed similar trend except that significant difference only occurred at the 15th MAP.

Discussion

Preponderance of grasses (*Panicum maximum*, *Elusine indica*) and

sedges (*Cyprus rotundus*) were recorded in the conventional cover crop plots relative to the creeping vegetable cover crop plots (Table 2). The highest percentages of these species were recorded during the initial two MAP. This may have been due to the initial vegetation of the fallow resulting from the age. Higher dominance of such weed species are common, among short fallow land (Akobundu, 1993) and their subsequent transfer to cultivated fields after fallow removal (Smith and Akinade, 2000). However, with their higher relative abundance in the conventional cover crop plots compared to creeping vegetable cover crop plot, it could suggest that certain modified micro environment like reduced light intensity, temperature, etc. may have occurred due to the growth of the creeping vegetable crops. This may have affected the emergence of the grasses and sedges. This is line with the observations of Nwagwu *et al.* (2000) and Blackshow *et al.* (2001). Nwagwu *et al.* (2000), observed the potency of *cucurbita pepo* in reducing the population of certain grass weed species relative to melon in an intercrop system in Southwestern Nigeria. This they attributed to the wide spreading habit and vigour of the *Cucurbita pepo*.

Table 2. Mean relative abundance of weed species as affected by creeping vegetables cover crops across the sampling periods (between 2004 and 2005 raining seasons)

Wed species	Family	LC	Sampling periods/Types of vegetable cover crops																														
			2004												2005																		
			2MAP*			4MAP			6MAP			10MAP			12MAP			14MAP															
	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep								
<i>Panicum maximum</i> Jacq.	Poaceae	P	84.6	9.1	6.0	69.4	6.2	35.4	5.2	2.5	26.1	1.9	21.0	2.4	3.5	6.5	2.2	41.2	-	1.0	44.5	-	12.9	-	0.1	14.7	-	10.4	-	0.5	20.3	-	
<i>Panicum repens</i> Linn.	"	P	-	1.5	23.6	44.3	3.4	-	3.5	3.2	9.2	1.3	-	1.0	4.7	8.0	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<i>Brachiaria deflexa</i> (Schumach)	"	A	2.1	-	0.9	-	-	0.4	-	0.6	-	-	0.5	-	0.5	-	-	16.6	7.4	8.3	29.6	6.0	3.1	0.6	2.4	3.3	0.9	5.8	4.0	2.8	6.4	3.6	
<i>Brachiaria lata</i> (Schumach) C.E. Hubbard	"	A	45.4	-	-	33.0	-	2.9	-	-	15.4	-	23.7	-	-	11.6	-	46.2	-	-	-	-	-	-	-	-	-	13.8	-	-	-	-	
<i>Elusin indica</i> Gaertn	"	A	20.4	-	-	-	0.4	12.3	-	-	-	0.1	5.1	-	-	-	0.1	45.0	0.9	-	53.9	-	13.7	0.4	-	0.8	-	26.8	0.2	-	30.8	-	
<i>Axonopus compressus</i> (S.W) P. Beauv.	"	A/P	0.8	8.2	-	8.8	-	0.2	4.3	-	7.0	-	0.5	1.0	-	2.2	-	2.7	3.1	7.4	4.4	5.6	0.5	1.6	3.1	0.5	3.2	1.3	1.3	3.0	2.6	1.4	
<i>Perotis indica</i> (Linn) O. Ktze	"	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.2	-	-	-	-	3.3	-	-	-	-	-	
<i>Digitaria horizontalis</i> Wild	"	A	-	-	-	5.6	-	-	-	-	2.1	-	-	-	-	1.3	-	-	-	-	3.1	-	-	-	-	1.1	-	-	-	-	0.3	-	
<i>Eragrostis tenella</i> (Linn) P. Beauv.	"	A/P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.9	-	-	-	-	7.9	-	-	-	-	0.7	-	-	-	-	
<i>Optismenus bumanii</i> (Retz.) P. Beauv.	"	A	7.1	-	-	-	-	0.3	-	-	-	-	3.4	-	-	-	-	52.9	-	-	-	-	10.2	-	-	-	-	10.4	-	-	-	-	-
<i>Cyprus rotundus</i> Linn.	Cyperaceae	P	27.7	17.3	5.6	54.7	25.2	4.9	6.1	1.3	7.8	2.3	6.4	2.1	2.1	14.6	17.5	17.7	14.2	35.1	11.7	8.3	5.3	0.1	0.6	6.5	3.9	7.0	6.7	15.3	4.3	4.3	
<i>Cyprus iria</i> Linn.	"	A	29.7	31.6	27.3	13.8	8.3	2.7	5.1	6.6	0.7	3.0	12.6	14.3	36.2	6.5	5.2	2.1	2.1	4.5	2.8	6.1	3.5	4.6	12.1	1.2	1.2	0.4	0.8	2.9	0.5	3.2	
<i>Talinum triangulare</i> (Jacq) Wild.	Portulacaceae	P	13.4	47.1	16.8	8.3	18.3	23.1	42.7	12.0	23.0	10.5	5.5	57.5	35.7	40.5	23.7	22.3	26.2	29.3	18.7	5.4	6.9	75.9	50.3	26.9	25.2	6.8	35.9	11.9	12.9	14.4	
<i>Peporomia pellucida</i> (L.) H.B. & K.	Piperaceae	A	-	-	-	-	3.4	-	-	-	-	4.4	-	-	-	-	2.7	0.7	1.5	1.0	8.4	33.0	3.2	4.1	2.9	15.0	50.0	0.6	0.4	0.6	2.1	11.5	
<i>Chromolaena odorata</i> (L) R.M. King & Robbison	Asteraceae	P	12.9	41.7	26.9	39.0	44.3	10.8	7.3	5.9	5.1	10.0	3.3	23.0	10.8	18.9	22.2	2.1	-	-	0.7	5.4	1.3	-	-	0.3	1.5	1.1	-	-	0.5	2.7	

		Sampling periods/Types of vegetable cover crops																															
		2004														2005																	
		2MAP*				4MAP				6MAP				10MAP				12MAP				14MAP											
Wed species	Family	LC	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep	Rc	Rcow	Rm	Rtel	Rep						
<i>Ageratum conyzoides</i> Linn	"	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.6	10.9	5.4	1.6	-	6.2	3.4	1.4	1.4	-	5.2	5.4	3.7	-	-	
<i>Aspilia africana</i> (Pers.)																																	
C.D. Adams.	"	P	10	-	-	8.8	-	2.3	-	-	2.9	-	6.6	-	-	6.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Commelina diffusa</i> Burm.	Commeliaceae	P	3.4	3.7	-	0.1	21.6	12.6	27.8	-	0.9	31.6	6.5	16.5	-	0.5	17	2.4	2.2	1.4	25.2	24.5	5.9	6.2	2.5	39.7	60	2.2	2.1	0.6	11.6	22.3	
<i>Phyllanthus amarus</i>																																	
Schum et Thonn.	Euphorbiaceae	A	3.3	0.9	-	0.6	-	1.3	0.3	-	0.4	-	1.4	0.3	-	0.5	-	-	-	3.3	0.9	-	-	-	0.2	0.2	-	-	-	2.5	0.4	-	
<i>Acalypha ciliata</i> Forsk	Euphorbiaceae	A	4.2	47.5	19.8	5.8	65.8	0.7	13.4	4.7	0.9	12.0	2.6	17.1	7.0	3.8	13.7	-	-	-	-	4.1	-	-	-	-	5.8	-	-	-	-	8.1	
<i>Diodia scandens</i> SW.	Rubiaceae	P	0.8	0.6	55.8	-	-	0.2	0.4	6.2	-	-	0.5	0.5	28.0	-	-	22.8	19.8	26.2	4.2	3.2	5.4	6.9	8.0	1.2	2.2	9.3	10.8	15.3	2.1	2.1	
<i>Mitracarpus villosus</i>																																	
(SW) DC.	"	A	-	28.8	-	-	-	-	9.6	-	-	-	-	21.6	-	-	-	0.9	16.3	-	-	-	0.1	6.1	-	-	-	0.5	9.1	-	-	-	
<i>Pouzolzia guinensis</i> Benth.	Urticaceae	A/P	1.9	-	-	-	-	-	-	-	-	-	1.1	-	-	-	-	3.2	2.4	1.8	13.9	-	1.0	1.0	0.7	6.3	-	1.8	1.1	2.0	2.3	-	
<i>Fleurya aestuans</i> (Linn)																																	
exMiq	"	A	-	0.8	-	-	-	-	0.3	-	-	-	-	0.4	-	-	-	-	-	-	2.3	-	-	-	-	0.9	-	-	-	-	1.3	-	
<i>Cleome ruidosperma</i> DC	Cleomaceae	A/P	18.4	39.3	9.9	19.1	-	4.7	15.7	5.4	7.9	-	9.9	9.5	4.2	10.5	-	2.2	-	4.4	13.8	-	1.0	-	1.9	5.2	-	1.3	-	2.7	2.0	-	
<i>Physalis angulata</i> Linn.	Solanaceae	A	0.2	0.3	-	-	0.1	0.5	0.5	-	-	0.6	0.8	0.7	-	-	0.8	0.6	0.2	3.7	-	0.6	1.2	0.6	4.0	-	1.1	1.2	0.7	5.8	-	2.8	
<i>Celosia triygna</i> L.	Amaranthaceae	A/P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	0.9	-	0.7	-	6.0	2.3	-	2.5	-	3.2	1.3	-	1.3	-	
<i>Malvastrum coromadelianum</i>																																	
(Linn) Garcke	Malvaceae	A/P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.9	-	2.1	21.8	-	17.6	3.2	23.4	-	6.0	-	3.7	32.8	-		
<i>Boerhavia diffusa</i> L.	Nyctaginaceae	P	-	-	-	15.9	-	-	-	-	20.9	-	-	-	-	32.5	-	-	-	-	18.0	-	-	-	25.2	-	-	-	-	46.8	-		
<i>Momordila charantia</i> Linn.	Cucurbitaceae	P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	-	1.1	-	-	-	-	2.7		
<i>Hypertis suaveolens</i> Poit	Lamiaceae	A/P	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	-	-	-	10.9	-	-	-	-	21.5	-		
<i>Euphorbia heterophylla</i>	Euphorbiaceae	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	16.2	-	-	12.5	0.2	23.6	-	-	25.0	0.9	34.0	-	-	40.8	
<i>Euphorbia hirta</i>	"	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	-	-	1.7	1.0	0.7	-	-	-	0.9	0.7	1.0	-	0.9	2.1	

*MAP = Months after planting, LC = Life Cycle, A = Annual, P = Perennial, Rc = Rubber/conventional crops (*Centrosema pubescens*), Rcow = Rubber + cowpea, Rm = Rubber + Melon, Rtel = Rubber + Telfairia and Rcp = Rubber + *Cucurbita pepo*

Teasdale (1993) reported that thick cover crop stands are capable of reducing light transmittance to weed seeds, thus, reducing their germination. This could have been responsible for the reduced weed density; spectrum and dry matter (Tables 3, 4 and 5) recorded in

Cucurbita/Rubber and Cowpea/Rubber plots, relative to other treatments. These two creeping vegetable cover crops had the highest vigour, rapid establishment and area of spread (cover) compared to the other creeping vegetable crops evaluated.

Table 3. Effects of creeping vegetable cover crops intercropped with rubber saplings on weed spectrum (No of species per m²) at different period during the rainy seasons of 2004 and 2005 (the first 14 months of rubber growth)

Type of creeping vegetable crop with rubber	Period of sampling (2004 – 2005) in months after planting					
	2	4	6	10	12	14
Rubber (conventional)*	10.70	9.63	14.60	10.20	8.00	12.50
Cowpea + Rubber	6.00	5.30	8.75	5.70	3.30	7.65
Melon + Rubber	6.81	6.20	9.52	6.20	5.10	6.77
Telfairia + Rubber	8.70	6.70	10.35	6.00	4.00	6.75
Pumpkin + Rubber	5.20	3.50	5.13	4.00	3.95	4.72
LSD (0.05)	3.56	3.75	3.03	3.25	4.16	2.75

* *Centrosema pubescens*

Table 4. Effects of creeping vegetable cover crops intercropped with rubber on weed density (No of stands per m²) at different period during the rainy seasons of 2004 and 2005 (the first 14 months of rubber growth)

Type of creeping Vegetable crop/rubber	Period of sampling (2004 – 2005) in months after					
	2	4	6	10	12	14
Rubber (conventional)*	97.70	89.11	190.50	712.31	120.70	625.25
Cowpea	53.00	45.16	90.50	255.74	72.32	215.25
Melon	54.70	44.21	102.80	277.30	64.33	240.21
Telfairia	84.70	65.10	110.27	269.70	82.75	249.31
Pumpkin	44.00	25.00	72.75	84.20	35.30	82.75
LSD (0.05)	29.00	33.11	63.32	124.97	25.68	139.33

* Rubber + *Centrosema pubescens*

Weed flora composition under creeping vegetables

Table 5. Effects of creeping vegetable cover crops intercropped with rubber on weed biomass (g/m^2) at different sampling periods during the rainy seasons of 2004 and 2005 (the first 14 months of rubber growth)

Types of creeping vegetable cover crop/rubber	Period of sampling (2004 – 2005) in months after planting					
	2	4	6	10	12	14
Rubber (conventional)*	486.76	265.51	630.51	406.77	120.70	722.35
Cowpea	186.74	131.25	272.28	195.21	72.32	340.52
Melon	266.72	137.49	395.75	184.30	64.33	620.51
Telfairia	370.21	193.73	340.98	212.00	82.75	641.62
Pumpkin	116.68	91.76	181.20	176.01	35.30	185.33
LSD (0.05)	185.11	76.25	120.92	107.11	25.68	52.11

*Rubber + *Centrosema pubescens*

The inability of the *Telfairia occidentalis* to perform like other cover crops could be ascribed to its sensitivity to grasses, which may have affected its growth vigour at the early stage (two MAP). The most predominant weed species under *Telfairia*/Rubber were grasses like *Panicum maximum* and *Brachiaria lata*. The sensitivity of this creeping perennial plant to grasses has been reported by Esiaba (1982), more especially when allowed to spread on the ground without being staked, as was the case in this study.

The lower values in most weed species relative abundance, spectrum, density and biomass recorded in the Cowpea plot relative to others with exception of *Cucurbita pepo* plots, is similar to the observation made by Okoh *et al.* (2004). They observed that cowpea

varieties with vigorous spreading habit, as is the case with the sub sp. *sesquipedallis* are capable of reducing weed spectrum and density. In addition, White *et al* (1989) reported, that the potentials of annual legumes like Cowpea in weed control does not only depend on the spreading ability but, also on some allelopathic chemical contained within the plant that suppresses weed germination and growth vigour.

The consistently lower relative abundance values in individual weed species, spectrum and density recorded during the fourth and 12th MAP sampling period, across the treatments could be ascribed to the shading effect of the cover crops. The period coincided with the peak of vegetable growth and spread of the cover crops in each year. This reflected on the weed dry matter (biomass) weight

recorded across the treatments (Table 5). Majority of the weed species observed in the conventional cover crop plots fall within the group Kuan (1993) classified as noxious weed species under immature rubber. Thus, suggesting that with the use of creeping vegetable cover crops with vigorous spreading habit like the vegetable Cowpea (sub sp. *sesquipedallis*) or *Cucurbita pepo*, most of the noxious weeds could be controlled.

As shown in Table 6, the effect of the creeping vegetable on plant height, and stem girth within the first 10 months of the plant growth did not differ

significantly from those conventional cover crops. The significant difference noticed from the 12 MAP for height and 15 MAP for girth with *Cucurbita pepo* given higher values is in conformity with other reports. This could be as a result of prolonged growth of some of this vegetable cover crop, which ensures higher soil moisture retention due to its massive mat-layer formation on the soil surface (Ayeni, 1993). Any crop left in the field before and after the drying up of the cover crop, benefits from the conserved soil moisture (Nwagwu *et al.*, 2000).

Table 6. Effect of creeping vegetable cover crops on the growth performance (Height and stem girth) of rubber saplings within the first fifteen months of growth

Type of creeping vegetable cover crop with rubber	Growth stage (Months after planting)				
	2	6	9	12	15
	Height (cm)				
Rubber (conventional)	34.42	48.59	89.06	134.5	146.50
Rubber + Cowpea	30.56	40.53	66.88	156.26	168.10
Rubber + Melon	35.49	45.78	62.89	142.68	155.68
Rubber + Telfairia	36.01	48.32	70.57	120.01	130.33
Rubber + Pumpkin	38.24	49.34	73.40	158.30	171.32
LSD (0.05)	Ns	Ns	Ns	38.20	40.44
	Girth (cm)				
Rubber (conventional)	3.00	5.10	7.10	9.21	12.34
Rubber + Cowpea	2.30	4.72	6.52	8.66	17.72
Rubber + Melon	2.50	5.10	6.75	8.35	16.02
Rubber + Telfairia	2.70	5.10	6.82	8.11	16.15
Rubber + Pumpkin	2.80	5.30	6.95	9.01	17.92
LSD (0.05)	-	-	-	-	3.31

Weed flora composition under creeping vegetables

References

- Akinyemi, S O S and Tijani-Eniola, H (1997). Effect of melon population density intercropped with plantain on weed control and intercrop productivity. *Nig. Journal of Weed Science* **10**, 27-34.
- Akobundu, I O (1987). *Weed science in the Tropics: Principles and practices*. John Wiley and Sons, Inc. 522pp.
- Akobundu, I O (1993). Integrated Weed Management Techniques to Reduce Soil Degradation. *IITA Research*. No.6, 11 – 15.
- Ayeni, A O (1993). Weed Management in crop Production in Nigeria. In: *Fundamentals of Agriculture* (Eds. Aiyelari, E A, Lucas, E O, Abatan, M O and Akiboade, O A) Afrika Link Books, Ibadan. pp 54 – 63.
- Blackshaw, R E, Moyer, J R, Doram, R C and Boswell, A L (2001). Yellow sweet clover, green manure and its residues effectively suppress weed during fallow. *Weed science* **49**, 406-413.
- Clay, S and Oberle, S (1996). Alternative weed Management strategies symposium: An Overview. *Jour. Produ. Agric.* **9** (4), 468-474.
- Derken, D A, Lafond, G P, Thomas, A G, Leopky, H A and Swanton, C J (1993). Impact of agronomic practices on weed communities: *Tillage System Weed Science* **41**, 409-417.
- Esekhade, T U, Imarhiagbe, E O, Ugwa, I K, Aigbekan, E O and Ojiekpon, F I (1996). Efficacy and comparative cost of weed control methods in a mature rubber plantation in Nigeria. *Indian Journal of Natural Rubber Research* **9** (2), 117-122.
- Esekhade, T U, Ogeh, J S and Tijani-Eniola, H (2004). Influence of rubber based cropping system on weed growth in immature rubber plantation. *Journal of Agric. Forest and Fisheries* **5** (2), 42-49.
- Esiaba, R O (1982). Cultivating the Fluted Pumpkin in Nigeria. *World Crops*. **34** (2), 70- 72.
- IRSG (International Rubber Study Group) (2000). *Rubber. Statistical Bulletin*. **54** (9). Wembley, UK.
- Kuan, C Y (1993). Weed management in rubber I. Classification of ground cover. *Planters' Bulletin. Rubber Research Institute of Malaysia*. **216**, 75-79.
- Kuan, C Y, Alif, A F and Nang, Y Z (1993). Weed management in rubber II. Control of noxious weeds with herbicides. *Planters' Bulletin. Rubber Research Institute of Malaysia* **216**, 80-86.
- Moss, S R and Rubin, B (1993). Herbicide - resistant weeds: a world wide perspective. *Journal of Agric. Sci., Cambridge*. **120**, 141-148.
- Nwagwu, F A, Tijani-Eniola, H and Chia, M H (2000). Influence of tillage and cover crops on weed control in Coco yam field at Ibadan, Southwestern Nigeria. *Nig. Jour. Weed Sci.* **13**, 39-44.
- Ojo-Atere, J A and Olomu, E I, Fagbami, A, Omueti, J A and Fapohunda, A (1987). Environment of southwestern Nigeria. In: *Southwestern Nigeria* (Eds. Adepetu, J. A., Fagbami, A and Obigbesan, G O). Federal Ministry of Agriculture, Water Resources and Rural Development. Pp. 1-63.

I K Okore and F A Akpobome

- Okoh, K A, Oladiran, J A and Kolo, M G M (2004). Evaluation of weed suppression efficiency and productivity of Cowpea varieties. *Nigerian Journal of Weed Science* **17**, 15-19.
- Schipper, R R (2000). African Indigenous Vegetables: An Overview of the Cultivated Species. NRI, DIFID and CTA. Pp 55-76.
- Smith, M A and Akinade, R A (2000). Comparative weed succession in a tropical rain forest zone. *Africa Journal of Environmental Studies* **1** (1&2), 104-114.
- Teasdale, J R (1993). Contributions of cover crops to weed management in sustainable agricultural systems. *Journal of Produ. Agriculture* **9** (4), 475-479.
- Teoh, C H, Toh, P Y and Khairudim, H (1982). Chemical control *Asystasis intrusa* (B. I.), *Clademia hirta* (Dom) and *Ellatoria psiscurtisii* (Bak) in rubber and Oil palm. In: *Proceedings of the 26th Annual Assembly of International Conference on Plant Protection Pin the Tropics*. Kuala Lumpur. Pp. 497-510.
- White, R H, Worshan, A D and Blum, U (1989). Allelopathic potentials of legume debris and aqueous extracts. *Weed Science* **37**, 674-699.

Address for correspondence: Dr I.K. Okore, Agronomy Division, Rubber Research Institute of Nigeria, P.M.B. 1049, Benin City, Edo State, Nigeria.
E-mail: iko7796@yahoo.co.uk