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Influence of Cassava and Turmeric Intercropping System on Phytosociology of Predominant Weeds in Calabar

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Abstract
An experiment was conducted in 2020 and 2021 cropping seasons at the Department of Crop Science Teaching and Research Farm, University of Calabar, to identify the predominant weeds in the farming area and assess how cassava/turmeric intercropping system affects their relative density, relative frequency and relative abundance. The experiment was laid out in a randomized complete block design (RCBD) and replicated three times. There were seven treatments, sole cassava, sole turmeric, and cassava intercropped with turmeric at 66,666, 50,000, 40,000, 35,714, and 28,571turmericc plants/ha. Data were collected on weed's phytosociological attributes every four weeks. *Ageratum conyzoides* L., *Aspillia bussei* O. Hoff, *Caladium bicolor* Vent., *Calapogonium mucunoides* Desv., *Cleome rutidosperma* DC., *Euphorbia heterophylla* L., *Gloriosa superba* L., *Ipomoea involuncrata* P., *Mitracarpos villosus* DC., *Oldenladia. Herbacea* L., *Phyllantus amarus* Schum., *Triumfeta rhomboidea* Jacq., *Axonopus compressus* Beav., *Cynodon dactylon* L., *Eragrostis ciliaris* L., *Panicum maximum* Jacq., *Kyllinga bulbosa* Beav. and *Kyllinga erecta* Schum. were the predominant weeds identified in the experimental area. *A. bussei*, *A. conyzoides*, *M. villosus* and *E. heterophylla* were relatively lower at higher turmeric density of 50,000 to 66,666 plants/ha in the intercrop mixture while *Axonopus compressus*, *Caladium bicolor*, *Cynodon dactylon*, *Gloriosa superba, Kyllinga bulbosa*, *Kyllinga erecta*, *Calapogonium mucunoides Triumfeta rhomboidea* and *Panicum maximum* were higher.

Keywords: predominant weeds; phytosociology; cassava, turmeric; intercropping

Introduction

Phytosociology, otherwise called plant sociology is the study of a group of plants found growing together in a given location or plant community (Dengler *et al.*, 2008). Phytosociological survey establishes the floristic composition, dispersion, structure, functions and dynamics of the vegetation component of a biotic community (Mendes *et al.*, 2018). Phytosociological study of weeds provides insight into the dynamics and relative importance of each weed species predominant in a particular phytosociety or across phytosocieties which is very important in understanding crop-weed ecosystem and provides a guide to taking effective weed management decisions (Nwagwu *et al.*, 2016; Sinha, 2017; Chauhan, 2020). The major phytosociological parameters studied are relative frequency, relative density, relative abundance, and relative importance index of each species component of the vegetation in the cropped area (Gomes *et al.*, 2010; Concenço *et al.*, 2013; Mendes *et al.*, 2018). These phytosiociological parameters show the species richness in the area and how each species relates with the others within the area (Dos Santos *et al.*, 2015; Nwagwu *et al.*, 2020; 2022; 2023). The relativity of the species indicates how each species relates to the other species in terms of density, frequency, and abundance within the studied area. The relative values are expressed as percentages and could be determined by dividing the absolute value of individual species by the sum of the absolute values of all the species comprising the weed community and multiplying the result by 100 (Maszura *et al.*, 2018). Understanding the abundance, distribution, and severity of each predominant weed species over time in a given cropping environment would be helpful in predicting changes in the weed community in response to cultural practices and agro-climatic conditions of the area (Nkoa *et al.*, 2015). There is a dearth of information on the phytosociological attributes of the predominant weeds

in Calabar cropping area as affected by the cropping pattern. Therefore, this experiment was carried out to highlight how cassava and turmeric intercropping systems affect the relative density, relative frequency, and relative abundance of the predominant weed species in Calabar.

Materials and Methods

Location

The experiment was conducted at Crop Science Teaching and Research Farm in the University of Calabar. Calabar is located at the southeast rainforest agro-ecological zone of Nigeria (4.5^0N - 5.2^0N, 8.3^0E), about 39 m above sea level and has a bimodal annual rainfall distribution that ranges from 3,000 mm to 3,500 mm with mean annual temperature range of 27 ^{0}C to 35 ^{0} C and relative humidity of 75 % to 88 % (Efiong, 2011). The experimental site was in secondary vegetation following a two-year fallow period having been previously used for cassava cultivation. The predominant weed species before land preparation were *Panicum maximum* Jacq., *Calapogonium mucunoides* Desv.*, Ageratum conyzoides* L.*, Caladium bicolor* Vent. and *Triumfetta rhomboidae* Jacq. The existing vegetation was cleared with machete and the debris packed using rake. The field was tilled to a depth of 20 – 30 cm using a spade and then demarcated into twenty-one uniform experimental units (4 m x 5 m) to meet the design specifications.

Experimental design and layout

The experiment was laid out in a randomized complete block design (RCBD) and replicated three times. There were seven treatments, cassava intercropped with turmeric @ 66,666 turmeric plants/ha (30 cm x 50 cm spacing), 50,000 turmeric plants/ha (40 cm x 50 cm spacing), 40, 000 turmeric plants/ha (50cm x 50 cm spacing), 35,714 turmeric plants/ha (40 cm x 70 cm), 28,571 turmeric plants/ha (50 cm x 70 cm) Sole turmeric at 66,666 plants/ha, 30 x 50 cm standard spacing (Amadi *et al*., 2015) and sole cassava were the controls.

Data collection

Weed assessment was conducted every four weeks from 4 – 20 weeks after planting (WAP). Sampling was achieved by placing a detachable wooden quadrat measuring 1 m x 1 m at random on two locations per treatment unit and the total number of weeds present within the quadrat were harvested, sorted into species, and recorded. Weeds were botanically identified by analyzing their external morphological characteristics using a weed identification handbook by Akobundu *et al*. (2014). The total number of each weed species was recorded separately for each treatment unit at each sampling period and was used to determine the phytosociological attributes of each weed species at the end of the sampling period. The phytosociological structures of the weeds were assessed as outlined by Sinha and Banerjee (2016), and Sinha (2017) which included:

$$\text{Absolute density} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats studied x area in m}^2\text{ of a quadrat}} \quad \ldots.1$$

$$\text{Relative density (RD)} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{sum of all absolute densities}} \times 100 \quad \ldots..2$$

$$\text{Absolute Frequency} = \frac{\text{Number of quadrats with species presence}}{\text{Total number of quadrats used}} \quad \ldots.3$$

$$\text{Relative Frequency (RF)} = \frac{\text{Species absolute frequency}}{\text{Sum of all absol ute frequencies}} \times 100 \quad \ldots.4$$

$$\text{Absolute abundance} = \frac{\text{Total number of individuals of a species in all quadrats}}{\text{Total number of quadrats in which the species occurred}} \quad \ldots.5$$

$$\text{Relative abundance (RA)} = \frac{\text{Species absolute abundance}}{\text{Sum of all absolute abundances}} \times 100 \quad \ldots.6$$

Results and Discussion

Results

Relative density

Table 1 shows the relative density of the weed species in the experimental site. *Axonopus compressus*, *Caladium bicolor*, *C. dactylon*, *G. superba, Kyllinga bulbosa*, *Kyllinga erecta*, *Calapogonium mucunoides* and *Panicum maximum* were moderately dense species with relative density range of 5.0 – 11.8 % across the treatments in both years of study. *Ageratum conyzoides*, *Aspillia bussei*, *Cleome rutidosperma*, *Eragrostis ciliaris*, *Ipomoea involuncrata*, *Oldenladia herbacea* and *Phyllantus amarus* were occasional to moderately dense species with relative density range of 2.8 – 7.0 % across the treatments. The relative densities of *Aspillia bussei*, *Ageratum conyzoides*, *Mitracarpos villosus* and *Euphorbia heterophylla* tended to decrease as the density of the intercrop mixture increased and were occasional species across the treatments. The relative density of *Triumfeta rhomboidea* was lowest at sole turmeric (2.8 %), but tended to increase as turmeric density increased in the intercrop (3.7 – 5.0 %). Generally, *Caladium bicolor* had the highest relative density values across treatments in both years, which however were within the moderately dense rating as some other species in the experimental area.

Relative frequency

The relative frequency of the weed species on the experimental site in 2020 and 2021 cropping seasons are shown in Table 2. *Ageratum conyzoides*, *Caladium bicolor*, *Cleome rutidosperma*, *Cynodon dactylon*, *Eragrostis ciliaris* and *Calapogonium mucunoides* were moderately frequent species with relative frequency range of 5.1 – 8.0 % across the treatments. *Aspillia bussei*, *Ageratum compressus*, *Mitracarpos villosus*, *Euphorbia heterophylla*, *Gloriosa superba, Ipomoea involuncrata*, *Kyllinga bulbosa*, *Kyllinga erecta*, *Oldenladia herbacea, Panicum maximum*, *Phyllantus amarus* were occasional to moderately frequent species with relative density range of 2.1 – 7.2 % across the treatments.Generally, *Ageratum conyzdes*, *Caladium*

bicolor, *Cleome rutidosperma*, *Cynodon dactylon*, *Eragrostis ciliaris* and *Mitracarpos villosus* are the more frequent species across the treatments in both years of study.

Relative abundance

The relative abundance of the weed species in the experimental site in both planting years are shown in Table 3. *Axonopus compressus*, *Caladium bicolor*, *Cynodon dactylon*, *Kyllinga bulbosa*, *Kyllinga erecta*, *C. mucunoides* and *P. maximum* were moderately abundant species with relative abundance range of 5.0 – 11.9 % across the treatments. *Ageratum conyzoides*, *Aspillia bussei*, *Mitracarpos villosus*, *Cleome rutidosperma*, *Eragrostis ciliaris*, *Euphorbia heterophylla, Gloriosa superba, Ipomoea involuncrata*, *Oldenladia herbacea*, *Panicum amarus* and *Triumfeta rhomboidea* were occasional to moderately abundant species with relative density range of 2.8 – 7.0 % in any quadrat they occurred across the treatments.

Discussion

The predominant weeds in the experimental site were *Ageratum conyzoides* L., *Aspillia bussei* O. Hoff, *Caldum bicolor* Vent., *Calapogonium mucunoides* Desv., *Cleome rutidosperma* DC., *Euphorbia heterophylla* L., *Gloriosa superba* L., *Ipomoea involuncrata* P., *Mitracarpos villosus* DC., *Oldenladia. Herbacea* L.*, Phyllantus amarus* Schum., *Triumfeta rhomboidea* Jacq., *Axonopus compressus* Beav., *Cynodoon dactylon* L., *Eragrostis ciliaris* L., *Panicum maximum* Jacq., *Kyllinga bulbosa* Beav. and *Kyllinga erecta* Schum. Previously, Shiyam *et al*. (2011) and Binang *et al*. (2016) had listed some of these weeds as predominant species in the same cropping environment. The similarity in the relative density of most weeds encountered across the different turmeric population densities intercropped with cassava in this study suggests that the weed species responded similarly to intercropping of cassava with turmeric at different densities. The weeds were mostly moderate species across the treatments, except *Aspillia bussei*, *Ageratum conyzoides*, *Mitracarpos villosus* and *Euphorbia heterophylla* that were occasional species when the densities of the intercrop mixture increased. This suggests that *Aspillia bussei*, *Ageratum conyzoides*, *Mitracarpos villosus* and *E. heterophylla* are easily choked and smothered off when the crop densities of the cultivated species are high. This finding corroborates the finding of Binang *et al*. (2016) who observed the smothering of the members of *Asteraceae* family by *Telfairia occidentalis*. On the other hand, the moderate density status of such species as *Axonopus compressus*, *Caladium bicolor*, *Cynodon dactylon*, *Gloriosa superba, Kyllinga bulbosa*, *Kyllinga erecta*, *Calapogonium mucunoides* and *Panicum maximum* across the treatments suggests that these species are not easily shaded off and will require additional weed management approach to effectively control them. The lower relative density of *Triumfeta rhomboidea* at sole turmeric treatment which tended to increase as turmeric density increased in the intercrop mixture suggests that this species is not easily controlled by shading. It further suggests that as the density of the intercrop mixture increased, most of the weed species such as *Aspillia bussei*, *Ageratum conyzoides*, *Mitacarpos villosus* and *Euphorbia heterophylla* were suppressed while *T. rhomboidea* remained unchanged. In support of this observation, *T. rhomboidea* has been reported to thrive well under shade than under direct sunshine (www.prota4u.org).

Conclusion

Most of the weed species such as *Axonopus compressus*, *Caladium bicolor*, *Cynodon dactylon*, *Gloriosa superba, Kyllinga bulbosa*, *Kyllinga erecta*, *Calapogonium mucunoides Triumfeta rhomboidea* and *Panicum maximum* were not easily shaded off by increasing the cropping density of turmeric in a cassava/turmeric intercropping system and will require additional weed management approach to effectively control them. On the other hand, *Aspillia bussei*, *Ageratum conyzoides*, *Mitacarpos villosus* and *Euphorbia heterophylla* are easily choked and smothered off when the crop densities of the cultivated species are high.

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Table 1: Relative density of weed species in the cropped area (%)

		2020							2021					
Weed species	**Treatments**	**CA_0**	**TM_0**	**CA +TM_1**	**CA +TM_2**	**CA +TM_3**	**CA +TM_4**	**CA +TM_5**	**CA_0**	**TM_0**	**CA +TM_1**	**CA + M_2**	**CA +TM_3**	**CA +TM_4**	**CA +TM_5**
	Life cycle														
Sedges															
Kyllinga erecta Schum.	A	6.00	5.40	5.90	5.50	5.30	6.10	5.60	6.40	5.50	6.50	5.90	5.00	6.00	5.60
Kyllinga bulbosa Bea.	A	5.50	5.70	5.20	5.70	5.50	6.70	5.40	6.40	5.00	6.30	5.70	6.30	6.20	5.90
Grasses															
Cynodoon dactylon L.	A	7.20	6.70	7.40	8.20	8.10	7.40	8.70	6.40	7.00	7.40	9.00	7.90	8.20	7.60
Panicum maximum Jac.	A	6.40	6.80	7.60	7.10	6.50	7.10	8.30	5.20	5.30	5.00	5.50	5.90	7.00	7.30
Eragrostis ciliaris L.	A	5.80	5.20	5.20	4.80	4.30	4.60	4.00	4.60	5.70	5.40	4.70	4.30	4.10	3.60
Axonopus compressus Bea.	P	5.70	8.00	7.10	6.30	6.90	7.40	6.90	6.70	6.70	6.10	7.80	8.50	9.20	9.70
Broadleaves															
Euphoba heterophylla L.	A	4.40	3.90	3.80	4.20	4.90	4.30	4.30	4.80	4.80	4.10	3.80	4.70	4.30	4.10
Oldenladia. Herbacea L.	A	4.40	5.00	3.80	4.00	4.30	2.80	4.20	3.40	4.50	6.70	5.20	3.40	3.80	3.90
Phyllantus amarus Schum.	A	6.00	4.60	4.00	4.80	5.30	4.10	4.20	5.60	4.60	4.30	4.00	4.70	4.30	3.60
Triumfeta rhomboidea Jac.	P	2.80	4.10	4.00	4.00	3.70	5.00	4.20	4.40	4.00	5.00	3.80	4.30	4.70	4.20
Ipomoea involuncrata P.	A	4.90	5.00	5.90	3.80	3.70	3.10	3.60	3.80	4.40	3.20	3.50	3.80	2.10	3.30
Mitracarpos villosus DC.	A	4.40	4.20	3.80	3.60	4.10	3.90	3.60	4.00	4.40	3.70	4.00	4.70	3.80	3.90
Calapo mucunoides Desv.	P	6.10	6.20	6.20	5.90	7.30	7.60	6.90	5.90	6.50	5.60	7.10	5.90	6.80	6.10
Cleom rutidosperma DC.	A	6.60	6.00	5.20	5.50	4.50	4.10	5.40	5.60	7.00	5.00	4.00	4.00	4.30	4.20
Aspillia bussei O. Hoff	A	5.20	4.40	5.00	4.80	5.10	4.60	4.30	5.60	5.20	4.80	3.80	4.70	3.90	4.90
Gloriosa superba L.	A	5.10	5.90	6.60	6.30	5.90	7.60	6.30	7.50	5.30	6.70	6.70	6.90	7.40	6.40
Ageratum conyzoides L.	A	5.10	4.90	4.50	4.80	4.70	4.30	4.30	4.90	5.70	4.80	4.80	4.30	3.80	4.50
Caldum bicolor Vent.	P	8.30	8.10	8.80	10.70	10.00	9.30	9.80	8.90	8.50	9.30	10.90	10.80	10.10	11.80

Rating: < 1% = trace / rare; between 1 and 5% = low / occasional plants; between 5 and 25% = moderate/scattered plants; between 25 and 100% = high / dense (Maszura et al., 2018)

A = annual; P = perennial; CA = cassava @ 10,000 plants/ha; TM_1 = turmeric @ 66,666 plants/ha (30 cm x 50 cm spacing); TM_2 = turmeric @ 50,000 plants/ha (40 cm x 50 cm spacing); TM_3 = turmeric @ 40,000 plants/ha (50 cm x 50 cm spacing); TM_4 = turmeric @ 35,714 plants/ha (40 cm x 70 cm spacing); TM_5 = turmeric @ 28,571 plants/ha (50 cm x 70 cm spacing); CA_0 = sole cassava @ 10,000 plants/ha; TM_0 = sole turmeric @ 66,666 plants/ha (30 cm x 50 cm

Table 2: Relative frequency of weed species in the cropped area (%)

		2020							2021						
Weed species	**Treatments**	**CA_0**	**TM_0**	**CA + TM_1**	**CA + TM_2**	**CA + TM_3**	**CA + TM_4**	**CA + TM_5**	**CA_0**	**TM_0**	**CA + TM_1**	**CA + TM_2**	**CA + TM_3**	**CA + TM_4**	**CA + TM_5**
	Life cycle														
Sedges															
Kyllinga erecta Schum.	A	6.40	5.10	5.30	4.80	5.30	5.80	4.60	5.20	5.30	6.80	5.70	5.30	5.30	6.20
Kyllinga bulbosa Bea.	A	4.90	5.10	4.40	4.80	6.00	6.60	5.40	5.90	4.60	5.10	6.40	6.00	5.30	4.80
Grasses															
Cynodoon dactylon L.	A	6.40	6.60	8.00	7.20	6.80	5.80	5.40	5.90	6.00	6.80	6.40	6.00	6.10	5.50
Panicum maximum Jac.	A	4.20	4.40	7.10	6.30	5.30	5.10	4.60	5.20	3.90	5.10	4.90	4.60	6.10	6.20
Eragrostis ciliaris L.	A	6.40	5.80	6.20	5.50	5.30	5.80	5.40	5.90	6.00	6.00	5.70	5.30	6.10	5.50
Axonopus compressus Bea.	P	4.20	4.40	7.10	6.30	6.00	5.80	4.60	5.90	6.00	5.10	5.70	6.00	6.10	6.20
Broadleaves															
Euphoba heterophylla L.	A	6.40	5.80	3.50	5.50	6.00	5.80	6.20	5.20	6.00	5.10	5.70	6.00	6.10	5.50
Oldenladia. Herbacea L.	A	4.90	5.10	3.50	4.80	4.50	2.90	4.60	4.50	5.30	6.00	5.70	4.60	4.70	4.80
Phyllantus amarus Schum.	A	6.40	5.80	4.40	4.80	6.00	4.40	5.40	5.90	6.00	5.10	6.40	6.00	6.10	5.50
Triumfeta rhomboidea Jac.	P	2.10	4.40	3.50	4.00	3.00	5.80	5.40	4.50	3.90	5.10	4.90	4.60	6.10	4.10
Ipomoea involuncrata P.	A	6.40	6.60	4.40	4.00	4.50	4.40	4.60	5.20	6.00	5.10	4.90	4.60	3.30	4.80
Mitracarpos villosus DC.	A	6.40	5.80	4.40	4.80	4.50	5.80	3.90	5.20	6.00	5.10	4.90	6.00	5.30	5.50
Calapo mucunoides Desv.	P	6.40	6.60	8.00	6.30	6.80	6.60	7.00	5.90	6.00	6.00	6.40	6.00	6.10	6.20
Cleom rutidosperma DC.	A	6.40	6.60	5.30	6.30	5.30	5.10	7.00	5.90	6.00	6.00	5.70	5.30	5.30	6.20
Aspillia bussei O. Hoff	A	5.60	5.80	4.40	5.50	6.00	5.80	5.40	5.90	6.00	5.10	4.20	5.30	6.10	5.50
Gloriosa superba L.	A	3.50	4.40	7.10	7.20	6.80	6.60	7.00	5.90	5.30	5.10	6.40	6.00	6.10	5.50
Ageratum conyzoides L.	A	6.40	5.80	5.30	5.50	6.00	5.80	6.20	5.90	6.00	6.00	5.70	6.00	5.30	6.20
Caladum bicolor Vent.	P	6.40	5.80	8.00	6.30	6.00	5.80	7.00	5.90	6.00	5.10	6.40	6.00	5.30	6.20

Rating: < 1% = trace / rare; between 1 and 5% = low / occasional plants; between 5 and 25% = moderate/scattered plants; between 25 and 100% = high / dense (Maszura et al., 2018)

A = annual; P = perennial; CA = cassava @ 10,000 plants/ha; TM_1 = turmeric @ 66,666 plants/ha (30 cm x 50 cm spacing); TM_2 = turmeric @ 50,000 plants/ha (40 cm x 50 cm spacing); TM_3 = turmeric @ 40,000 plants/ha (50 cm x 50 cm spacing); TM_4 = turmeric @ 35,714 plants/ha (40 cm x 70 cm spacing); TM_5 = turmeric @ 28,571 plants/ha (50 cm x 70 cm spacing); CA_0 = sole cassava @ 10,000 plants/ha; TM_0 = sole turmeric @ 66,666 plants/ha (30 cm x 50 cm

Table 3: Relative abundance of weed species in the cropped area (%)

Weed species	Treatments	2020							2021						
		CA_0	TM_0	CA + TM_1	CA + TM_2	CA + TM_3	CA + TM_4	CA + TM_5	CA_0	TM_0	CA + TM_1	CA + TM_2	CA + TM_3	CA + TM_4	CA + TM_5
	Life cycle														
Sedges															
Kyllinga erecta Schum.	A	5.00	5.70	5.90	6.20	5.50	5.80	6.70	6.70	5.70	5.30	5.80	5.20	6.20	5.10
Kyllinga bulbosa Bea.	A	5.90	6.00	6.20	6.40	5.00	5.70	5.50	5.90	6.00	6.80	5.00	5.80	6.40	6.90
Grasses															
Cynodoon dactylon L.	A	6.00	5.50	4.90	6.20	6.60	7.10	8.80	5.90	6.50	6.00	7.90	7.30	7.50	7.70
Panicum maximum Jac.	A	8.10	8.40	5.70	6.10	6.80	7.70	9.90	5.40	7.30	5.40	6.30	7.10	6.40	6.60
Eragrostis ciliaris L.	A	4.90	4.80	4.50	4.70	4.50	5.10	4.10	4.80	5.30	5.00	4.60	4.50	3.80	3.70
Axonopus compressus Bea.	P	7.90	9.80	8.50	8.60	6.30	7.10	6.10	6.20	6.20	6.50	7.70	7.90	8.40	8.80
Broadleaves															
Euphoba heterophylla L.	A	3.70	3.60	5.70	4.10	5.90	4.10	5.20	5.00	4.50	4.40	3.80	4.30	3.90	4.20
Oldenladia. Herbacea L.	A	4.80	5.30	5.70	4.50	4.50	5.30	4.90	4.10	4.70	6.20	5.20	4.00	4.50	4.60
Phyllantus amarus Schum.	A	5.00	4.20	4.80	5.50	4.80	5.20	4.20	5.20	4.30	4.70	5.30	4.30	4.40	3.70
Triumfeta rhomboidea Jac.	P	6.90	5.00	6.00	5.40	6.70	4.80	4.20	7.30	5.40	5.40	4.30	5.20	4.30	5.80
Ipomoea involuncrata P.	A	4.10	4.20	7.10	5.20	4.50	4.00	4.30	4.00	4.00	3.70	3.90	4.60	3.40	3.90
Mitracarpos villosus DC.	A	3.70	3.90	4.50	4.10	4.90	3.70	5.20	4.10	4.00	4.00	4.50	4.30	3.90	4.00
Calapo mucunoides Desv.	P	5.10	5.10	4.10	5.00	5.90	6.40	5.50	5.40	6.10	5.20	6.30	5.50	6.20	5.50
Cleom rutidosperma DC.	A	5.50	5.00	5.20	4.70	4.70	4.40	4.30	5.20	6.50	4.60	3.90	4.20	4.40	3.90
Aspillia bussei O. Hoff	A	4.90	4.10	6.00	4.70	4.60	4.40	4.40	5.20	4.90	5.10	5.00	4.90	3.60	4.20
Gloriosa superba L.	A	7.60	7.20	5.00	4.80	4.80	6.40	5.00	6.90	5.50	7.20	6.00	6.40	6.80	6.50
Ageratum conyzoides L.	A	4.20	4.50	4.50	4.80	4.30	4.10	3.90	4.50	5.30	6.00	4.80	4.00	3.90	4.10
Caldum bicolor Vent.	P	6.90	7.50	5.80	9.10	9.10	8.80	7.80	8.20	7.90	10.10	9.60	10.00	11.90	10.70

Rating: < 1% = trace / rare; between 1 and 5% = low / occasional plants; between 5 and 25% = moderate/scattered plants; between 25 and 100% = high / abundant (Maszura et al., 2018)

A = annual; P = perennial; CA = cassava @ 10,000 plants/ha; TM_1 = turmeric @ 66,666 plants/ha (30 cm x 50 cm spacing); TM_2 = turmeric @ 50,000 plants/ha (40 cm x 50 cm spacing); TM_3 = turmeric @ 40,000 plants/ha (50 cm x 50 cm spacing); TM_4 = turmeric @ 35,714 plants/ha (40 cm x 70 cm spacing); TM_5 = turmeric @ 28,571 plants/ha (50 cm x 70 cm spacing); CA_0 = sole cassava @ 10,000 plants/ha; TM_0 = sole turmeric @ 66,666 plants/ha (30 cm x 50 cm spacing)