World Journal of Agricultural Sciences 6 (5): 473-479, 2010
ISSN 1817-3047

Altering the Time of Intercropping Cowpea (*Vigna unguiculata* (L.) Walp.) Relative to Maize (*Zea mays* L.): A Food Production Strategy to Increase Crop Yield Attributes in Adamawa-cameroon

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Abstract: Intercropping is the simultaneous cultivation of more than one crop species on the same piece of land and is regarded as the practical application of basic ecological principles such as diversity, competition and facilitation. Field investigations were carried out in 2007 and 2008 in Ngaoundéré to examine yield attributes when cowpea and maize were planted under pure and intercropping conditions. Additive mixtures of cowpea were planted into maize at 2 and 4 weekly intervals. The time of introducing cowpea into maize significantly affected the yield attributes of cowpea. Simultaneous planting generally and significantly ($p < 0.001$) showed increased pod and cowpea seed yield compared to cowpea/maize intercropping systems, and when the time of introducing cowpea into maize was delayed by 2 or 4 weeks, irrespective of the cowpea varieties used. Positive and significant correlations existed between all the yield attributes of cowpea, as well as between cowpea and maize yields. Our results suggest that pure cowpea culture or simultaneous cowpea/maize cropping could be recommended if cowpea yield benefits are to be achieved, or if the crude protein content of maize needs to be supplemented.

Key words: Cowpea · Maize · Intercropping · Yield attributes · Adamawa

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is among the most important grain legumes grown in the tropics and sub-tropics [1]. The crop is particularly important in Africa, Nigeria being the largest producer [2]. In the sudano-guinea savannah of Cameroon that extends from Adamawa to the Far North regions, it is one of the widely cultivated and consumed grain legumes. Investigations reported have revealed that 78% of farmers in the Far north, 48% in the North, and a very small proportion in the Adamawa region intensively cultivate this crop [3]. However, it is mainly grown in the eastern and western regions, where the leaves, green pods and dried grains are eaten in various forms [4]. In all these regions, cowpea is generally grown in pure culture or intercropped with a large number of traditional crop species especially maize, sorghum, cassava and soybeans [5]. Apart from the direct contribution to livestock production through the provision of protein-rich fodder, cowpea can improve the productivity of cereal crops by increasing the amount of nitrogen available for uptake [6]. Reasons for intercropping vary, depending on individual farmer production goal, but invariably include more crops at harvest, improved yields, increased soil fertility, insurance against total crop failure, lack of growing areas due to agro-pastoral conflicts that constraint growers to resume several culture on the same fenced plot, or the system that reduce the risk of plant attacks by the same pathogens or pests. In Cameroon, yields usually range from 300 to 500 kg/ha, just a fraction of the estimated potential yield of over 2 t/ha [7]. In East Africa, average hectares under cowpea per family are usually very small (< 1 ha), while yields are generally low, often < 300 kg/ha, although yields as high as 4000 kg/ha can be achieved with better crop husbandry [8]. Although pests are the most important constraints in cowpea production in the tropics [9-11], poor agronomic practices significantly contribute to reduced yield [12]. In growing areas, poor weed control, untimely planting and low plant

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populations further curtail yield [13, 14]. Although adopted by most growers, intercropping is, however, defavorable to growers as far as growth and crop yields are concerned, due to high pod losses under the shadow of the competitive leaves, spoilage of seeds when maturity occurs in the rainy season. There is little information about the optimal time to introduce cowpea into various crops. Evidence from other cropping systems, however, suggest that improved resource utilization and hence, increased yield can be achieved with proper manipulation of time of planting [15]. Therefore, the objective of this study was to investigate on the times of planting cowpea in association with maize in order to minimize cowpea and the intercrop yield looses.

MATERIALS AND METHODS

Study Area: Experiments were conducted at Selbé Darang and Wakwa in the Department of Vina in the Adamawa province. The experimental sites were located at 1113 m altitude, 13°34'latitude, and 7°21 N longitude [16], and were characterized by a tropical altitude climate of guinea type with two seasons and abundant precipitations (1539.3 mm/year, from April to October). The mean temperature is 22°C with a maximum in May at 34.6°C and a minimum in January at 9.9°C. Soils are ferruginous and were originated from basaltic and granitic rock with pH ranging from 5.5 to 6.5. The C/N ratios are elevated on the surface (15 to 18) [17]. The ion exchange capacity does not exceed 12 meq/100g on the surface and 6 to 8 meq/100g at the depth.

Biological Material: Wo cowpea varieties and one maize variety were used in this experiment. The two cowpea varieties were A222-14 (white seeds and flowers, erected, 85-100 days to maturity) and IT97K-818-28 (white seeds and flowers, semi-erected, 90-100 days to maturity). Both seeds were obtained from the Institute of Research and Agricultural Development (IRAD) of Maroua. The Shaba maize variety (120 days to maturity) used was under vulgarization in the region.

Experimental Design and Treatments Experiments were carried out from June to November 2007 and 2008 and were arranged each year in four randomized complete blocks design (RCBD) repeated in two different study sites (Selbe-Darang and Wakwa). Each experimental unit was a (8 x 6) m^2 plot per treatment. Three dates of planting cowpea relative to maize were investigated. Each cowpea variety was grown as sole crop and as intercrop with maize. Treatments were considered as follows: T_0, in which cowpea was grown as sole crop; T_1, in which cowpea and maize were, planted simultaneously; T_2, in which cowpea was planted 2 weeks after maize; T_3, in which cowpea was planted 4 weeks after maize.

Cowpea was sown on lines in the two sites on the 7th of June 2007 and 9th of June 2008, at a density of 50.000 cowpea plants/ha (80 cm apart and 25 cm between plants), and 25.000 maize plants/ha (80 cm apart and 50 cm between plants).

Assessment of Yield Attributes: Sampling was carried out twice during the growth phase: at the beginning of flowering with the appearance of flower buds, and at 90% pods maturity. The first sampling was used to assess the dry weight, while the second served for the measurement the harvest index. The vegetative part of randomly selected plants was cut and separated in stems, branches, leaves, reproductive organs and pods). An electronic balance (Metter Toledo) was used to determine the fresh weight (FW) of different organs. All these organs were dried at 105°C for 24h in an air dry oven. Dried samples were allowed to cool in a dessicator and their dry mass (DM) determined. The difference between the DM and the FM was used to calculate the water content as follows:

$$\text{Water content} = (\text{FM-DM/FM}) \times 100.$$

The harvest index (HI) was then calculated through the formula [18]: $HI = (SdW/StW) \times 100$,

Where, SdW is the seed weight and StW, the shoot weight.

At harvest, the average number of pods per plant (NPPt) was quantified on 10 randomly selected plants per plot. The number of seeds per pod (NSPd) was determined by threshing 20 pods selected randomly from the sampled plants. Then, the number of seeds per plant (NSPt) was the product (NPPt x NSPd). The 100-seed weight (100-SW) was evaluated by weighing a random sample seeds from experimental units using an electronic balance. Seed yield was then quantified as the product (NSPt x 100-SW). For maize, the 1000-seed weight and grain yield per experimental unit were assessed.

Statistical Analysis: Data collected were subjected to analysis of variance (ANOVA) procedures. Means were separated between treatments with the Fisher's Least Significant Difference (LSD) test at 5% level of probability, using a Statgraphic Plus, version 5.0 (SIGMA

PLUS) computer package. Comparisons were made between treatments of the same year. The Statistical Package for Social Sciences (SPSS) program was used to assess correlations between yield attributes of crops.

RESULTS AND DISCUSSION

Figure 1 indicated that when each of the two cowpea varieties was planted as sole crop or simultaneously with maize, the harvest index was significantly greater ($p < 0.001$) than when cowpea was planted 2 or 4 weeks after maize. For any of the cropping year, the harvest index was the lowest (17.79 and 15.29, respectively for A2214 and IT97K varieties) when cowpea was planted 4 weeks after maize. Defined as the ratio of the seed dry weight over the shoot dry weight at maturity, the harvest index has been used as the selection criteria for yield improvement of cultivated crops [19]. Thus, the harvest index has been shown to vary with the shoot dry weight and the environmental conditions, and is considered as a genotypic characteristic [20].

Growing cowpea as sole crop or simultaneously with maize significantly increased the number of cowpea pods per plant at harvest than when cowpea was planted 2 and 4 weeks after maize (Table 1). There was no significant difference in pods number produced per plant, whereas cowpea was planted 2 or 4 weeks after maize. Cowpea grown in pure culture produced up to 29 and 22 pods/plant for A2214 and IT97K varieties, respectively, against only 12 and 13 when cowpea was planted 4 weeks after maize. The lowest number of pods per plant recorded in cowpea planted 2 and 4 weeks after maize has been attributed to shading effect of the taller component crop (maize), which obstructed solar radiation from penetrating into the lower cowpea canopy [14]. Similar results were reported in cowpea maize intercropping [21].

Results in Table 2 demonstrated that the weight of 100 seeds was significantly increased ($p < 0.001$) when cowpea was grown as sole crop, simultaneously with maize or 2 weeks after planting maize, compared to when cowpea was planted 4 weeks after maize. In cowpea sole crop, the weight of 100 seeds was not necessarily the main factor involved in seeds yield [22], but the number of seeds per pod. The number of seeds per pod was found to correlate with the number of pods per plant and the seed yield, revealing their importance as the main components contributing to increased seed yield [23].

During the first cropping year, no treatment showed a significant effect on the number of seeds per pod for cowpea variety A2214, although treatments T_0 and T_1 significantly increased the number of seeds/pod during the second cropping year for the same variety (Fig. 2).

Table 1: Effect of the time of planting cowpea relative to maize on the number of cowpea pod per plant

	Year 2007		Year 2008	
Treatments	Var A2214	Var IT97K	Var A2214	Var IT97K
T_0	30.35^{b}	21.35^{bc}	28.65^{b}	23.5^{bc}
T_1	27.45^{b}	23^{c}	25.35^{b}	27.8^{c}
T_2	17.05^{a}	17.55^{b}	17.45^{a}	19.15^{ab}
T_3	12.85^{a}	11.5^{a}	13.75^{a}	15.6^{a}
LSD 5%	10.4**	5.45**	7.9**	7.9**

T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

Table 2: Effect of the time of planting cowpea relative to maize on 100 cowpea seed dry weight

	Year 2007		Year 2008	
Treatments	Var A2214	Var IT97K	Var A2214	Var IT97K
T_0	19.8^{c}	17.31^{bc}	15.11^{c}	19.54^{c}
T_1	17.62^{b}	18.77^{c}	14.37^{bc}	18.31^{bc}
T_2	16.36^{b}	15.87^{b}	13.94^{b}	17.3^{b}
T_3	13.43^{a}	12.26a	12.08^{a}	13.56^{a}
LSD 5%	2.18	2.9	1.16	2.24

T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

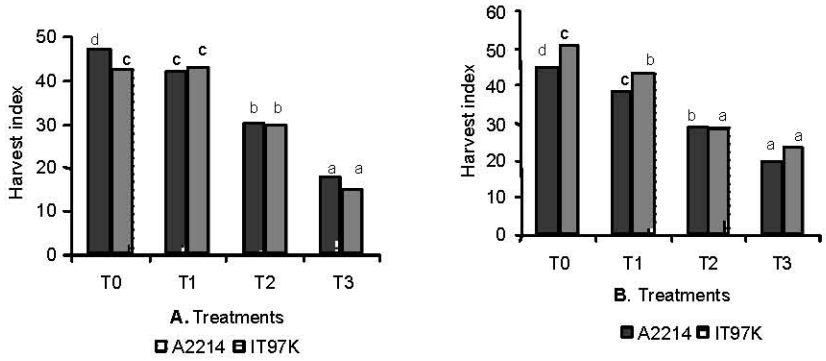

Fig. 1: Effect of the time of planting cowpea relative to maize on the harvest index of cowpea during the 2008 (A) and 2007 (B) cropping season
T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

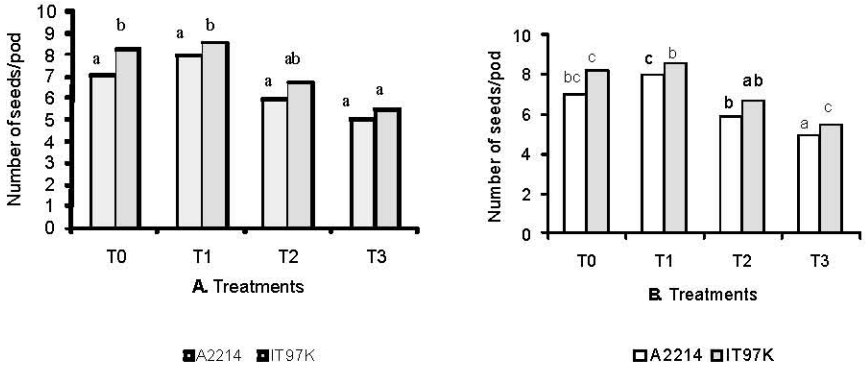

Fig. 2: Effect of the time of planting cowpea relative to maize on the number of cowpea seed per pod during the 2008 (A) and 2007 (B) cropping season
T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

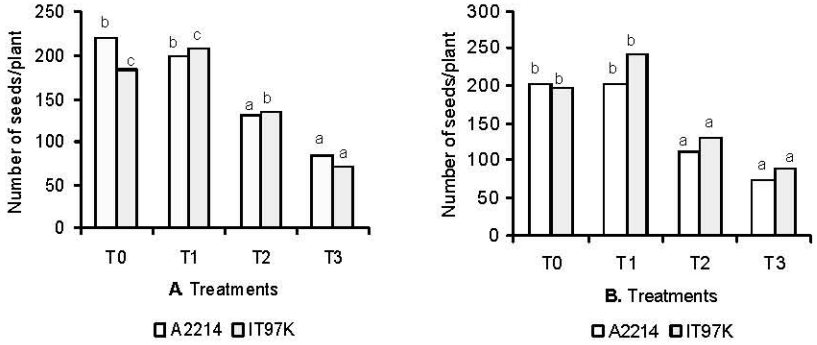

Fig. 3: Effect of the time of planting cowpea relative to maize on the number of cowpea seed per plant during the 2008 (A) and 2007 (B) cropping season.
T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

Table 3: Effect of the time of planting on yields of cowpea and maize at harvest

	Yield of cowpea					
	Year 2007		Year 2008		Yield of maize	
Treatments	Var A2214	Var IT97K	Var A2214	Var IT97K	Year 2007	Year 2008
T_0	44.48^{c}	32.19^{bc}	30.62^{b}	37.92^{c}	459.53^{c}	481.56^{c}
T_1	35.16^{c}	39.88^{c}	29.14^{b}	44.33^{c}	440.77^{b}	458.69^{c}
T_2	21.66^{b}	23.11^{b}	15.79^{a}	23^{b}	387.17^{a}	388.99^{b}
T_3	11.07^{a}	8.99^{a}	9.23^{a}	11.8^{a}	282.25^{a}	285.75^{a}
LSD 5%	10.59	14.11	13.35	11.19	53.6	69.7

T_0: treatment in which cowpea was planted as sole crop; T_1: treatment in which cowpea and maize were planted simultaneously; T_2: treatment in which cowpea was planted 2 weeks after maize; T_3: treatment in which cowpea was planted 4 weeks after maize. Values of a variety for a growing year follow by the same letter are not different at 5% level of significance

Table 4: Correlations between yield attributes during the 2007 cropping season

	HI	NPPt	100 Sdw	Cowpea yield	Maize yield
NPPt	r = 0.525**				
	p < 0.001				
100 Sdw	r = 0.592**	r = 0.362**			
	p < 0.001	p < 0.001			
Cowpea yield	r = 0.630**	r =0.796	r = 0.656**		
	p < 0.001	p < 0.001	p < 0.001		
Maize yield	r = 0.710**	r = 0.484**	r = 0.521**	r = 0.538**	
	p < 0.001	p < 0.001	p < 0.001	p < 0.001	
NSPd	r = 0.308**	r = 0.102^{ns}	r = 0.271**	r = 0.503**	r = 0.256**
	p < 0.001	p = 0.201	p < 0.001	p < 0.001	p < 0.001

HI = Harvest Index; NPPt = Number of Pods per Plant; 100-Sdw = 100 seed dry weight; NSPd = Number of Seeds per pod; ** denotes highly significant correlations; ns denotes non significant correlations.

Table 5: Correlations between yield attributes during the 2008 cropping season

	HI	NPPt	100 Sdw	Cowpea yield	Maize yield
NPPt	r = 0.459**				
	p < 0.001				
100 Sdw	r = 0.437**	r = 0.200**			
	p < 0.001	p < 0.001			
Cowpea yield	r = 0.534**	r = 0.784**	r = 0.540**		
	p < 0.001	p < 0.001	p < 0.001		
Maize yield	r = 0.644**	r = 0.366**	r = 0.492**	r = 0.492**	
	p < 0.001	p < 0.001	p < 0.001	p < 0.001	
NSPd	r = 0.391**	r = 0.347**	r = 0.351**	r= 0.367**	r = 0.367**
	p < 0.001	p < 0.001	p < 0.001	p < 0.001	p < 0.001

HI = Harvest Index; NPPt = Number of Pods per Plant; 100-Sw: 100 seed weight; NSPd = Number of Seeds per pod; ** denotes highly significant correlations

Conversely, the number of seeds/pod from treatments T_0 and T_1 was significantly greater than that of treatments T_2 and T_3 for cowpea variety IT97K in each of the 2007 and 2008 cropping year.

For both cowpea varieties, the number of cowpea seeds per plant was significantly increased by pure culture or the simultaneous cropping of cowpea with maize (Fig. 3). This was more pronounced for treatments T_1 of A2214 and IT97K cowpea varieties. Cowpea planted with four weeks delay after maize generally resulted in low harvest index, low pods per plant, low seeds per pod, low seeds per plant and low seed weight. When cowpea was sown as pure culture, the harvest index, the number of pods per plant and the 100 seeds dry weight of the variety A2214 were significantly greater than those of the variety IT97K. During the two growing seasons, these two cowpea varieties did not significantly differ as far as all the other yield attributes are concerned when cowpea was sown with two or four weeks delay after maize.

Cowpea planted as pure culture (treatment T_0), simultaneously with maize (treatment T_1) or with 2 weeks delay after maize (treatment T_2) significantly improved cowpea and maize yields than cowpea planted 4 weeks after maize (treatment T_3). Whereas, the pure maize culture increased the maize yield more than the simultaneous cowpea-maize culture during the first year, there was no

significant difference between the maize yields from treatment T_0 and T_1 during the second cropping year (Table 3). Similar yield increment was obtained from intercropping cereal crops with forage legumes [24, 25], or with grain legumes [26]. Maize yields were on the other hand not significantly affected by the inclusion of cowpea. This is because of the height advantage it has compared to cowpea. In cowpea/millet intercropping the millet canopy was reported to interfere with light penetration and thus, the yields of intercropped cowpea were reduced [15]. The situation is worse especially when cowpea planting was delayed relative to millet. These findings are similar to the present results in cowpea-maize intercropping, and are in agreement with Obuo *et al.* [12] that revealed better yield advantage when sorghum was intercropped with a semi-spreading cowpea cultivar than an erected cultivar, or in millet-cowpea intercropping [26].

Data in Table 4 and 5 indicates that positive and significant correlations ($0.271 = r < 0.799$; $p < 0.001$) were found between the yield attributes of cowpea during the two cropping seasons, as well as between cowpea and maize yield ($r = 0.200$; $p < 0.001$). In contrast, there was no significant correlation ($r = 0.102$; $p = 0.201$) between the number of cowpea pods per plant and the number of seeds per pod. This is obvious since fewer pods can yield higher seeds than higher pods and vice versa.

CONCLUSION

The present results demonstrated that there is a scope for farmers to increase cowpea and system productivity in the Guinea-savannah by intercropping maize with medium maturing improved cowpea varieties such as IT97K and A2214. The productivity of the system could further be enhanced by adopting simultaneous culture of maize and cowpea, which increased cowpea productivity without decreasing that of maize and/or offered an opportunity for selective input application. Intercropping practices offer many advantages, but improved understanding of the ecological mechanisms associated with planned spatial diversity, including associated additional benefits, is needed to enhance the benefits achieved.

ACKNOWLEDGEMENTS

The authors wish to thank all the technicians who help in establishing the field experiments, and controlling plants from the devastating effects of birds and animals.

REFERENCES

1. Jackai, L.E.N. and C.B. Adalla, 1997. Pest management practice in cowpea: a review. In: *Advances in Cowpea Research*, eds. Singh, B.B., D.R. Mohan Raj, K.E. Dashiell, and L.E.N. Jackai, pp: 240-258. Co-publication by International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agriculture and Science (JIRCAS), IITA, Ibadan, Nigeria.
2. Iceduna, L.C., E. Adipala and M.W. Ogenga-Latigo, 1994. Evaluation of 80 cowpea lines for resistance to scab, *Sphaceloma* sp. Afric. Crop Sci. J., 2: 207- 214.
3. Ta'Ama, M., 1986. *Highlights of five years of cowpea research in Cameroon*. IRA, Bean-cowpea CRSP, Maroua, pp: 13.
4. Parh, I.A., 1997. A preliminary study on documentation of cowpea cultivar, cowpea cropping seasons and major insect pests in the South-western Forest and Western Derived Savannah Zones of Cameroon. Cam. J. Biol. Biochem. Sci., VII(2): 27-36.
5. Ntoukam, G., M. Ta'Ama, L. Kitch, C. Endongo, O. Boukar, and J. Detongnon, 1993. Cowpea production and storage in the Semi-arid area of Cameroon, Africa. Production Guide, Institute of Agronomic Research, Cameroon, pp: 1-8.
6. Giller, K.E., 2001. *Nitrogen Fixation in the Tropical Systems*. 2nd Edition CABI: Wallingford, UK, pp: 150-300.
7. Singh, B.B., O.L. Chambliss and B. Sharma, 1997. Recent Advances in Cowpea Breeding. In: *Advances in Cowpea Research*, Singh, B.B., D.R. Mohan Raj, K.E. Dashiell and L.E.N., Jackai (Eds.), pp: 30-49. IITA, Ibadan, Nigeria.
8. Rusoke, D.G. and P.R. Rubaihayo, 1994. The influence of some crop protection management practices on the yield stability of cowpeas. Afric. Crop. Sci. J., 2: 43- 48.
9. Jackai, L.E.N. and R.A. Daoust, 1986. Insect pests of cowpeas. Ann. Rev. Entomol., 31: 95-119.
10. Sabiti, A., E. Nsubuga, E. Adipala and D.S. Ngambeki, 1994. Socio-economic aspects of cowpea production in Uganda: A Rapid Rural Appraisal. Uganda J. Agric. Sci., 2: 29-38.
11. Omongo, C.A., M.W. Ogenga-Latigo, S. Kymanywa and E. Adipala, 1997. The effect of seasons and cropping systems on the occurrence of cowpea pests in Uganda. Afric. Crop Sci. Conf. Proc., 3: 1111-1116.
12. Obuo, J.E., E. Adipala and D.S.O. Osiru, 1998. Effect of plant spacing on yield advantages of cowpea-sorghum intercrop. Trop. Sci., 38: 1-7.

13. Parh, I.A., 1999. Insect pests incidence on cowpea in the Cameroonian Southwest Forest and Western Derived Savannah zones, their contribution to yield loss in Foumbot and their control. Tropicultura, 16-17(2): 83-88.
14. Adipala, E., C.P. Ocaya and D.S.O. Osiru, 2002. Effect of time of planting cowpea (*Vigna unguiculata* (L.) Walp.) relative to Maize (*Zea mays* L.) on growth and yield of Cowpea. Tropicultura, 20(2): 49-57.
15. Reddy, K.C. and P.L. Visser, 1997. Cowpea intercrop growth and yield as affected by time of planting relative to millet. Afric. Crop. Sci. J., 5: 351-357.
16. Boutrais, J., 1978. *Two Studies on Breeding in the Tropical Humid Zone of Cameroon.* ORSTOM, Paris, pp; 194.
17. Rippstein, G., 1985. *Study on the vegetation of Adamawa. Evolution, conservation, regeneration and improvement of a pasture ecosystem in au Cameroon. Study and Synthesis of I.E.M.V.T.* No 14. Alfort House, Paris. pp: 1136.
18. Julier, B., C. Hughe and J. Papineau, 1993. Dry matter, nitrogen accumulation and seed yield in determinate autumn sown white lupinus (*Lupinus albus* L.). Agronomie, 13: 335-352.
19. Le Gouis, J., 1993. Grain filling and shoot growth of 2-row winter barley varieties. Agronomie, 13: 545-552.
20. Singh, B.B., Y. Mai-Kodomi, and T. Terao, 1999. A simple screening method for drought tolerance in cowpea. Indian J. Gen., 59(2): 211-220.
21. Wahua, T.A.T., O. Babalola and M.E. Aken'Oven, 1981. Intercropping morphologically different types of maize with cowpeas: LER and growth attributes of associated cowpea. Exp. Agric., 17(4): 407- 413.
22. Ngakou, A., 2007. Potential of selected biofertilizers and a mycopesticide in managing *Megalurothrips sjostedti* and improving cowpea production in Cameroon. PhD thesis, Department of Biochemistry and Microbiology, University of Buea, Cameroon., pp: 197.
23. Siddique, A.M.R. and S.N. Gupta, 1992. Path coefficient analysis of yield components in cowpea (*Vigna unguiculata* (L.) Walp.). Ann. Biol., 8: 77-80.
24. Mpairwe, D.R., E.N. Sabiiti N.N. Ummuna, A. Tegegn and P. Osuji, 2002. Effect of Intercropping cereal crops with forage legumes and source of nutrients on cereal grain yield and fodder dry matter yields. Afric. Crop. Sci. J., 10(1): 81-97.
25. Ngongoni, N.T., M. Mwale, C. Mapiye, M.T. Moyo, H. Hamudikuwanda and M. Titterton, 2007. Evaluation of cereal-legume intercropped forages for smallholder dairy production in Zimbabwe. Livest. Res. Rural Dev., 19 (9): *Article #129. Retrieved March 22, 2010, from http:// www.l rrd.org/ lrrd19/ 9/ ngon19129.htm*
26. Mohammed, I.B, O.O. Olufajo, B.B. Singh, K.O. Oluwasemire and U.F. Chiezey, 2008. Productivity of Millet/Cowpea Intercrop as Affected by Cowpea Genotype and Row Arrangement. World J. Agric. Sci., 4(S): 818-824.