INNSPUB

International Journal of Agronomy and Agricultural Research (IJAAR)
ISSN: 2223-7054 (Print) 2225-3610 (Online)
http://www.innspub.net
Vol. 5, No. 6, p. 1-8, 2014

RESEARCH PAPER OPEN ACCESS

Influence of intercropped groundnut (*Arachis hypogaea*) on the performance of weed control treatments in maize production

S.T.O. Lagoke, E. Eni, J. A. Adigun, B. B. Phillip

Department of Plant Physiology and Crop production, Federal University of Agriculture, Abeokuta, Nigeria

Article published on December 18, 2014

Key words: Intercropped groundnut, maize, weed control.

Abstract

Field trials were conducted in 2007 and 2008 early and late wet seasons, respectively at the Federal University of Agriculture Abeokuta (07º 20`N, 3º 23`E) in the forest-savanna transition agroecological zone of South-western Nigeria. Five weed control treatments viz pre-emergence application of commercial formulation of metolachlor plus prometryne (Codal Gold^{R}, 412 EC) at 1.6kg a.i/ha alone, 1.6kg a.i/ha followed by supplementary hoe weeding at 6 weeks after planting (WAP), 2.4kg a.i/ha, two hoe weedings at 3 and 6 WAP and a weedy check were assigned to the main plots while intercropping methods which included four combinations of groundnuts between rows of maize spaced at 50cm and 75cm, as well as sole crops of maize and groundnut constituted the sub-plot treatments. Intercropped groundnut significantly suppressed weed infestation compared with the sole crops of maize and groundnut. Weed infestation was consistently lower in maize planted at intrarow spacing of 75cm in mixture with three groundnut stands in the inter-row between two maize stands and maize planted at 50cm in similar mixture with two groundnut stands compared with the other cropping methods. In both years of study, maximum cob and grain yields were obtained with sole maize spaced at 50cm within rows. Intercropped maize at 75cm produced grain yield comparable to the corresponding sole crop in both years. Intercropped groundnut in maize spaced at 50cm significantly reduced grain yield of maize in 2007 and non-significantly in 2008 compared to the corresponding sole crop. All the weed control methods evaluated resulted in significantly lower weed cover score than the weedy check.

* **Corresponding Author:** E. Eni ✉ Eni, Enor favour206@yahoo.com

Introduction

Maize (*Zea mays L.*) ranks second to wheat among the world's cereal crops and first in Africa (IITA, 2000). It is one of the most important cereal crops in Nigeria (Adigun and Lagoke, 1999). Nigeria is the largest producer of maize in Africa with nearly 8 million tonnes (IITA, 2009). The total land area planted to maize in Nigeria is about 3.3 million hectares with an estimated yield of about 2.2 tonnes per hectare (FAOSTAT, 2011). Maize is a major source of carbohydrate (3434 Kcal/kg of metabolic energy (Job, 1993). Maize can be baked, roasted or boiled for consumption. It is used as adjunct in brewery industries and in compounding livestock feeds (IITA, 2000; 2009). In spite of the various uses of maize in Nigeria, maize production has been greatly constrained by several factors which include: use of low yielding local varieties, low soil fertility, drought, diseases, pests and weed problems. Of all the constraints limiting maize production in Nigeria, weeds are the most deleterious causing 69-92% reduction in grain yield (Lagoke, 1978; Lagoke *et al.*, 1981, Magani, 1990). Hoe-weeding which is the traditional method of weed control is plagued with many problems because it is slow, tedious, labour-intensive, time consuming and may be expensive due to non-availability of labour particularly at the peak of farming season (Ogungbile and Lagoke, 1986; Adigun *et al.*, 1992). Although weed control by herbicide is known to cut down on labour requirements and enhances precision, it's use may often require special skill and supplementary hoe weeding to control later emerging weeds thus imposing additional cost on the farmer.

The use of low growing legume cover crop to supplement other control measures for season long weed control have been suggested by various workers (Akobundu, 1987; Udensi *et al.*, 1999; Isah, 2002; SP-IPM, 2003; Badmus *et al.*, 2006; Ojelade, 2004; Giwa, 2007). There is however paucity of information on the use of groundnut in this regard. Apart from improving soil productivity, the use of groundnut, as food legume, as a supplementary weed control cover crop in mixture with maize would provide additional source of plant protein. The use of groundnut as a food legume and as a cover crop for supplementary weed control will be attractive to farmers, being a major source of vegetable oil and protein of most Nigerians. Groundnut intercropped with maize has been reported to significantly reduce *Striga* incidence compared with soybean intercrop (Isah, 2002). Groundnut grown within row mixture with maize effectively controlled weeds but maize grain yield was reduced as a result of inter-specific competition between the component crops (Badmus, 2005). The objective of this study therefore was to determine a suitable spatial arrangement of maize and groundnut mixture that will facilitate effective weed control devoid of inter-specific crop competition for the available resources in the system.

Materials and methods

Description of Experimental Site and Design

Field trials were conducted in 2007 and 2008 early and late wet seasons respectively at the Federal University of Agriculture Abeokuta (07° 20`N, 3° 23`E) in the Forest-Savanna Transition agroecological zone of South-western Nigeria. Details of the physico-chemical properties and weed flora are contained in Tables 1 and 2. In both trials, the land was ploughed and harrowed at two weeks interval. The treatments consisted of two factors laid out in a split plot arrangement in a randomized complete block design in three replicates. The main plot treatments were five weed control treatments viz pre-emergence application of commercial formulation of metolachlor plus prometryne (Codal Gold, 412 EC) at 2.4kg a.i/ha alone, 1.6kg a.i/ha alone, 1.6kg a.i/ha followed by (fb) one supplementary hoe weeding (SHW) at 6 weeks after planting (WAP), two hoe weeding at 3 and 6 WAP and a weedy check. While the sub plot treatments consisted of four combinations of groundnut stand density between rows of maize spaced at 50cm (one and two) and 75cm (two and three), sole crops of maize spaced at 50cm and 75cm as well as sole groundnut spaced at

25cm within rows. The intercropped groundnut stands were also spaced within the rows at 25cm.

Table 1. Soil physico-chemical characteristics at the experimental site in the Forest-Savanna Transition agroecological zone of South-western Nigeria.

Soil Composition	**% level composition**	
	2007	**2008**
(Particle size analysis)		
Sand	72.7%	81.6%
Silt	10.7%	10.2%
Clay	16.6%	8.2%
Textural class	sandy-loam	sandy-loam
Chemical composition		
Organic carbon	2.54%	2.07%
Available P	8.74ppm	0.16ppm
Total N	0.18%	0.21%
Total K	0.48%	0.72%

Table 2. Common weed flora at the experimental site and their occurrence in the Forest-Savanna Transition agroecological zone of South-western Nigeria.

Weed species	**Level of infestation**	
	2007	**2008**
Broadleaves		
Talinum triangulare (Jacq.) Willd	+	+
Commelina bengalensis (L.)	++	+
Tridax procumbens (L.)	++	++
Euphorbia heterophylla (L.)	+++	++
Euphorbia hirta (L.)	++	+
Centrosema pubescens Benth.	+	+
Physalis angulata (L.)	+	+
Grasses		
Panicum maximum Jacq.	+++	++
Imperata cylindrica (L.) Raeuschel.	+	+++
Rottboellia cochinchinensis (Lour.) Clayton	+	++
Eleusine indica (L.)	++	+
Digitaria horizontalis (Willd.)	+	+
Sedges		
Cyperus esculentus (L.)	+	+
Cyperus rotundus (L.)	+	+

+++ = High infestation (60-90% occurrence)

++ = Moderate infestation (30-59% occurrence)

\+ = Low infestation (1-29% occurrence)

Cultural Practices

Four and five dressed seeds of maize were planted per hill at intra-row spacing of 50cm and 75cm, respectively on rows spaced at 75cm apart. The stands were later thinned to 2 and 3 plants per stand for 50cm and 75ccm intra-row spacings, respectively, at 3

weeks after sowing. Maize variety TZL Comp. 1-STR SYN-Y was planted in the early wet season of 2007 while DMR-ESR-Y an early maturing variety was planted in the late wet season of 2008. Groundnut (variety RMP 91) was planted in both years.

The gross and net plot sizes were 4.5m x 4.5m and 3m x 3m respectively for plots with maize spaced at 75cm while the net plot size for plots with maize spaced at 50cm were 3m x 3.5m. Fertilizers were applied at the rate of 100kg N/ha, 50kg per hectare each of P_2O_5 and K_2O. All herbicide treatments were applied pre-emergence one day after planting in a spray volume of 250l/ha using a CP3 knapsack sprayer with a green deflector nozzle at a pressure of 2.1kg/cm^2. Hoe-weeding was carried out on appropriate plots at 3 and 6WAP using West African hand hoe. Weeding operation was preceeded by weed cover score assessment and sampling.

Data Collection and Analysis

Data collected included plant height, leaf area, vigour score, dry matter production and grain yield of maize; groundnut cover score and pod yield: weed cover score and dry matter production. All data collected were subjected to analysis of variance and treatment means were compared using Duncan Multiple Range Test. Correlation coefficient analysis was carried out to determine the relationships among various parameters.

Results and discussion

With the exception of Codal at 2.4kg ai/ha in 2007, the four weed control methods evaluated resulted in similar vigour scores and grain yields of maize that were significantly higher than those of the weedy check in both years (Table 3).

Table 3. The effect of weed control treatments and cropping pattern on crop vigour and yield in 2007 and 2008 in the forest-savanna transition agroecological zone of South-Western Nigeria.

	CROP VIGOUR SCORE AT 9WAP				CROP YIELD			
	Maize		Groundnut		Maize grain		Groundnut pod	
TREATMENT	2007	2008	2007	2008	2007	2008	2007	2008
Weed control method (C)								
Codal at 2.4kg a.i/ha	7.3ab	7.3a	6.4ab	5.4a	2832a	1484a	248b	92bc
Codal at 1.6kg a.i/ha alone	7.5a	7.2a	6.2ab	5.8a	2714a	1605a	262b	108b
Codal at 1.6kg a.i/ha fb[1] SHW[2]	7.4a	7.4a	6.7a	6.1a	2535a	1559a	439a	230a
Hoe-weeding at 3 and 6WAP[3]	7.5a	7.3a	6.1ab	6.5a	2642a	1736a	410a	191a
Weedy Check	6.7b	6.1b	5.9b	0.32b	2151b	1113b	204b	44c
SE+	0.16	0.32	0.20	0.56	106.4	113.6	40.4	17.4
Cropping pattern (P)								
75cm maize + 2 groundnut	7.0c	6.9ab	5.8b	5.1b	2593b	1323c	216bc	78b
75cm maize + 3 groundnut	7.1bc	6.6b	6.4b	5.3b	2547b	1190c	287b	98b
50cm maize + 1 groundnut	7.2bc	7.1ab	5.3b	4.5c	2448b	1605ab	159c	66b
50cm maize + 2 groundnut	7.4ab	7.3a	6.3b	5.6b	2567b	1677a	130c	43b
75cm Sole maize	7.4ab	6.9ab	-	-	2396b	1397bc	-	-
50cm sole maize	7.6a	7.4a	-	-	2922a	1804a	-	-
Sole groundnut	-	-	7.6a	6.2a	-	-	770a	381a
SE+	0.13	0.18	0.19	0.18	106.7	84.7	45.2	18.5
SE + (Interaction) CxP	0.29NS	0.41NS	0.42NS	0.40NS	238.6NS	189.5NS	101.0NS	41.3NS

1. fb = Followed by 2. SHW = Supplementary hoe weeding 3. WAP =Weeks after planting

4. Means followed by the same letter(s) within the same column and treatments are not significantly different at 5% level probability (DMRT) 5. NS = Not significant at 5% level of probability.

Similarly all the weed control treatments in 2008 and Codal at 1.6kg a.i/ha fb SHW in 2007 resulted in similar vigour score of groundnut that were significantly higher than those of corresponding weedy check. Furthermore, groundnut pod yields of plots hoe-weeded twice and those given supplementary hoe-weeding to preemergence herbicide treatments were significantly higher than those of all the other treatments without any hoe-weeding in both years. The supplementary hoe weeding at 6WAP improved the performance of groundnut as earlier reported by Adigun (2002), Badmus (2005), Giwa (2007), and Adebomi (2008).

All the weed control methods resulted in significantly lower weed cover score than the weedy check (Table 4). In 2007, weed cover score at 9WAP was similar among the weed control methods while supplementary hoe weeding of plots given low rate of Codal further depressed weed cover score. In the late planted crop in 2008 where late weeding played a major role in controlling broad leaves which emerged late, plots weeded at 6WAP had lower weed cover scores at 9 and 12WAP compared with those given preemergence herbicide application alone. Broadleaf weed dry matter production was minimum in plots hoe weeded at 3 and 6WAP in both years and were comparable with those of plots treated with Codal at low rate fb SHW in both years (Table 4). The results agree with earlier reports of Badmus *et al.* (2006) and Adigun and Lagoke (2003) on the efficiency of herbicides and hoe weeding to significantly reduce weed growth.

Table 4. The effect of weed control treatments and cropping pattern on weed cover score and dry matter production in the forest-savanna transition agroecological zone of South-Western Nigeria.

TREATMENT	Weed Cover Score 9WAP		12WAP		Weed Dry Matter (kg/ha) 12WAP	
	2007	2008	2007	2008	2007	2008
Weed control method (C)						
Codal at 2.4kg a.i/ha	2.6b	5.0b	3.0bc	4.4c	251b	288a
Codal at 1.6kg a.i/ha alone	2.7b	5.1b	3.2b	5.4b	323ab	226ab
Codal at 1.6kg a.i/ha fb[1] SHW[2]	1.6b	2.8c	2.2c	3.1d	107c	147ab
Hoe-weeding at 3 and 6WAP[3]	2.0b	2.8c	2.5bc	3.4d	111c	118b
Weedy Check	6.2a	7.2a	6.2a	6.7a	387a	269a
SE±	0.33	0.29	0.27	0.27	32.7	48.9
Cropping pattern (P)						
75cm maize + 2 groundnut	2.7bc	4.4bc	3.0b	4.6bc	280ab	267
75cm maize + 3 groundnut	2.5c	4.5bc	2.7c	3.9d	91d	259
50cm maize + 1 groundnut	3.0b	4.2cd	3.2b	4.1cd	235bc	218
50cm maize + 2 groundnut	2.3c	4.0d	2.6c	3.8d	132cd	171
75cm sole maize	3.9a	5.1a	4.7a	5.0b	245bc	207
50cm sole maize	4.1a	4.8ab	4.8a	4.9b	398a	168
Sole groundnut	2.7bc	5.0a	3.1b	5.9a	269abc	219
S.E±	0.15	0.14	0.13	0.21	45.4	51.9NS
S.E+ (Interaction) CxP	0.33NS	0.32NS	0.31	0.46NS	101.6	116.1NS

1 fb = Followed by 2 SHW = Supplementary hoe weeding 3 WAP = Weeks after planting

4 Means followed by the same letter(s) within the same column and treatments are not significantly different at 5% level probability (DMRT)

5 NS = Not significant at 5% level of probability.

Sole maize spaced at 50cm intra-row produced maximum grain yields which were significantly higher than those in mixture with groundnut in 2007 (Table 3). The depression in the yield of the crops planted in mixture was probably due to the interspecific competition between maize and groundnut rather than weed infestation because weed was suppressed by groundnut component. All the intercrop mixtures had similar maize grain yield indicating that the effect of the competition was the same irrespective of maize spacing. In 2008 however, both intercropped and sole maize planted at 75cm intrarow spacing produced significantly lower grain yield compared with the maximum in 2008 (Table 3). The higher maize grain yield which was observed in maize spaced at 50cm compared with those at 75cm can be attributed to the higher intra specific competition within stands which had three plants and two plants as present in stands of maize at 75cm and 50cm spacings respectively.

Sole maize had higher vigour than the corresponding intercrop. In 2007, maize planted at 75cm within rows and intercropped with two and three groundnut stands between stands as well as that planted at 50cm with one groundnut stand between maize stands had significantly lower crop vigour score than the maximum with sole maize at 50cm despite lower grain yield by all the intercropped maize. This effect can also be attributed to the result of interspecific competition between maize and groundnut in the mixtures. Similarly maximum pod yield were obtained from sole groundnut in both years (Table 3). Groundnut pod yield was lower in maize intercropped at 50cm than 75cm in 2007 because of more vigorous growth of maize and competitive advantantage. It is obvious that interspecific competition resulted in growth and yield depression in maize as earlier observed by Badmus *et al.*, 2006. Adequate growth resources especially moisture and possibly soil nutrient was probably responsible for the similar effect of interspecific competition irrespective of the system in the early planted maize in 2007. However in 2008 with delayed planting and limited exposure to moisture, intercropping elicited different responses to cropping pattern. Maize planted at three plants per stand with more groundnut stands between stands had lower yield than those at 50cm spacing due to less stress as indicated by Badmus *et al.*, 2006.

Intercropping of groundnut with maize caused significant reduction in weed growth compared with the sole crop alone in both years (Table 4). Weed growth was consistently lower in intercropped maize spaced at 75cm with three groundnut stands and two groundnut stands between maize stands than maize spaced at 50cm with one groundnut stand between which had lower groundnut population. The higher population of groundnut in the former which provided adequate ground cover was probably responsible for effective weed suppression by smothering on the plots. These were also observed to result in minimum weed infestation when interacting with Codal at 1.6kg a.i/ha fb SHW as well as with hoe-weeding twice. Broad leaf weed dry matter production which was the dominant species was also higher in the sole crop of maize than the intercrop (Table 4) for the same reason given for higher infestation above. These results corroborate earlier reports of Akobundu *et al.* (2000), Chikoye *et al.* (2001) and Chikoye and Ekeleme (2001) on the effectiveness of velvet bean in smothering speargrass in maize and cassava. Giwa (2007), Adebomi (2008) and Odeniji (2008) have all reported reduced weed infestation in similar mixtures compared with sole maize crop.

Conclusion

Acceptable weed control with consequent high maize yields were obtained with the weed control methods in this study. Codal at 1.6kg a.i/ha fb SHW consistently resulted in crop performance and weed control comparable to that of two hoe-weedings in both years. The positive effect of pre-emergence application of Codal at low rate followed by SHW at the early stage of crop growth for weed control

without causing any injury to the crop and effective crop growth parameters confirm further the usefulness of herbicide as a substitute for hand weeding at 2-3WAP.

The result of this study also indicate that with 75cm intra row maize spacing, groundnut intercrop at three stands between two maize stands could be adopted for effective weed control and crop yield. However with 50cm spacing, further work is recommended to achieve an appropriate intercropping pattern involving groundnut and maize spaced at 50cm that will prevent interspecific competition while providing effective weed control.

In conclusion, no intercrop combination alone can be used as weed control method. No combination used in this study alone gave significant weed control or crop yield. Intercropping can however be used to complement other weed control methods to enhance effectiveness as observed in this study.

References

Adebomi OO. 2008. Effect of intercropped groundnut (*Arachis hypogaea* L.) density on the performance of weed control treatments in maize (*Zea mays* L.) production B.Sc. Project, University of Agriculture, Abeokuta, Nigeria 25-30.

Adigun JA, Lagoke STO, Karikari SA. 1992. Weed interference in transplanted sweet pepper (*Capsicum annuum L.)* Samaru Journal of Agricultural Reasearch **9,** 49-61.

Adigun JA, Lagoke STO. 1999. Weed control in maize with various herbicide combinations in the Northern Guinea Savanna of Nigeria. *Nigerian Journal of Botany* **12,** 79-84

Adigun JA. 2002. Weed management with various herbicide combinations in maize-groundnut intercrop. Nigerian Journal of Crop Protection **20,** 13-23.

Adigun JA, Lagoke STO. 2003. Weed management with various herbicide combinations in a maize-groundnut intercrop. Nigerian Journal of Plant Protection **20,** 12-23.

Akobundu IO. 1987. Weed Science in Tropics: Principle and Practice. John Wiley and Sons, 522 p.

Badmus AA. 2005. Effect of groundnut (*Arachis hypogea L.*) intercrop on weed control in maize (*Zea mays*) production M.Sc. Thesis, University of Agriculture, Abeokuta, Nigeria, 90-101.

Badmus AA, Lagoke STO, Adigun JA, Okeleye KA. 2006. Effects of intercropped groundnut and weed control methods on maize production in south western Nigeria. ASSET Series **6(1),** 289-269.

Chikoye D, Ekeleme F, Udensi EU. 2001. Cogon grass suppression by intercropping cover crops in corn/cassava systems. Weed Science **49,** 653-667.

Chikoye D, Ekeleme F. 2001. Growth characteristics of ten *Mucuna* accessions and their effect on dry matter of speargrass. Biological Agriculture and Horticulture **18,** 191-201.

Choudhary AH, Lagoke STO. 1985. Evaluation of herbicides and herbicide mixtures for weed control in groundnut in Northern Nigeria. Samaru Journal of Agricultural Research **1 & 2,** 19 – 20.

FAOSTAT 2011. http://www.faostat.fao.org/site /567/ desktopdefault.aspx

Giwa MB. 2007. Effect of groundnut (*Arachis hypogaea* L.) intercrop on weed control in maize (*Zea mays* L.) production. B.Sc. Project, University of Agriculture, Abeokuta, Nigeria, 22-30.

IITA. 2000. International Institute of Tropical Agriculture. Maize Improvement Programme Research Report, Ibadan, Nigeria.

IITA. 2009. http://www.iita.org/maize (accessed on February 20, 2012).

Isah KM. 2002. Management of *Striga hermonthica (Dee) Barth* as influenced by maize variety and spacing, split application of compound fertilizer and legume intercrop. M.Agric.Thesis, University of Agriculture, Abeokuta, Nigeria, 51-58.

Job TA. 1993. Role of Maize in the livestock Industry. In: Fakorede, M. A. B., Alofe, C. O. and Kim, S. K., ed. Maize Improvement, Production and Utilization in Nigeria. Proceedings of the Annual National Workshop of the maize Association of Nigeria, IITA, Ibadan, 239-242.

Lagoke STO. 1978. Methods of controlling speargrass (*Imperata cylindrical* L. Beauv.*) in maize (Zea mays* L.*)* Ph.D Thesis, Department of Agronomy, University of Ibadan, Nigeria, 310-360.

Lagoke STO, Kataria DO, Ogungbile OA. 1981. Potential for improved weed control practices in field crop production in the Nigerian savannah zone. Paper presented at the seminar on Green Revolution in Nigeria, held at IAR. Ahmadu Bello University, Zaria, Nigeria, September 1982.

Magani IE. 1990. Effects of period of weed interference and season long weed control on maize (Zea mays L.) M.Sc. Thesis, Department of Agronomy, Ahmadu Bello University, Zaria, Nigeria, 73-80.

Odeniyi OO. 2008. The effect of intercropped groundnut (*Arachis hypogaea* L.) on weed control treatments in maize (*Zea mays* L.) production. B.Sc. Project, Department of Plant Physiology and Crop Production, University of Agriculture, Abeokuta, Nigeria. 28-32.

Ogungbile AO, Lgoke STO. 1986. On-farm evaluation of the economics of chemical weed control in Oxen-mechanized maize production in Nigeria Savanna. Tropical Pest Management, **32(4),** 269-273.

Ojelade OB. 2004. Use of groundnut (*Arachis hypogaea* L.) for enhanced weed management in maize (*Zea mays* L.) Postgraduate Diploma Project, Department of Plant Physiology and Crop production, University of Agriculture, Abeokuta. p 67.

SP-IPM. 2003. Tackling the scourge of parasitic weeds in Africa. IPM Research Brief No.1, International Institute of Tropical Agriculture (IITA), Cotonou, Benin. 24 p.

Udensi UE, Akobundu IO, Ayeni AO, Chikoye D. 1999. Management of Cogon grass (*Imperata cylindirica*) with velvet bean (*Mucuna pruriens var. ulitis*) and herbicides. Weed Technology **13(2),** 201-208.