BIORESEARCH BULLETIN
Sapience Research Labs

ORIGINAL PAPER OPEN ACCESS

Influence of weeding frequency and plant population on yield and yield's components of groundnut (*Arachis hypogaea* L.) in North Kordofan of Sudan

Ahmed M. El Naim and Mona A. Eldouma

Abstract:

Background: A field experiment was conducted at North Kordofan of Sudan, on naturally infested field during 2006/07 and 2007/08 rainy seasons, to determine optimal weeding frequency for weeding management in four plant populations (17, 1 8 1and 7 plants m^{-2}) of groundnut *(Arachis hypogaea* L). Weeding treatments consisted of three levels (no weeding, weeding once (at 2 weeks) and weeding twice (at 2 and 4 weeks after sowing). The weeds were controlled using a hand hoe. Weeds significantly reduced the yield attributes. Weeding twice at 2 and 4 weeks after sowing was optimal for pods number, 100- seed weight and seed yield (g/ plant). Final yield (t/ha) increased with the treatments 17 plants m^{-2} and weeding twice.

Key words: Groundnut, *Arachis hypogaea* L, Weeds, Spacing, Harvest index, Yield.

Ahmed M. El Naim and Mona A. Eldouma
Department of Crop Sciences, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Elobied, Sudan, P. O. Box 160.

Corresponding E-mail: naim17amn@yahoo.com
Mob: 00249-912883160.

Web address:
http://bioresonline.org/archives/A145.pdf

Article citation:
El Naim A. M and Eldouma M. A. 2011. Influence of weeding frequency and plant population on yield and yield,s components of groundnut (Arachis hypogaea L.) in North Kordofan of Sudan.
Bioresearch Bulletin 1: 058-064.

INTRODUCTION

Groundnut or peanut (*Arachis hypogaea* L.) is the sixth most important oilseed crop in the world. It's grown over 20 million hectares in the tropical and sub tropical part of about one hundred countries in the world. The total annual world production amounts to about 25 million tons of unshelled nuts, 70% of which is contributed by India, China and U.S.A (Khidir, 1997). Groundnut is an excellent source of plant nutrients containing 45-50% oil, 27-33% protein as well as essential minerals and vitamins. It plays an important role in the dietary requirements of resource poor women and children.. Groundnut oil is composed of mixed glycerides and contains a high proportion of unsaturated fatty acids, in particular, oleic (50-65%) and linoleic (18-30%) (El Naim, *et al*, 2010[a]). Groundnuts are also important in the confectionary trade and the stable oil is preferred by the deep-frying industries, since it has a smoke point of 229.4°C compared to the 193.5°C of extra virgin olive oil.

The oil is also used to make margarines and mayonnaise (Hui, 1996 , Young, 1996). Sudan is one of the major groundnut producing countries. The main problems limiting production of peanut are poor cultural practices and inadequate weed management. Groundnut cannot compete effectively with weeds, particularly 3–6 weeks after sowing; therefore, early removal of weeds is important before flowering and during pegging (Page *et al*, 2002). If early weeding is done well, and crop spacing recommendations followed, then the weeds that come up later are smothered with the vigorous growth of the crop. Once flowering and pegging begins it is advisable to weed by hand pulling rather than by using a hoe, as this is less likely to disturb any developing pods. Hand weeding (hoeing) is still by far the most widely practiced cultural weed control technique in field crop production throughout the Sudan, because of the prohibitive costs of herbicides and fear of toxic residue coupled with the lack of knowledge about their use. The objectives of this study were: to investigate the effect weeding frequencies on yield and yield's components of groundnut grown in different plant population.

MATERIAIS AND METHODS

A field experiment was conducted in the Agricultural Research Station Farm, Elobied, Sudan, Latitude 13 16N and longitude 30 23 E, for two successive seasons (2006/07 and 2007/08). The climate of the area is arid and semi arid zone. The soil is sandy with low fertility. Annual rainfall ranges between 350-500mm. Average maximum daily temperatures varied between 30 to 35 C, most of the year.

The experiment was laid at randomized complete block design (RCBD) with three replications. The plot size was 4 × 3 meters. The weeding treatments consisted of three levels: no weeding, weeding once (at 2 weeks) and weeding twice (at 2 and 4 weeks after sowing), designated as W_0, W_1 and W_2 respectively and four intra-row spacing of 20, 30, 40 and 50 cm (17, 1 8 1and 7 plants m^{-2}) were used, henceforth designated as S_1, S_2, S_3 and S_4 respectively.

The seeds of groundnut (variey Sodari) were obtained from Arab Sudanese Seed Company, Elobied. Sowing dates were on 16th of July. Seeds were sown on rows 60 cm apart, in hills. Four seeds were placed in each hill, which were then thinned to two plants per hill, two weeks later. Weed species found at each site were recorded at 15 days after sowing (DAS) and then continued with an interval of 14 days. Weeds counts made by placing the quadrate (0.5m x 0.5m) at random locations in plots repeated four times in order to obtain a reasonably good estimate of small weeds. The relative weed densities were calculated.

A sample of five plants was taken at random from the inner rows of each experimental unit to measure the following attributes:

-Number of pods per plant

-100-seed weight.

-Final seed yield (t/ha) was determined as follows.

$$\text{Seed yield (t/ha)} = \frac{\text{seed weight (kg) of 5 plants}}{\text{Harvested plot area } (m^2)} \times 10000$$

-Harvest index was determined by using the following formula:

$$\text{Harvest index} = \frac{\text{Economical yield (seed yield/plant)}}{\text{Biological yield (shoot seed weight)}} \times 100$$

Data were analyzed statistically using analysis of variance according to Gomez and Gomez (1984) procedure for a randomized complete block design. The differences of means were identified by least significant differences (L.S.D) at $P \geq 0.05$.

RESUITS AND DISCUSSION

The majority of weeds in the experimental site were the broad leaves (dicotyledons), while grasses (monocotyledons) found in a lesser density (**Table 1).** The dominant weeds flora infecting groundnut during growing season were Alhuskaneet (*Cenchrus biflorus* L), Sheilini (*Zornia glochidiata* L) and Alraba (*Trienemara pentanture* L). They had relative weeds density of 27%, 21% and 11% respectively. El Naim and Ahmed (2010) found that the *Cenchrus biflorus* L was the most dominant weed in fields of Kordofan.

Weeds have been defined as higher plants in the agro ecosystem, which are not sown, undesired, out of place or generally as plants which do more harm than good.

Weeds lead to direct yield losses of crop for water nutrients light, space and/or carbon dioxide. This degree of damage is mainly a function of their leaf area index, as compared with that of the crop (Ishag, 1971; Bedry, 2007 and El Naim and Ahmed, 2010). This might explain the significant effect of weeds on most of the parameters measured in the present study. This result may be attributed to vigorous plant with less competition for light, nutrients, and free space in weed free environment. Yadava and kurnar (1981) and reported that weed control in peanut led to increased seed yield per plant compared to non weeded plants. Weeding increased number of pods per plant (**Table 2**), 100 seed weight (**Table 3**), pods yield per plant (**Table 4**) and final pods yield (ton ha^{-1}) (**Table 5**). This is because hand-weeding resulted in a better

Table 1. Weeds classification and their relative density of non weeded peanut (groundnut) during the growing season in the experiment site.

Scientific name	Classification	Local name	Weeds density
Cenchrous biflours.	Monocot	Alhuskaneet	27%
Zornia glochidiata.	Dicot	Sheilini	21%
Trienemra pentanture.	Dicot	Alraba	11%
Sesamum alatum.	Dicot	Simsim Elgumal	4%
Ocimum basilicum.	Dicot	Elryhan	0.7%
Allium spp.	Bulb	Bureaj	1.3%
Echinocola colonum.	Monocot	Aldiffera	4%
Rullia patula.	Dicot	Tagtaga	7%
Corchorus olitorius.	Dicot	Almlukhia	3%
Tribulus trerrestris.	Dicot	Aldraisa	0.3%
Ipomea kordofana.	Dicot	Eltabar	1.6%
Solanum dobium.	Dicot	Aljubain	6%
Abutilon figarinum.	Dicot	Alniada	7.2%
Ipomea sinensis.	Dicot	Elhantoot	0.1%

Table 2. Effect of weeding frequencies and plant population on number of pods per plant of groundnut

	2006/07					2007/08				
Treatments	**S_1**	**S_2**	**S_3**	**S_4**	**Mean**	**S_1**	**S_2**	**S_3**	**S_4**	**Mean**
W_0	8.3^{d}	5.0^{d}	3.3^{d}	3.3^{b}	5.0^{c}	3.3	3.0	2.7	4.3	3.3
W_1	8.7^{d}	13.7^{C}	14.3^{C}	20.0^{ab}	14.1^{b}	8.3	10.0	12.3	11.0	10.4
W_2	15.3^{bc}	18.0^{bc}	14.3^{C}	23.7^{a}	17.8^{a}	7.3	11.0	11.3	14.0	10.9
Mean	10.8	12.2	10.6	15.6		6.3	8.0	8.8	7.1	
SE ±W	0.8					1.0				
SE ±S	0.9					1.19				
SE ±WXS	0.6					2.1				
C.V%	22.86					43.62				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test

Table 3. Effect of weeding frequencies and plant population on 100- seed weight of groundnut.

Treatments	2006/07					2007/08				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	31.96	36.4	25.6	30.1	31.0^{b}	22.2	21.5	21.8	16.6	20.9
W_1	34.6	36.8	36.3	38.9	36.7^{a}	23.8	20.8	22.7	20.3	21.7
W_2	37.4	36.5	37.4	40.5	37.9^{a}	20.7	23.4	21.1	24.4	21.9
Mean	34.7	36.6	33.1	36.5		21.9	18.9	21.8	20.4	
SE ±W	1.11					1.7				
SE ±S	1.12					1.9				
SE ±WXS	2.23					3.39				
C.V%	11.01					27.33				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test.

Table 4. Effect of weeding frequencies and plant population on seed yield per plant (g) of groundnut.

Treatments	2006/07					2007/08				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	29.0^{ca}	19.9^{cd}	7.5^{d}	8.2^{d}	16.2^{c}	10.6	10.	8.3	11.	10.0^{b}
W_1	32.5^{c}	54.5^{b}	58.0^{b}	70.5	53.9^{b}	28.8	29.	36.6	29.7	31.0^{a}
W_2	59.6^{b}	64.7^{ab}	57.9^{b}	85.9^{b}	66.9^{a}	21.1	30.6	33.4	41.9	31.8^{a}
Mean	40.4^{b}	46.4^{ab}	41.1^{b}	54.8^{a}		20.2^{b}	23.2^{a}	29.1^{a}	35.3^{a}	
SE ±W	3.6					3.6				
SE ±S	4.1					4.2				
SE ±WXS	7.2					7.2				
C.V%	27.2					51.21				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test.

Table 5. Effect of weeding frequencies and plant population on final seed yield (t/ha) of groundnut

Treatments	2006/07					2007/08				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	0.95^{bc}	0.4^{cd}	0.1^{d}	0.1^{d}	0.39^{c}	0.3	0.2	0.1	0.2	0.2^{c}
W_1	1.1^{b}	1.2^{b}	0.95^{bc}	0.9^{bc}	1.04^{b}	0.4	0.6	0.6	0.4	0.5^{b}
W_2	1.97^{a}	1.4^{b}	0.95^{bc}	1.2^{b}	1.38^{a}	0.7	0.7	0.6	0.6	0.7^{a}
Mean	1.3^{b}	$1.^{ab}$	$0.6.3^{a}$	$0.7.^{a}$		0.5^{b}	0.5	0.4^{a}	0.4^{a}	
SE ±W	0.1					0.1				
SE ±S	0.1					0.1				
SE ±WXS	0.2					0.1				
C.V%	33.07					57.24				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test.

performance of growth and yield components by reduced competition and increased availability of resources like nutrients, soil moisture and light paved way for higher leaf area per plant. Similar results observed by many workers; Ishag (1971), Hamdoun and Ani(1977), Dreman and Jenning (1977), Bedry (2007), Kumara *et al* (2007 and kumar (2009) in groundnuts crop. They observed that pod yield was greatly increased with weeding treatments, which encouraged early flowering, increased flowering, developed higher leaf area index, increased number of pods and branches per plant and finally maximized pod yield. Weeding twice resulted in increased 100-seed weight. This may be due to better availability of nutrients and better translocation of photosynthates from source to sink and may be due higher accumulation of photosynthates in the seeds. Weeding and spacing had no significant effect on shelling percentage in both Seasons (**Table 6**). Weeding twice had the highest harvest index (**Table 7**). This result confirmed the findings of El Naim and Ahmed (2010).

This may be due to better translocation of photosynthates from source to sink area and may be due to higher accumulation of photosynthates in the seeds (economical yield). The reduction in number of pods per plant with increasing plant densities observed in this investigation concurs with many researchers in different crops (Quayyum, 1990,, Kandasamy, *et al* 1991, Allam, 2002; El Naim *et al*, 2010[b] and El Naim and Jabereldar, 2010). They reported that high plant population reduced the number of pods per plant. These results may be attributed to the competition between plants and between the different parts of the individual plant under high planting population. Decreasing plant spacing decreased seed yield per plant during the two seasons (Table 4). This was primarily because of a reduced number of pods per plant at higher plant population. Similarly, Levy *et.al* (1985), Allam (2002) and El Naim and Jabereldar (2010)

Table 6. Effect of weeding frequencies and plant population on shelling Percentage of groundnut.

Treatments	2006/07					2007/08				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	74.1	51.0	55.7	28.6	52.4	61.1	58.4	59.2	56.0	58.7
W_1	73.8	73.7	70.9	75.6	73.5	62.8	58.8	58.3	59.7	59.9
W_2	74.7	71.5	41.4	72.6	65.0	57.6	61.8	58.9	59.5	58.8
Mean	74.2	65.4	56.	58.9		60.5	59.2	58.8	58.4	
SE ±W	8.2					1.8				
SE ±S	9.5					2.0				
SE ±WXS	16.4					3.2				
C.V%	10.22					10.22				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test

Table 7. Effect of weeding frequencies and plant population on harvest index of groundnut.

Treatments	2006/07					2007/08				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	37.5	32.93	23.7	17.0	27.79[b]	32.6	44.2	40.4	37.6	38.7[b]
W_1	38.8	41.3	44.23	46.26	42.65[a]	44.9	47.5	34.7	36.8	40.1[a]
W_2	40.5	42.0	41.16	44.69	42.16[a]	44.7	38.8	40.1	41.0	41.2[a]
Mean	38.9	38.65	36.35	36. 8		40.7	43.3	38.4	38.5	
SE ±W	1.74					1.8				
SE ±S	2.0					2.1				
SE ±WXS	3.5					3.7				
C.V%	16.06					15.73				

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test.

pointed that seed yield per plant substantially decreased with increasing plant population. They attributed this reduction to inter plant competition for assimilates and low pod yield. In contrast, increasing plant spacing increased seed yield (t/ha). Majumdr and Roy (1992), Imayavaramban et al., (2002) and Allam (2002) reported supporting evidences. Plant spacing had no significant effect on harvest index. This confirms the constant relationship between biological yield and seed yield (Green *et al*., 1986; El Naim and Jabereldar, 2010; El Naim *et al*, 2010[C]).

CONCLUSION

Hand hoeing twice at 2, 4 weeks after sowing is effective to control weeds and recommended to improved yield of groundnut in North Kordofan of Sudan.

REFERENCES

Allam AY. 2002. Effect of gypsum, nitrogen fertilization and hill spacing on seed and oil yields of sesame cultivated on sandy soil .Agron .Dept.,J., 69:465-469.Ind.J Agron. 25:562-563.

Bedry KA. 2007. Effect of weeding regimes on faba bean (*vicia faba* l.) yield in the Northern State of Sudan. University of Khartoum Journal of Agricultural Science. 15:220-231.

Drennan DSH and Jennings EA. 1977. Weed competition in irrigated cotton (*Gossypium barabadens* L) and groundnut *(Arachis hypogaea.L)* in the Sudan Gezira. Weed research. 17:3-9.

El Naim AM and Ahmed SE. 2010. Effect of weeding frequencies on growth and yield of two roselle (*Hibiscus sabdariffa*L) Varieties under rain fed. Australian Journal of Basic and Applied Sciences. 4(9):4250-4255.

El Naim AM and Jabereldar AA. 2010. Effect of Plant density and cultivar on growth and yield of cowpea (*Vigna unguiculata* L.Walp). Australian Journal of Basic and Applied Sciences. 4(8):3148-3153.

El Naim AM and Ahmed MF. 2010. Effect of Irrigation Intervals and Intra- row Spacing on the Vegetative Growth Characteristics in Sunflower (*Helianthus annuus* L) hybrids in Shambat Soil. Journal of Applied Sciences Research. 6(9):1440-1445.

El Naim AM, Eldoma MA and Abdalla AE. 2010[a]. Effect of weeding frequencies and plant density on vegetative growth characteristic of groundnut (*Arachis hypogaea* L.) in North Kordofan of Sudan. International Journal of Applied Biology and Pharmaceutical Technology. 1 (3):1188-1193.

El Naim AM, El day EM and Ahmed AA. , 2010[b].Effect of plant density on the performance of some sesame (*Sesamum indicum* L) cultivars under Rain -fed. Research Journal of Agriculture and Biological Sciences. 6(4):498-504.

El Naim AM, Hagelsheep AM, Abdelmuhsin ME and Abdalla AE. 2010[c]. Effect of Intra-row spacing on growth and yield of three cowpea *(Vigna unguiculata*L. Walp.) varieties under rainfed. Research Journal of Agriculture and Biological Sciences. 6(5):623-629.

Gomez KA and Gomez AA. 1984. Statistical for Agricultural Research. John. Wiley and Sons. New York.

Green CF, HebblethWaite PD and Ricketts HE. 1986. The price of irrigation *Faba bean*. Fabis, News letter. 15:26-31.

Hamdoun AM and Ani KB. 1977. Weed control problems in the Sudan. PANS. 23:190-194.

Hui YH. **1996**. Peanut Oil. Bailey's Industrial Oil and Fat Product. 2:337-392.

Imay avaramban V, Singaravel R, Thanunathan K and Manickam. 2002. Studies on the effect of different Plant densities of sesame. department of Agronomy, Annamalai university, Annamalai Nagar (TamilNadu Indai-Crop.Reasearch-Hisar. 24 (2):314-316 4ref.

Ishag HM. 1971. Weed control in irrigated groundnut (Arachis hypogaea.L in the Sudan Gezira .J. Agric sei, camb. 77:237-242.

Joshi KR. 2004. Effect of time of weeding and levels of N and P2 P5Fertilizers on the grain yield of maize. Nepal Agric. Res. J. 5:69-70.

Kandasamy G, Balasubara manian TN and Thangavelu S. 1991. Study on the varietal and spacing interaction In sesame.and afflower Newletter. 6:41.43.

Khidir MO. 1997. Oil seed crops in the Sudan. Khartoum University press, Khrtoum, Sudan. 55-60.

Kumara O, Basavaraj T and palaiah P. 2007. Effect of weed management practices and fertility levels on growth and yield parameters infinger millet. Karnataka J. Agric. Sci. 20:230-233.

Kumar NS. 2009. Effect of plant density and weed management practices on production potential of groundnut (*Arachis hypogaea* L.). Indian Journal of Agricultural Research. 43: 1.

Levy A, Palevitch D and Kleifeld J. 1985. Evaluation of Sesame cultivars and Cultural practice. In: FAO Plant Production and protection Sesame Technical paper No 66:107.114.

Majumdr DK and Roy S K. **1992.** Response of summer sesame (Sesamum indicum) To irrigation, row spacing and plant population . Indian Joumal of Agronomy. 37(4):758-762.

Page WW, Busolo-Bulafu CM, vander PJA and Chancellor TCB. 2002. Recommended groundnut production practices for smallholder farmers in Uganda. University of Greenwich, Greenwich, London, SE10 9LS.

Quayyum SM, Rajput MA, Ansari AH and Umarani GM. 1990. Effect of different inter and intra –row spacing on various agronomic traits in Sesame (Sesamum indicumL.). Sesame and sesame and Safflower Newsletter. 5:23-28.

Yadava TP and Kurnar. 1981. Stability analysis for pods yield and maturity in bunch group of groundnut (*A rachis hypogaea* L) .Indian Journal Agic Res. 12:14.

Young C. 1996. Peanut oil. Bailey's Industrial Oil and Fat Product. 2:337-392.