EFFECT OF WEEDING FREQUENCIES AND PLANT DENSITY ON THE VEGETATIVE GROWTH CHARACTERISTIC IN GROUNDNUT (*Arachis hypogaea* L.) IN NORTH KORDOFAN OF SUDAN

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ABSTRACT: Weeds play an important role in the proper stand establishment of the growing crop, which ultimately affect the productivity and quality at the end of the growing season. A Field experiment conducted at North Kordofan of Sudan, on naturally infested fields during 2006/07 and 2007/08 seasons, to determine optimal weeding frequency for weeding management in four plant density (17, 1 1, 8 and 7 plants m^{-2}) of groundnut *(Arachis hypogaea L*). Weeding treatments consisted of three levels (no weeding, weeding once (at 15 days) and weeding twice (at 15 and 30 days after sowing). The weeds were controlled using a hand hoe. The dominant weed species were *Cenchrus biflorus* L, *Zornia glochidiata* L and *Trienemara pentanture* L. Weeds significantly reduced the vegetative growth attributes measured. Weeding twice at 15 and 30 days after sowing was optimal for plant height, branches, nodes number and leaf area index. High vegetative growth performance obtained at population of 17 plants m^{-2}.
Key words: *Arachis hypogaea* L, weeding, vegetative, growth, kordofan

INTRODUCTION

Groundnut is the sixth most important oilseed crop in the world. It contains 48-50% oil and 26-28% protein, and is a rich source of dietary fiber, minerals, and vitamins. Groundnut is grown on 26.4 million ha worldwide with a total production of 37.1 million metric t and an average productivity of 1.4 metric t/ha. Over 100 countries worldwide grow groundnut (Khidir, 1997). Developing countries constitute 97% of the global area and 94% of the global production of this crop. The production of groundnut is concentrated in Asia and Africa (56% and 40% of the global area and 68% and 25% of the global production, respectively). Cultivated groundnut (*Arachis hypogaea* L.) belongs to genus *Arachis* in subtribe *Stylosanthinae* of tribe *Aeschynomenea* of family *Leguminosae*. Groundnut or peanut is play an important role in the dietary requirements of resource poor women and children and haulms are used as livestock feed. 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%) (Young, 1996). 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 tropics 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 vegetative growth characteristics of groundnut grown in different plant populations.

MATERIAIS AND METHODS

A field experiment was conducted in the Agricultural Research Station, Elobied, Sudan, Latitude 13 ˚16´ N 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 15 days) and weeding twice (at 15 and 30 days 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 1, 8 and 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 as 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:

- Plant height (cm): the height of the plant from ground level to the tip of the plant.
- .Number of nodes/plant: determined by counting the number of nodes of the main stem.
- Number of branches/plant.
- Leaf area index (L.A.I).

Leaf area index (L.A.I), a dimensionless quantity, is the leaf area (upper side only) per unit area of soil below. It is expressed as m^2 leaf area per m^2 ground area. Leaf area was determined using the leaf area Meter.

Leaf area index (L.A.I) was determined as follows.

$$\text{Leaf area index} = \frac{\text{Leaf area per plant}}{\text{Plant ground area}}$$

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 DISCUSSTION

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 infesting groundnut during growing season were *Cenchrus biflorus* L, *Zornia glochidiata* L and *Trienemara pentanture* L. They had relative weeds density of 27%, 21% and 11% respectively.

Table1. 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
Zornia glochidiata.	Dicot	Sheilini	21%
Cenchrous biflours.	Monocot	Alhuskaneet	27%
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%

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. They 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; El Naim and Ahmed, 2010). This might explain the significant effect of weeds on most of the parameters measured in the present study.

Weeding was significantly affected plant height (Table 2). Weeds decreased plant height in season (2006/07) by about 70% compared to weeding treatment. Weeding twice had a highest plant height. Weeding facilitates plants to have more resources for growth, these results agreed with Joshi (2004), Mubarak (2004), Bedry (2007) and El Naim and Ahmed (2010); they found that, increasing weeding times increased plant height, due to efficient weed control. Plant density had no significant effect on plant height. The non significant effect of plant density on mean plant height observed in this study may be attributed to the fact that plant spacing has often, but not always, been associated with increased plant height. Supporting evidences were reported in different crops by Lazim (1973), El Naim and Jabereldar (2010) and El Naim *et al* (2010).

Table 2.Effect of weeding frequencies and plant population on plant height (cm) of ground nut

Treatments	2006/2007					2007/2008				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	15.8	13.9	10.7	17.0	14.4^{c}	8.1	7.9	5.9	6.9	8.7
W_1	17.0	28.6	18.4	21.1	21.3^{b}	8.9	9.3	11.0	8.2	8.9
W_2	27.3	22.8	20.7	22.3	23.3^{a}	9.7	8.6	10.6	12.1	10.3
Mean	20.0^{a}	21.8^{b}	16.6^{b}	20.1^{a}		8.3	8.4	9. 6	9.1	
SE ±W	1.75					0.8				
SE ±(S)	2.0					0.9				
SE ±WXS	3.51					1.6				
C.V%	30.9					30.9				

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 number of nodes per plant of ground nut

Treatments	2006/2007					2007/2008				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	36.7^{cde}	25.7^{de}	16.0^{e}	18.3	41.1^{b}	6.0	6.3	5.3	8.0	8.3
W_1	52.7^{bcd}	71.3^{ab}	61.3^{abc}	58.00^{abcd}	56.5^{a}	12.0	10.3	9.7	7.3	9.000
W_2	59.7^{abc}	48.0^{acde}	89.7^{a}	72.0^{ab}	54.8^{a}	11.0	9.7	10.3	11.0	9.4
Mean	49.7^{c}	48.3^{b}	55.7^{ab}	49.4^{a}		9.7	8.8	8.4	8.8	
SE ±W	5.0					11				
SE ±S	5.8					1.2				
SE ±WXS	10.1					2.1				
C.V%	34.30					41.59				

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 number of branches per plant of groundnut

Treatments	2006/2007					2007/2008				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	4.66	4.33	4.00	4.00	4.25	4.7	3.0	3.7	3.7	4.3
W_1	5.66	5.66	5.00	5.66	5.50	5.0	5.3	3.7	5.7	4.7
W_2	6.00	5.66	5.66	6.00	5.83	4.7	5.0	5.0	5.3	4.8
Mean	5.4	5.2	5	5.2		4.8	4.4	5.7	4.2	
SE ±W	0.19					0.3				
SE ±S	50.22					0.4				
SE ±WXS	0.38					0.7				
C.V%	12.83					25.89				

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

They reported that plant spacing had no significant effect on plant height. Weeds and weeding treatments had no significant effect on the number of nodes per plant (Table 3). Weeding had significant effect on the number of branches per plant. Weeds decreased the number of branches per plant (Table 4). The highest number of branches per plant was obtained at weeding twice. 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 Weiss (1983) reported that weed control in peanut led to increased number of branches per plant compared to non weeded plants. Plant spacing treatments had no significant effect on number of branches per plant. However Suzki (1958) and El Naim *et al* (2010) found that, at a close spacing the branches develop less in number than at wider spacing. Increased weeding frequencies increased leaf area index (Table 5). This was due to better control of weeds. The reduced competition and increased availability of resources like nutrients, soil moisture and light paved way for higher leaf area per plant (leaf area index). These results are conformity with the findings of Kumara *et al* (2007) and El Naim and Ahmed (2010).. The inter-action (Plant density and weeding) treatments had significant effect on leaf area index. Plant density of 17 plants $^{m-2}$ and weeding twice had higher leaf area index (L.A.I) than other combinations (Table 5).

Table 5. Effect of weeding frequencies and plant population on leaf area index of groundnut

Treatments	2006/2007					2007/2008				
	S_1	S_2	S_3	S_4	Mean	S_1	S_2	S_3	S_4	Mean
W_0	2.2^{bcd}	1.3^{cde}	1.0^{e}	0.8^{e}	1.3	0.2^{bcd}	0.2^{cde}	0.1^{e}	0.1^{e}	0.2
W_1	3.5^{b}	1.8^{b}	1.7^{bc}	1.4^{de}	2.1	0.3^{b}	0.3^{b}	0.3^{bc}	0.1^{de}	0.2
W_2	3.9^{a}	2.5^{bc}	1.9^{b}	1.7^{b}	2.5	0.4^{a}	0.3^{bc}	0.2^{bc}	0.2^{bc}	0.3
Mean	3.2^{a}	1.9^{a}	1.5^{a}	1.3^{a}		0.3^{b}	0.2^{a}	0.2^{a}	0.1^{a}	
SE ±W	0.11					0.0				
SE ±S	0.14					0.0				
SE ±WXS	0.23					0.0				
C.V%	20.48					24.77				

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

Conclusion

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

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