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Influence of Plant Spacing and Weeds on Growth and Yield of Peanut (*Arachis hypogaea* L) in Rain-fed of Sudan

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Abstract A field experiment was conducted for two consecutive seasons to assess the impact of four plant spacing (10, 20, 30 and 40 cm) and three weeding levels (no weeding, weeding once (at two weeks from sowing) and weeding twice (at two weeks and at four weeks) on growth and yield of peanut (groundnut) in rain-fed under Kordofan (Sudan) conditions. A randomized complete block design in four replications was used. The results showed that plant spacing of 10 cm gave 40% more yield than that at 40 cm and was the best for maximizing yield under rain-fed conditions. The growth and yield attributes of groundnut were significantly reduced when the crop was left un weeded. Weeding twice had the highest number of pods per plant, 100- Kernel weight, pods yield per plant and final pod yield (t/h). Weeds reduced pod yield by about 40%. The field was dominated by *Cenchrus biflours* L.

Keywords Groundnut, Spacing, Weeds, Growth, Yield, Kordofan

1. Introduction

Groundnut or peanut (*Arachis hypogaea* L.) is 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; El Naim et al., 2010a). Groundnut is an excellent source of plant nutrients contains 45-50% oil, 27-33% protein as well as essential minerals and vitamins. They 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 (especially the practice of wide spacing) as well as inadequate weed management (EL Naim *et al.,* 2010[a]). 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 plant spacing and weeding on growth, yield and yield's components of groundnut grown under rain-fed in Sudan.

2. Materials and Methods

A field experiment was conducted in the North Kordofan, Elobied, Sudan, Latitude 13°16´ N and longitude 30°23´ E, for two successive seasons (2007 and 2008). The climate of the area is arid and semi arid zone. The soil is sandy with low fertility. Annual rainfall ranges between 350-500 mm. Average maximum daily temperatures was varied between 30 to 35° C, most of the year.

The experiment was laid at randomized complete block design (RCBD) with four replications. The plot size was 4 × 4 meters. The weeding treatments consisted of three levels: no weeding, weeding once (at two weeks after sowing) and weeding twice (at two and four weeks), designated as W_0, W_1 and W_2 respectively and four plant spacing of 10, 20, 30 and 40 cm were used, henceforth designated as S_1, S_2, S_3 and S_4 respectively.

Sowing dates were on first week 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

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weeks later. Weeds counts made by placing the quadrate (0.5m x 0.5m) at random locations in plots repeated three times in order to obtain a reasonably good estimate of weeds.

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

- Shoot length (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.

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

- Days to 50% flowering: The number of days from sowing to the time when 50 Percent of the plants within the plot bear at least one flower each.

- Days to 50% maturity: Time to 95% physiological maturity was taken as the number of days from planting till 95% of the plants in the plot became yellow. Their leaves begin to shed and the pods had solid shell with wide veins before shoot dried.

-Number of pods per plant

-100- kernel weight.

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

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

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 Duncan's Multiple Range Test (DMRT) at $P \geq 0.05$.

3. Results

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 25%, 20% and 15% respectively.

Results of shoot length and number of nodes per plant are shown in Table 2. Weeding was significantly affected shoot length. Weeds decreased plant height in season (2007) by about 70% compared to weeding treatment. The highest shoot obtained at W_2 (weeding twice).

Weeds and weeding treatments had no significant effect on the number of nodes per plant. Plant spacing had no significant effect on plant height and number of nodes per plant. Results of number of branches and leaf area index are shown in Table 3. Weeding had significant effect on the number of branches per plant. Weeds decreased the number of branches per plant. The highest number of branches per plant was obtained at weeding twice (W_2). Weeding significantly affected the leaf area index. Weeding improved leaf area index. The closer spacing had higher leaf area index than the wider spacing. Plant spacing and weeding had no significant different in days to 50% flowering and 95% physiological maturity (Table 4).

Table 1. Weeds and Their Relative Density of non Weeded Groundnut

Scientific name	Classification	local name	Weeds density
Cenchrous biflours.	Monocot	Alhuskaneet	25%
Zornia glochidiata.	Dicot	Sheilini	20%
Trienemra pentanture.	Dicot	Alraba	15%
Sesamum alatum.	Dicot	Simsim Elgumal	6%
Abutilon figarinum.	Dicot	Alniada	9.2%
Allium spp.	Bulb	Bureaj	1.3%
Echinocola colonum.	Monocot	Aldiffera	5%
Rullia patula.	Dicot	Tagtaga	9%
Corchorus olitorius.	Dicot	Almlukhia	3%
Tribulus trerrestris.	Dicot	Aldraisa	0.3%
Ipomea kordofana.	Dicot	Eltabar	3.2%

Table 2.. Effect of Plant Spacing and Weeds on Shoot Length and Number of Nodes per Plant of Groundnut

Treatments	2007		2008	
	Shoot length (cm)	No. of nodes per plant	Shoot length (cm)	No. of nodes per plant
S_1	20.0a	19.7	18.3	19.7
S_2	21.8b	18.3	18.4	18.8
S_3	16.6b	25.7	19.6	18.1
S_4	20.1a	19.4	19.1	18.8
SE ±	2.0	5.8	0,9	1.2
W_0	14.4^c	18.3	18.7	18.3
W_1	21.3^b	58.0	18.9	19.0
W2	23.3^a	71,0	20.3	19.4
SE ±	1.75	5.0	0.8	11.5
C.V%	30.9	34.3	30.9	50.1

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

Table 4. Effect of Plant Spacing and Weeds on 50% Flowering and 95% Physiological Maturity of Groundnut

Treatments	2007		2008	
	50% flowering	95% maturity	95% maturity	95% maturity
S_1	31.6	83.7	83.7	91.3
S_2	31.3	83.9	83.9	91.3
S_3	31.2	83.3	83.3	92.0
S_4	31.4	84.3	84.3	92.0
SE ±	0.21	0.4	0.4	0.4
W_0	31.4	83.8	83.8	91.5
W_1	31.5	83.8	83.8	91.8
W2	31.3	83.8	83.8	92.0
SE ±	0.18	0.4	0.4	0.3
C.V%	2.07	1.5	1.5	1.2

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

Results of number of pods and 100-kernel weight are shown in Table 5. Weeding had significant effect on the number of pods per plant in the first season. Weeds decreased the number of pods per plant. W_2 improved the number of pods per plant. Increased spacing increased number of pods per plant. Weeding significantly affected the 100- kernel weight. Increased weeding frequencies increased 100- kernel weight.

Table 5. Effect of Plant Spacing and Weeds on Number of Pods per plant and 100- Kernel Weight of Groundnut

Treatments	2007		2008	
	Number of pods	100-kernel weight	Number of pods	100-kernel weight
S_1	5.6	34.7	6.3	21.9
S_2	8.6	36.6	8.0	18.9
S_3	16.6	33.1	10.2	21.8
S_4	18.7	36.5	12.1	20.4
SE ±	0.9	1.12	1.2	1.9
W_0	11.0^b	31.0^b	7.8	20.9
W_1	12.0^{ab}	36.7^a	8.4	21.7
W2	14.0^a	37.9^a	8.5	21.9
SE ±	0.8	1.1	1.0	1.7
C.V%	22.9	11.01	43.6	27.3

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

Plant spacing had no significant effect on 100-kernel weight.

Results of pod yield are presented in Table 6. Weeding treatments significantly affect the pod yield per plant. Weeding twice increased pod yield per plant. Unweeded Treatment had a poor yield. Weeding improved pod yield (t/ha). W_2 had a highest pod yield compared to others.

Table 6.. Effect of Plant Spacing and Weeds on Seed Yield (g/plant) and Final Seed Yield (t/ha) of Groundnut

Treatments	2007		2008	
	Pod yield (g/plant)	Pod yield (t/ha)	Pod yield (g/plant)	Pod yield (t/ha)
S_1	40.4	1.3	20.2	0.5
S_2	46.4	1.0	23.2	0.5
S_3	41.1	0.6	29.1	0.4
S_4	54.8	0.7	35.3	0.4
SE ±	4.1	0.1	4.2	0.1
W_0	16.2	0.4	10.0	0.2
W_1	53.9	1.0	31.0	0.5
W2	66.9	1.4	31.8	0.7
SE ±	3.9	0.1	3.6	0.1
C.V%	27.2	33.0	51.2	57.1

4. Discussion

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 twice had a highest plant height. Weeding facilitates plants to have more resources for growth, these results agreed with Joshi (2004), Mubarak (2004) and Bedry (2007); they found that, increasing weeding frequency increased plant height, due to efficient weed control.

Weeds decreased the number of branches per plant. 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 unweeded plants. Increased weeding frequencies increased leaf area index. 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 El Naim *et al.* (2010^a). Weeding increased number of pods per plant, 100 kernel weight, pods yield per plant and final pods yield (ton ha^{-1}). This is because hand-weeding resulted in a better performance of growth and yield components. Similar results observed by many workers; Ishag (1971), Mubarak (2004) Bedry (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-kernel 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 twice had the highest harvest index. 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 increased in number of pods per plant with increasing plant spacing observed in this investigation concurs with many researchers in different crops (El Naim *et al*, 2010^b and El Naim and Jabereldar, 2010). They reported that closer spacing 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. This was primarily because of a reduced number of pods per plant at closer spacing. Similarly, El Naim and Jabereldar (2010) found that seed yield per plant substantially decreased with decreased plant spacing.

They attributed this reduction to inter plant competition for assimilates and low pod yield. In contrast, increasing plant spacing increased pod yield (t/ha). El Naim et al. (2010[c]) reported supporting evidences.

5. Conclusions

The study revealed that the intra-row spacing of 10 cm and weeding twice should be preferred for groundnut production in North Kordofan of Sudan under rain-fed conditions.

REFERENCES

[1] Bedry K. A. 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

[2] El Naim, A. M. and Ahmed, S. E. 2010. Effect of weeding frequencies on growth and yield of two roselle (Hibiscus sabdariffaL) Varieties under rain fed. Australian Journal of Basic and Applied Sciences, 4(9): 4250-4255,

[3] El Naim, A, M. and Jabereldar, A. A. 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.

[4] El Naim, A. M., Eldoma, M. A. and Abdalla, A. E. 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

[5] El Naim, A. M., El day, E. M. and Ahmed, A. A. 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

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

[7] Gomez K. A. and Gomez A. A. 1984. Statistical for Agricul tural Research. John. Wiley and Sons. New York.

[8] Hui Y. H. 1996. Peanut Oil. Bailey's Industrial Oil and Fat Product .2, 337-392.

[9] Ishag H. M. 1971. Weed control in irrigated groundnut ((Arachis hypogaea L). in the Sudan Gezira. The Journal of Agricultural Science. 77, 237-242

[10] Joshi K. R. 2004. Effect of time of weeding and levels of N and P2 P5 fertilizers on the grain yield of maize. Nepal Agric. Res. J. 5, 69-70

[11] Khidir M. O. 1997. Oil seed crops in the Sudan. Khartoum University press, Khrtoum, Sudan

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

[13] Kumar N. S. 2009. Effect of plant density and weed management practices on production potential of groundnut (Arachis hypogaea L.). Indian Journal of Agricultural Research. 43,1

[14] Mubarak H. A. 2004. Studies on weed management in irrigated groundnuts (Arachis hypogaea L). in Sudan. Ph.D. Thesis. Faculty of Agricultural Sciences, University of Gezira, Wad Medani, Sudan,

[15] Weiss E.A. 1983. Oil seed crops. Longman Inc. New York.

[16] Yadava T. P. 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

[17] Young C. 1996. Peanut oil. Bailey's Industrial Oil and Fat Product. 2, 337-392