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Weed Population Dynamics under the Influence of Sunshine on the Growth and Yield of Groundnut (*Arachis hypogea*) in the Savanna Dry Farm Land of Sokoto

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ABSTRACT
Productivity of groundnut (*Arachis hypogaea* L.) is becoming very low, due to many limiting factors beset in its cultivation. Plant density and weed competition in crop constitute the main limiting factors. In order to combat the problems, the optimum plant density and most appropriate weeding period for good production in groundnut has been investigated at the dry farmland of Usmanu Danfodiyo University, which aimed at understanding weed crop interaction as regards to the nature of weeds as they interfere with groundnut production system in the Sudan Savanna. Five weed species emerged early in the plots with *Cenchrus biflorus* (47.57%) having the highest percentage of emergence followed by followed by *Zonia latifolia* (33.33%). A total of 17 weeds species emerged late in the plots. Among those that ranked high in number and percentage from the, are *Acroceras amplectans* (24.50%) followed by *Achyranthes aspera* (23.32%). The species with the lowest percentage emergence in the sun plots are *Indigo-ferahirsuta* (1.97%). Certain weeds species were found to be common to both early and late emergence and they were separated as the common weed species. The germination ranged from 141 to 160. Higher light intensity and weeding reduced competition from weeds, enabled plants in the sun to grow and yield better than those in the un-weeded plots.
Keywords: Groundnut, yield, weeds, Growth, Savanna and Dry farm land

INTRODUCTION

Populations of weeds capable of affecting crop yields are present in every field during every year.
While competition is the primary interaction between crops and weeds, other types of interactions also influence crop responses to weeds. Plants are able to sense the presence of neighboring plants and may alter their growth pattern in response to these neighbors, even in the absence of limiting resources (Akobundu, 1987). This is known as a shade avoidance response, and typically involves increased stem elongation to allow one plant to gain a height advantage over others.
This response may be responsible for yield losses that occur when weeds compete for short periods of time early in the growing season when there may be sufficient resources available to satisfy the needs of both the crop and weed (Islam *et al.*, 2011). Weeds appear much more adapted to agro-ecosystems than our crop plants. Without interference by man, weeds would easily wipe out the crop plants. This is because of their competition for nutrients, moisture, light and space which are the principle factors of production of crop. Generally, an increase in on kilogram of weed growth will decrease one kilogram of crop growth (Page *et al.*, 2009).
Groundnut is an important food crop of the world and also a source of income for farmers. Groundnut cultivation is influenced by a number of factors such as climatic factors, edaphic (soil factors) and

biological factors such as pests and diseases and agronomic factors such as spacing and weed management. Groundnut is grown on 26.4 million hectares worldwide with a total production of 36.1 million metric tons, and an average productivity of 1.4 metric tons (FAO, 2004). Garko *et al*. 2016 and Youdeowei (2002) made observation on the weed flora of groundnut fields and reported that, out of 55 weed species 14 were monocots and remaining 41 species were of dicots belonging to 21 families. The weeds associated with groundnut in the experimental field were *Boerhavia diffusa, Trainthema portulacastrum, Eclipta alba, Amaranthus viridis, Parthenium hysterophorus, Gynandropsis pentaphylla, Cyperus rotundus, Panicum repens* and *Dactyloctenium aegyptium.* (Norman *et al.* 1996)

Generally, correct timing of weeding is imperative in the determination of yield in groundnut cultivation. Therefore, the objectives of this study were to determine:

(i) To document the prevalent weeds species and their dominance

(ii) and the yield response of groundnuts to different weeding period.

MATERIALS AND METHODS

The Study area

The study was carried out at the dry land farm of Usmanu Danfodiyo University, Sokoto is located between latitude 13.02'N and longitude 5.25'E at altitude of 351m above the sea level (Salau *et al.,* 2017). The climate of the area is of the Sudan savanna type characterized by long dry season between the month of October to May and short unimodal rainy season between May to October. The mean annual rainfall lies between 600-700mm. The mean maximum and minimum temperature are 40^{o}C and 15^{o}C respectively. Also the mean relative temperature varies from 5% in February to 70-90% in August or at the peak of rainy season (Anon, 2004). Most perennial trees shade their leaves and barks during the dry season periods. The area covered by full herbaceous plants (grass and forb) and shrub grow during the rainy season.

Sampling Procedure

The materials used in the field were pick axe, trowel, measuring tape, meter rule and polythene bags. In the field, twelve plots were marked out. Six were in an open field and the other six were in shade. Each plot measured 3 meter and was divided into 12 rows. On each row, three viable groundnut seeds were sown in fifteen holes of 20cm interval, making a total of 540 seeds per plot.

The characteristics of the different plots are as follows: Plot 1, there was no weeding both before and after sowing plot -2, was weeded two weeks after planting and every three week, thereafter up to harvesting. Plot -4, was weeded once before planting. Plot -6, was weeded twice, once before planting, two weeks after planting and every three weeks up to harvest.

Weeding was carried by uprooting all weeds that emerged in the plots. The treatments given to the plots in the open field were repeated in the plot under shade. The seeds planted in the shade, were shaded by neem tree of *Azadirachta indica*. The experiment lasted for 11 weeks after sowing.

Plant Identification

Weeds occurring in all plots were identified to species and counted. The identification was verified by comparison with the herbarium specimens at the Usmanu Danfodiyo University, Sokoto. The identification of the weeds was in accordance with Alam *et al.* (2002).

Emergence of Seeds Sown

The number of groundnut plants emerged from the seeds sown in each sample plot were counted and recorded as it appeared. Seed yield and biomass were determined by weighing on a meter balance. The dry weight sample was obtained by oven at 70^{o}C for 48 hours.

RESULTS

Weed species associated with groundnut crop in dry land farm

The number of weed species competing with groundnuts in dry land farm was analyzed. Thirty eight (38) weed species belonging to twenty flowering plants families were encountered on the farm. Eleven (11) species belonging to three flowering plant families were found to be monocotyledons while the remaining

27 weed species belonging to 17 flowering plant families were dicotyledons. Among the dicotyledons there are seedlings of tree species *Azadirachta indica* and *Psidium guajava*.

Early and Late Emergence of Weed Species in the Plots

The result of the determination of early and late stage development of the weeds in the plots is presented in Tables 1. The number and percentage of weeds that emerged early between first to fifth week are given in Table 1. Five weed species emerged early in the plots with *Cenchrus biflorus* (47.57%) having the highest percentage of emergence followed by followed by *Zonia latifolia* (33.33%). The lowest percentage emergence was recorded for *Pennisetum* spp (2%) in the plots: whereas *Tech rosia*, *Cencerus zonia* and *Pennisetum* species emerged early in the sun plots.

The number and percentage of weed species that emerged late between the sixth week and eleventh week are given in Table 2. A total of 17 weeds species emerged late in the plots. Among those that ranked high in number and percentage from the, are *Acroceras amplectans* (24.50%) followed by *Achyranthes aspera* (23.32%). The species with the lowest percentage emergence in the sun plots are *Indigo- ferahirsuta* (1.97%). Certain weeds species were found to be common to both early and late emergence and they were separated as the common weed species. Weed found to have emerged early and late in the plots, The weed species that had high percentage emergence were (those from the sun) *Borreriaradiata* (81.75%) and *Corchustridens* (4.83%). The species with the lowest percentage emergence in the sun plots is *Cleome viscose* (0.9%).

Table 1: Percentage of weeds emerging early in plots of groundnuts

Weed species	No	Percentage (%)
Calotropis procera	6	6
Tephrosia bracteolate	11	11.1
Cenchrus biflorus	47	47.57
Zonia latifolia	33	33.33
Pennisetum sp	2	2.0
Digitaria debilis	0	0
Psidium guajava	0	0

Table 2: Percentage of weed species emerging late in plots of groundnuts

Weed species	No	%
Achyranthes aspera	59	23.32
Ipomea involuerata	15	5.92
Alysicarpus vaginalis	31	12.25
Acroceras amplectans	62	24.50
Waltheria indica	9	2.55
Eragrostis tenella	9	3.16
Sesbania bispinosa	8	9.88
Euphoria hirta	25	4.74
Cassia mimosoides	12	7.11
Crotalaria spp	18	1.97
Indigofera hirsute	5	0
Cassia obstusifolia	0	0
Dactyloctenum aegyptum	0	0
Tridax procumbens	0	0
Phyllanthus amarus	0	0
Sesamum indicum	0	0
Pennisetum polystachion	0	0

Germination of Groundnut Seeds in the Plots

The result of the percentage germination of groundnut plant per plot sampled is presented in Tables 3. The germination in the plots was generally higher and the highest percentage was 31.85% for plot 6 and a lower percentage of 13.5% for plot 4.

Table 3: Germination of Seeds of *Arachis hypogea* per plot in the dry land farm at UDUS

Plot NO.	No of Seed Sown	Emergence	Percentage
1	540	132	24.4
2	540	128	23.70
3	540	124	22.96
4	540	71	13.15
5	540	90	16.67
6	540	172	31.85

Effect of Weeds on Groundnut Yield

The yield of groundnut in the plots is presented in Table 4. The highest yield 1399.4 grams recorded was in Plot 3. While the lowest yield of 451.8 grams was in Plot

Table 4: Seed yield of *Arachis hypogea* grown in the plots in dry land farm

Plot No	Sunshine Yield (g/m^2)
1	505.6
2	544.3
3	1399.4
4	458.3
5	451.8
6	629.5

DISCUSSION

From the investigation, thirty- eight (38) weed species belonging to twenty (20) flowering plant families were found occurring in the Savannah dry land farm of Usmanu Danfodiyo University, Sokoto. Some of these weeds appear as soon as rain star and can be described as the early emergence weeds such as *Calotropis procera*, Tephrosia *bracteolate*, *Cenchrus biflorus*, *Zornia latifolia*, *Pennisetum spp*, *Sida cordifolia*, *Pennisetum pediceqtum*, *Acroceras amplectans*, *Digitaria deblis* and *Psidium guajava*. Some weeds take quite a long time after the rainy season before they appear like *Borreria radiate*, *Achyranthes aspera*, *Corchorus tridens* and *Hibiscus sadariffa* while some disappeared very quickly as soon as the rain stop like *Indigo-ferahirsuta* and *Sida cordifolia*.

From the density of weeds encountered in the farm, it is clear tha five species namely *Borreria radiate*, *Amaranthus spinosus*, *Corchorus tridens*, *Azadirachta indica* and *Achyranthes aspera* constitute almost 78% of entire weed community in the farm.

The university dry land is cultivated once in a year during the rainy season of June to October, and is then left cleared until another rainy season begins. This indicates that groundnut crop performs better and is able to compete effectively with weeds under the sun area. Light is an important growth factor competed for by weeds and crops, the ability to grow rapidly and develop canopy cover is important for successful competition for light.

The consistently higher seedling emergence in the stirred plots is in agreement of weeds seeds (Ahmed *et al.*, 2011, Alam *et al.*, 2002). For example, in plots 2.3 5 and 6 were weeding was done after planting, the soil become soft, loose and aerated which are necessary conditions for seed germination and thus indicates that weeding at regular interval enhances germination, growth yield and low weed infestation of groundnut crops than in non- weeded plots.

Competition with weeds during the first days or weeks after crop emergence is critical for crop performance. For example in Plot 4, where weeding was only done before planting, and left with weeds

up to harvesting period, there is low crop yield probably due to high competitive ability for nutrients, water space and light by the weeds than the crops especially for photosynthetic activities and other metabolic processes (IITA, 2005). Also, there is marked indication of stunted growth habit, leaf discoloration and defoliation of groundnut crops as a result of high incidence of weed species composition on some of the sample plots.

CONCLUSION

In the study thirty- eight (38) weed species associated with groundnut crop in the University dry land farm, were identified. These weed species were most abundant in the area. The highest groundnut yield recorded in the plots that were weeded during the experiments was due to high light availability to the crops and the weeding process that reduced weed infestation at regular intervals and thereby reducing competition for food, water, space and air between the crops and weeds. The higher light intensity and regular weeding reduced competition from weeds, enabled plants in the sun to grow and yield better than those in the un-weeded plots

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