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Editorial

Praise be to Allah and peace and prayers be upon his messenger.

Dear reader.

We are pleased to present this 3rd volume of Merowe University of Technology – Abdullatif

Alhamad journal.We appreciatedyour satisfaction and your feedback to the previous volumes and we are looking forward to receiving yourvaluable comments of the present volume In this volume, we have focused on scientific and knowledge diversity with aview to lending a hand that actively participates in the rebuilding of our beloved country

In this volume you will find diversified topics carefully selected to cover a wide range of science branches and knowledge.

The journal will soon be published online to reach wider readership. Finally, we are full of hope that you will find this volume of value in helping science and knowledge. We invoke Allah to guide us in the right direction

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Comparative Web Based Analysis for Universities Ranking Systems

Mohammed Ahmed Osman ^{1*}, Rashid A. Saeed², Mohammed Mustafa³ 1.Department of Physical and Mathematical, Sciences, Merowe University of Technology (MUT) Merowe, Sudan

- 2.Dept. Computer Engineering, Taif University, Al-Taif, KSA
- 3. Dept. of Computer Science, University of Tabuk, , Tabuk, KSA
- * E-mail: rmoh2003m557@merowe.edu.sd

Abstract

The global ranking of universities appears to measure the performance of institutions of higher education through their websites by measuring some indicators such as scientific research, global outlook and the percentage of faculty staff member and alumni and staff wining Nobel Prizes. This paper describes the history of well-known international ranking systems and compares four of them to identify their differences. Universities can benefit from these classifications in order to improve their academic and practices and make them stronger. It is very important that universities are interested in innovation and connectivity with the community. We noticed that this aspect of the third mission absent in most of these classifications. There are also no standards criteria in ranking to measure contribution of universities which associated with industry by helping in consultancy and innovations. The paper found that universities rankings can be done in relevant peers, as well as from national and regional systems that operate in same models.

Keywords—global ranking; research; higher education; Reputation; staff awards

مستخلص:

يقاس اداء مؤسسات التعليم العالي من خلال مواقعها الالكترونية بقياس بعض المؤشرات مثل اداء المؤسسة في البحوث العلمية التي تقدمها وكذلك الظهور العالمي وجودة اعضاء هيئة التدريس و الخريجون واعضاء هيئة التدريس ممن نالوا جائزة نوبل في العلوم.

هذه الورقة تناولت الجهات المشهورة التي تقوم بعمل تصنيف دوري للجامعات وقامت بعمل مقارنة لاربعة تصنيفات عالمية لمعرفة الفروقات بينهم. تستفيد الجامعات من هذه التصنيفات لتطوير ادائها الاكاديمي والعملي ومن المهم جدابالنسبة للجامعات ان ترتبط بمجتمعاتها وتساهم في تطوير الابتكارات ورعايتها

الورقة توصلت الي ان الجهات الاربعة التي تناولتها لم تهتم بقياس المهمة الثالثة للجامعات وهي تنمية المجتمع وكنيرة وكنلك توصلت الي ان المقارنة تكاد تكون معدومة بين الكثير من الجامعات لان هنالك جامعات قديمة وكبيرة في العالم الاول ولايمكن مقارنتها بجامعات حديثة وفي العالم الثالث حيث تنعدم الموارد المادية والبشرية وكما ان التصنيفات لم تهتم بمشاركة الجامعات في النهضة الصناعية والابتكارات وتقديم الحلول الاستشارية

I.Introduction:

Today websites are the main source of academic communication to institutions of higher education and scientific research centers. Therefore, academic institutions dedicate a large part of their resources to improve their presence on the Internet. The interest in publishing on the Internet reflects the activity of scientific and research performance of these institutions as well as the accessibility of a large number of diversities.

This is a social role for scientists in these institutions and to benefit from the scientific and educational journals published on the web. These rankings are conducted by some famous international magazines, newspapers, some academic institutions scholars, and governments' information centers. University ranking systems have become increasingly important because the growth of the knowledge economy and increased global competition, it is important for universities to analyze their capabilities through these rankings by anticipating their positions and conducting comparative analyzes with other universities to improve the quality of education and scientific research performance.

The university classification systems grant students the transparency of information in case of choosing a particular university department. The university ranking systems depend on a selection of indicators and the ranking table is based on them and varies according to the specific circumstances of each country in terms of education systems, expectations, cultures, and other aspects. Most of these frameworks uses research-based indicators to deal with the facts.

National ranking systems are better able to deal with regional and cultural factors because they are built for country-specific purposes, when the scope of the ranking at the national level, it is likely to produce a more accurate list through the higher assessment, educational or political institutions can take the necessary measures to enhance the quality of higher education in relative terms.

These types of systems have great potential to increase the quality of academic institutions. For the purpose of this study the paper analyses four international ranking systems for universities to study the criteria's and indicators used and to study the differences and similitudes between them.

The study address the question about is the four international ranking systems suitable for all universities across the world through comparison top 10, top 25, top 50, top 100 cross ranking, the result expected that the four international ranking systems not similitude when we see the universities league table for each ranking system and also there are small and newer universities which haven't huge number of researcher and academics staff to compare with those age more than one hundred years old.

The reminder of this paper is organized as follows: Section II is the literature review. Section III, discusses the research methodologies, Section IV discusses (ARWU), Section V discusses QS, section VI reviews THE, VII discusses Webometrics rankings, Section VIII general discussion, and last Section IX conclusion.

II.Literature Review:

The phenomenon of assessment and classification of universities start in the world when US News and World Reports magazine published a report on the best American colleges in terms of performance [1], [2]Universities believe that classifications are important in building reputation because of transparency that support university administration, where classification systems represent strategic planning, optimal utilization of resources and marketing to the university. It helps workers to organize; quality assurance, finance and academic mobility are also great importance to the performance of higher education institutions [3]. Classification systems also provide information that helps students and their families to make decisions about university

education. According to the European Union of Universities, classification has a periodic scheduling method, a classification that focuses on scientific research based on a set of indicators[4]. The classifications have several categories based on level, field, focus on the target, education or scientific research[5].

Academic Rankings of World Universities (ARWU) are based on the performance of scientific research, as well as the quality of graduates and faculty members who have received international medals or Nobel prizes, articles in natural sciences published in refereed international journals [4].

One of the most important classifications between 2004 and 2009 was the emergence of a collaboration called The-QS, which began with the correlation between them. There was a significant change in the way indicators were calculated [6]. The academic outlook represents 40% of the indicators which also included the percentage of teaching staff from abroad to the number of

students and the percentage of teaching staff compared to students and teaching staff holding PhD's[6].

However, these two classifications are different in some weights and indicators, they are based on research and their system depends on the web. It supports the idea that university publications on the web affect their appearance in terms of the number of articles published, we have very important questions as growing number of institutions that classify universities, which standard they have and measure, which systems are built, is it reliable, Therefore, the taxonomic experts conducted joint studies to assess the quality of different classification systems.

They published a set of principles for the evaluation of classification systems called (Berlin Principles). These principles are the methodology for monitoring performance by the International Classification Experts Group (IREG) [7] Several initiatives have emerged to evaluate European universities, including U-Map, U-Multibank, and AHELO [6], by using U-Map tools user can present performance report about specific discipline of study. U-Map have six dimensional criteria that are research, knowledge transfer, international orientation, teaching and international engagement [8].

Center of Higher Education Policy Studies (CHEPS) of university of Twente in Netherlands lead classification of universities by U-Map tools which funded by European Union U-Map displays comparison of up to three institutions to assesq2sment of higher education institutions in more detailed manner by using profile viewer tools [6]. Another classification system is the classification of the Center for Higher Education in Germany (CHE). It has been a national center for the classification of German universities only, but some countries are using as well. This classification is multi-dimensional. Students have the occasion of choosing their own measures and own ranking lists rendering to their interests by using multi-dimensional ranking [9].

III. Ranking Methodology:

The methodology for this comparative analysis contains:

- •Selection of Some international universities rankings systems are based on their results in the four most prestigious and influential world university rankings: the Academic Ranking of World Universities (ARWU), the QS World University Rankings (QS) and THE World University Rankings [10].
- •The criteria and weights used for each Indicators.
- Data sources used.

- •Compare Top 10, 25, 50,100 universities similarity and differences between the selected rankings.
- •Comparative analysis, regarding the ranking criteria and weights for top universities.
- Statistics by countries.
- •the academic ranking of world UNIVERSITIES (ARWU)

Center for World-Class Universities (CWCU) published the Academic Ranking of World Universities (ARWU), Graduate School of Education of Shanghai Jiao Tong University, China, and updated on an annual basis since 2003, Shanghai Ranking Consultancy has been published and copyrighted the Academic Ranking of World Universities annually comparing and evaluating the top 500 higher education institutions in the world. It was increased to 800 institutions at 2017. The record number of 1000 universities was published in 2018[11], ARWU uses six objective indicators and Weights to rank world universities as follows:

Alumni (10%)— alumni number of universities winning Nobel prizes in science, technology Engineering and Mathematical (STEM). Unlike weights are set conferring to the obtaining degrees periods. If a one obtains more than degree from an institution, the institution is considered once.

Award (20%) –Number of staff obtain Nobel prizes in science, technology Engineering and Mathematical (STEM).

Fig. 1: ARWA Indicator

HiCi (20%) – Highly cited researchers. Only the main affiliations of highly cited researchers are measured.

N&S (20%) – Papers published in nature and science. A weight of 100% is assigned for primary author, 50% for second author affiliation, 25% for the third author affiliation, and 10% for the fourth author affiliations. Only article publications are calculated.

PUB (20%) – Papers indexed in science citation index-expanded (SCI-E) and social science citation index (SSCI). Article publications are calculated.

PCP (10%) – The average of the five above wieght divided by the full-time academic staff.

IV. WORLD UNIVERSITY RANKING

The QS ranking has been published since 2004 by the research company Quacquarelli Symonds Limited. It focuses on a multidimensional assessment

of relative strengths of leading world universities whose num-ber has been constantly increasing up to the record number of 1000 institutions in 2018[12].

Fig. 2 QS Indicators

Compared to the ARWU, it does not use the US database Web of Science but the database Scopus of the Dutch publishing house Elsevier, which of course contributes to a greater balance between institutions from English-speaking and non-English-speaking countries. Compared with the two other top rankings, it has the widest scope, as it is addressed by its authors not only to future students and their parents to guide them what university to choose but also to present students, academics, employers, government agencies and all other users to indicate to them what level a given university has reached. Universities will be evaluated according to six criteria.

Academic reputation Institution's (40%)

Academic Reputation score have highest weighting of any metric allotted the world's survey of academic opinion, in relations of extent and scope, is an unequaled means of gauging mawkishness in the academic folk.

Employer reputation (10%)

Students should receive valuable training for the employment market. It means how successful universities are preparing their primary customers (students). Faculty/Student Ratio (20%)

This ratio is indication of teaching quality which is treated as the most important metric. This metric is assessing the extent to which university is able to support students with full access to their instructors.

Citations per faculty (20%)

Citations received by all articles produced by university throughout five years period divided by faculty members. Elsevier's Scopus database is used for cita¬tions. In 2017, QS assessed 99 million citations from 10.3 million papers where self-citations were excluded.

International faculty ratio (5%) – measures the ability of a university to attract undergraduates, postgraduates and faculty from all over the world that is key to its success on the world stage.

International student ratio (5%)

The proportion of foreign students (foreigners) out of the total number of students.

V.TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKING

The World University Ranking is an annual university ranking published by Times Higher Education magazine, which collaborated with some startups to rank the world's QS universities from 2004 to 2009 before the magazine became co-operative with Thomson Reuters in the new classification system.

Fig. 3 The Indicators

Teaching (the learning environment): 30%

The most recent Academic Reputation Survey (run annually) that underpins this category was carried out in January to March 2018, attracting 10568 responses. It examined the perceived prestige of institutions in teaching. The responses were statistically representative of the global academy's geographical and subject mix. The 2018 data are combined with the results of the 2017 survey, giving more than 20000 responses [13]

Research (volume, income and reputation): 30%

The most protuberant effect in this category looks at university's character for research excellence among its peers [13].

Citations: Research impact (30%)

Measures capturing the number of times a university's published work is cited by scholars and researchers..

International outreach (staff, students and research 7.5%)

It determines an ability to attract faculty and students from across the world, which in turn proposes that it holds a strong international brand.

Industry income (knowledge transfer 2.5%)

Universities ability to help industry with innovations, inventions and consultancy has become a core mission of the modern global universities [14]. VI.WEBOMETRICS

Since 2004 Cybermetrics Lab (Spanish National Research Council, CSIC) every six month perform an independent exercise for ranking academic institutions, for providing useful information about the performance of universities, Webometrics Ranking is published twice a year ,the objectives is promoting substantial increases of the volume and quality of their electronic publications[15]. Webometrics have four indicators as followed:

- •Presence (5%): It includes all the sub domains sharing the same (central or main) web domain and all the file types including rich files like pdf documents.
- •Visibility (50%): number of external networks (subnets) originating backlinks to the university's Webpages

Fig. 4 Webometrics Indicators

- •Transparency (10%): number of citations from top authors according to the source
- •Excellence (35%): number of papers amongst the top 10% most cited in 26 disciplines.

VII.DISCUSSIONS

The paper found that when applying Top10 universities cross ranking for websites only four universities appears in the four international ranking systems as selected in the study (TABLE1), Massachusetts Institute of Technology ranking (1) according to Qs and (5) according to THE and (4) according to ARWU, Harvard university rank (1) according to ARWU and Webometrics, university of Oxford rank (1) according to THE and (7) according to ARWU and Webometrics, Three Universities from United States while Only university of Oxford from United Kingdom.

TABLE 1: COMPARATIVE TOP 10 UNIVERSITIES OF FOUR INTERNATIONAL GLOBAL RANKING SYSTEMS (QS,THE, ARWU, WEBOMETRICS) 2018

•	,				
Webo	ARWU	THE	Qs	Con	University
3	4	5	1	US	MIT
2	2	4	2	US	Stanford University
1	1	6	3	US	Harvard University
7	7	1	6	US	University of Oxford

when applying universities cross ranking for websites in top 25 the paper found that only thirteen universities appears in the four international ranking systems as selected in the study, University of Cambridge rank (2) in THE and rank (11) in Webometrics, university of Chicago rank (9) in QS and rank (24) in Webometrics, Princeton university rank (6) in ARWU and (22) in Webometrics, United states have (11) universities in top 25 cross ranking while United

Kingdom \Box have (2). when apply universities cross ranking for websites in top 50 and top 100 the paper found that 22 and 36 universities respectively appear in the four international ranking systems (TABLE 2).

TABLE 2: COMPARATIVE TOP 25 UNIVERSITIES CROSS RANKING OF FOUR RANKING SYSTEMS (QS,THE, ARWU ,WEBOMETRICS)2018

Webo	ARWU	THE	Qs	Con	University
3	4	5	1	US	MIT
2	2	4	2	US	Stanford University
1	1	6	3	US	Harvard University
11	3	2	5	US	University of Cambridge
20	17	16	7	US	University of Oxford
24	10	9	9	US	University of Chicago
22	6	7	13	US	Princeton University
8	12	19	14	US	Cornell University
13	13	12	16	US	Yale University
18	18	13	17	US	Johns Hopkins University
9	8	14	18	US	Columbia University
10	16	11	19	US	University of Pennsylvan ia

TABLE3: TOP 10 25 50 100 UNIVERSITIES -COMPARISON BETWEEN THE FOUR INTERNATIONAL RANKING ACROSS COUNTRIES 2018

Top 100	Top 50	Top 25	Top 10	Countries
23	16	11	3	Us
4	4	2	1	Uk
2	1	-	-	Canada
2	1	-	-	China
1	-	-	-	Japan
4	-	-	-	Australia
36	22	13	4	Total

TABLE 4: RESULTS OF THE FOUR GLOBAL UNIVERSITY RANKINGS, FOR 2018

Webo	THE	QS	ARWU	Criteria		
Reputation In	Reputation Indicators					
-	-	-	20%	Staff Award		
-	-	-	10%	Alumni Award		
-	-	10%	-	Employer Rep		
-	30%	-	-	Teaching		
-	-	5%	-	Intern Students		
-	-	5%	-	Intern Staff		
50%	-			Visibility		
	7.5%	40%	-	Academic Rep		

5%	-	-	-	Presence		
55%	37.5%	60%	30%	Total Score		
Performance	Performance Indicators					
10%	30%	20%	20%	HiCi		
35%	30%	-	40%	Volume		
-	-	-	10%	PCP		
-	2.5%	-	-	Income		
-	-	20%	-	Faculty staff ratio		
70%	40%	62.5%	45%	Total Score		

Through this paper We studied and addressed the four famous international ranking, firstly we describe a historical overview, then analyzed methodologies used and weights, criteria for each ranking and made a top10, top25, top50, top100 cross ranking and found that not more than 36 universities crossed appeared in the Top 100 ranking mentioned on this paper and most of them from United States. We observed that ARWU put percentage to staff and alumni who award Nobel prizes and Fields Medals, while the other three ranking system ignore this criteria. Qs Set 10% for Employer Reputation based on the responses to a survey distributed worldwide to employers from a number of different sources, while others ranking systems ignored.

Although Qs set 5% to international staff and international students while no weight for others. Qs Set 40% to academic reputation and THE set 7.5% no weight for ARWU and Webometrics. THE weights teaching as 30% no score for others. Webometrics weights 50% to visibility and 5% to presence while no weights for the Qs, THE, ARWU. All four ranking systems agree with High Citation impact indicator, THE set 30%, QS and ARWU set 20% while Webometrics set 10%. Although for research volume THE, ARWU,

Webometrics set weights while QS ignored. ARWU set 10% for Academic performance Per-capita, while others gone, THE weighted income per academic whiles others omitted. Qs Weighted 20% for faculty staff ratio while others ignored.

We agree with the study[16] Conclude that focus of Times Higher Education ranking system is research quality an education ,and the focus of academic ranking of the world focus on research quality and it is output, and Quacquarelli Symonds (QS) focus on academic and employer's reputation. The study did not talk about webometrics focus, but we found that webometrics focus on quality of research.

VIII.Conclusion:

This paper found that these ranking uses different dataset sources to analyze criteria and calculation score, all four ranking systems mentioned on this paper uses same analytical tools and data source to measures research quality, Essential Science Indicators (ESI), Science Citation Index-Expanded (SCIE) and the Social Sciences Citation Index (SSCI) in Web of Science Core Collection, thus the calculation score is fair across research quality. The differences come from structural variables including, size, age, geography, disciplinary orientation, and country differences.

It is difficult for new born universities to pass most of the criteria's belonging to ranking systems. In the third world most newer universities have not enough budgets or funds or scientific laboratories to conducting a researches unlikes olders like US country which most of top 100 rank universities in the world, other universities mission to transfer technology to industry which is refer to innovation, the community engagement (social, cultural, environmental roles) and even the political influence.

In this paper we proposed to divide the criteria used in the international ranking systems as Reputation and performance. It is observed that the methodologies and criteria used are not homogenous and cannot give precise comparisons and are not inclusive for all purposes and missions of universities, the study found that there are structural variables affect the ranking criteria's, universities peers, age, size, country location, numbers of staff, numbers of alumni, funds allocated for research and community development.

We found that universities rankings can be done in a relevant peer, as well as from national and regional systems that operate in same models. The study found that ranking systems focus on quality of teaching and quality of research but didn't put criteria to measure third mission for universities which is very important, most of universities round the word opening offices or directorate or establish academic colleges for this purpose.

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The Usage of Matlab in Calculating the Total Mean Curvature

Abdel Radi Abdel Rahman Abdel Gadir*1 , Ragaa Mohammed Haj Ebrahim*2 and Abubaker Abdalla Mustafa*3

- 1- Department of Mathematics, Faculty of Education, Omdurman Islamic University, Sudan
- 2- Department of Mathematics, Faculty of Education, Elzaiem ElAzhary University, Sudan
- 3-Department of Mathematics, Faculty of Education, Dalanj University, Sudan

Abstract:

This study aims to calculation the total mean curvature using Matlab.

We followed the historical mathematical applied method and we found the following results:

The first fundamental form plays such a basic role in the theory of surfaces that we found it convenient to introduce more modern version , all curves in equivalence class have the same normal curvature and their geodesic curvatures vanished , the second fundamental form is symmetric , the first fundamental form on a surface measures the square of the distance between two infinitesimally separated points. There is a similar interpretation of the second fundamental form such that the second fundamental form measures the distance from a point on the surface to the tangent plane at a second infinitesimally separated point, to calculate the total mean curvature using

Matlab we used the first and second fundamental forms of the surface and we found possibility of calculating total mean curvature using matlab Key Wards: Calculation, Total Mean Curvature, Matlab

مستخلص

الماتلاب بإستخدام الكلي الانحناء متوسط حساب إلى تهدف الدراسة هذه :التالية النتائج إلى وتوصلنا التطبيقي الرياضي التاريخي المنهج اتبعنا

حديثاً عرضاً تقدم سهلة وجدناها حيث السطوح نظرية في أساسياً دوراً تلعب للسطح الأولي الأساسية الصيغة الأساسية الصيغة , متلاشي لها الجيوديسي والإنحناء الطبيعي الإنحناء نفس لها التكافؤ صنف في المنحنيات جميع الصغر متناهي بشكل نقطتين بين المسافة مربع تقيس للسطح الأولي الأساسية الصيغة , متماثلة للسطح الثانية علي نقطة من المسافة تقيس أنها حيث للسطح الثانية الأساسية للصيغة مشابه تفسير يوجد .المنفصلة للنقاط بإستخدام الكلي الإنحناء متوسط لحساب .الصغر متناهي بشكل الثانية الأساسية الصيغة إستخدمنا الماتلاب الكلي الإنحناء متوسط حساب إمكانية ووجدنا للسطح الثانية و الأولي الأساسية الصيغة إستخدمنا الماتلاب بإستخدام .الماتلاب بإستخدام

Introduction:

In daily life, we see many surfaces such as balloons, tubes, tea cups and thin sheets such as soapbubble, which represent physical models. To study these surfaces, we need coordinates for the work of the necessary calculations. These surfaces exist in the triple space, but we cannot think of them as three dimensional. For example, it we cut a cylinder longitudinal section, it can be individual or spread to become aflat ona desktop. This shows that these surfaces are two-dimensional inheritance and this should be described by the coordinates. This gives us the first impression of how the geometric description of the surface. The regular surface can be obtained by distorting the pieces of flat paper and arranging them in such away that the resulting shape is free of sharp dots or pointed letters or intersections (the surface cutsitself) and thus can be talked about the tangent level at the shape points. The surface is said to be in the triple vacuum is subgroup from (Le, a special pool of points) of

course, not all particle groups are surfaces and certainly mean smooth and two – dimensional surfaces.

Matlab is a software package for computation in engineering, science, and applied mathematics. It offers a powerful programming language excellent graphics and a wide range of expert knowledge. Matlab is published by a trademark of the math works. The focus in Matlab is on computation, not mathematics: Symbolic expressions and manipulations are not possible (except through the optional symbolic tool box, a clever interface to Maple). All results are not only numerical but inexact. The limitation to numerical computation can be seen as a drawback, but it is a source of strength too: Matlab is much preferred to Maple, Mathematic, and the like when it comes to numeric.

On the other hand compared to other numerically oriented languages like C++ and Fortran, Matlab is much easier to use and comes with a huge standard library. The unfavorable comparison here is a gap in execution speed. This gap is not always as dramatic as popular lore has it, and it can often be narrowed or closed with good Matlab programming. Moreover, one can link other codes into Matlab, or vice versa, and Matlab. [3]

Surfaces in:

 $\label{eq:definition} Definition (2.1): \ Coordinate \ chart \ is \ a \quad map \quad from \ an \ open \ subset \ of \ into \ .$

(2.1)

We will always assume that the Jacobian of the map has maximal rank. In local coordinates, a coordinate chart is represented by three equations in two variables:

The assumption that the Jacobian $J=(xi^{-1}/u^{-1})$ be of maximal rank allows one to invoke the Implicit function Theorem. Thus, in principle, one can locally solve for one of the coordinates, say x3, in terms of the other two, like so:

The locus of points in satisfying the equations can also be locally represented by an expression of the form:

$$(2.4)$$
 [6]

Definition(2. 2):Let and be two coordinate charts with anon – empty intersection. The two charts are said to be equivalent if the map and its inverse are infinitely differentiable the definition simply states that two

equivalent charts and represent different reparametrizations for the same set of points in [[1

Definition(2.3):A differentiability smooth surface in is aset of points in satisfying the following properties:

- If then p belongs to some chart.
- If belongs to two different charts and , then the two charts are equivalent. Intuitively, we may think of a surface as consisting locally of number of patches "sewn" to each other so as to form a quilt from a global perspective. The first condition in the definition states that each local patch looks like apiece of , whereas the second differentiability condition indicates that the patches are joined together smoothly. Another way to state this idea is to say that a surface a space that is locally Euclidean and it has a differentiable structure so that the notion of differentiation makes sense .If the Euclidean space is of dimension , then the surface is called ann-dimensional manifold. [7]

Examples(2.4): Consider the local coordinate chart:

The vector equation is equivalent to three scalar functions in two variables: ,

Clearly, the surface represented by this chart is part of the sphere . The chart cannot possibly represent the whole sphere because, although a sphere is locally Euclidean, (the earth is locally flat) there is certainly a topological difference between a sphere and a plane. Indeed, if one analyzes the coordinate chart carefully, one will note that at the North pole the coordinates become singular. This happens because implies that regardless of the value of , so that the North pole has an infinite number of labels. The fact that it is required to have two parameters to describe a patch on a surface in is a manifestation of the 2-dimensional nature of the surfaces. If one holds one of the parameters constant while varying the other, then the resulting 1- parameter equations describe a curve on the surface. Thus, for example, letting constant in equation (2.5), we get the equation of a meridian great circle. [4] Notation(2.5): Given a parameterization of a surface in local chart, we will denote the partial derivatives by any of the following notations.

3. The First Fundamental form:

Let be a local parameterization of a surface. Then, the Euclidean inner product in induces an inner product in the space of tangent vectors at each point in the surface. This metric on the surface is obtained as follows:

Thus, (3.1) Where (3.2)

We conclude that the surface, by virtue of being embedded in R3, inherits a natural metric (3.1). Which we will call the induced metric. A pair , where is a manifold and is a metric is called a Riemannian manifold if considered as an entity in it self, and Riemannian submanifold of if viewed as an object embedded in Euclidean space. An equivalent version of the metric (3.1) can be obtained by using a more traditional calculus notation:

We can rewrite the last result as

(3.3)

Where:,,,

That is: [11]

Proposition(3.1): The parametric lines are orthogonal if .[1]

4. The Second Fundamental Form:

Let be a coordinate patch on a surface. Since and are tangential to the surface, we can construct a unit normal to the surface by taking

(4.1)

Now, consider a curve on the surface given by . Without loss of generality, we assume that the curve is parameterized by arclength so that the curve has unit speed. Using the chain rule, we se that the unit tangent vector to the curve is given by

(4.2)

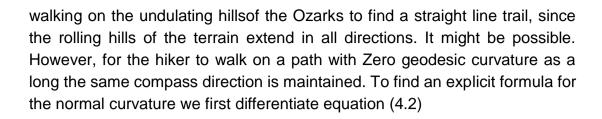
Since the curve lives on the surface and the vector is tangent to the curve, it is clear that is also tangent to the surface. On the other hand, the vector doesn't in general have this property, so we decompose in to its normal and tangential components

(4.3)

Where .

The scalar quantity is called the normal curvature of the curve and is called the geodesic curvature vector. The normal curvature measures the curvature of resulting from the constraint of thecurve to lie on a surface. The geodesic curvature vector, measures the "Side ward" component of the curvature in the tangent plane to the surface. Thus, if one draws a straight line on a flat piece of paper and then smoothly bends the paper into a surface, then the straight line would now a acquire some curvature. Since the line was originally straight, there is no sideward component of curvature so in this case. This means that the entire contribution to the curvature comes from the normal component, reflecting the fact that the only reason there is curvature here is due to the bend in the surface itself.

Similarly, if one specifies a point and a direction vector, one can geometrically envision the normal curvature considering the equivalence class of all unit speed curves in that contain the point and whose tangent vectors line up with the direction of .Of course, there are infinitely many such curves, but at an infinitesimal level, all these curves can be obtained by intersecting the surface with a "Vertical" plane containing the vector and the normal to . All curves in this equivalence class have the same normal curvature and their geodesic curvatures vanish. In this sense, the normal curvature is more of a property pertaining to a direction on the surface at a point, whereas the geodesic curvature really depends on the curve itself. It might be impossible for a hiker



Taking the inner product of the last equation with the normal and noticing that , We get

(4.4)

Where:

(4.5) .[6]

Example(4.1): Find with the command sqrt(pi). The answer should be . Note that Matlab knows the value of pi, because it is one of Matlab's many built-in functions. [9]

(4.2) Curvature:

An important fact about covariant derivatives is that they don't need to commute. If is a section and then is a section also and so we may take it's covariant derivative and this fact has an underlying geometric interpretation which we will explore later.

A measure of this lack of commutatively is the curvature operator which is defined for a pair to be the map defined by

Or (4.5).[2]

Definition (4.2.1):The lie bracket of two vector fields and an a surface is defined as the commentator, (4.6)

Meaning that if is a function on , then

(4.7)

[4]

Proposition(4.2.2): The lie bracket of two vectors is another vector in .

Proof:if suffices to prove that the bracket is a linear derivation on the space of functions consider vectors and smooth function in , then,

and

[10]

(4.3) Mean curvature:

Definition (4.3.1): Let and be the principal curvatures of a surface path . The mean curvature of is

To compute and, we use the first and second fundamental forms of the surface:

and

Again, we adopt the matrix notation:

By definition, the principal curvatures are the eigenvalues of $\,$. Hence the determinant of this matrix is the product $\,$, the Gaussian curvature $\,$. So

(4.8)

The trace of the matrix is the sum of its eigenvalues thus, twice the mean curvature . After some calculation, we obtain : trace

(4.9)[2]

(4.4) Total Curvature:

One of the most important geometric invariants of a surface is gotten by integration of curvature.

Definition (4.4.1): Let be the Gaussian curvature of a compact surface oriented by are form .

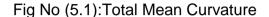
Then:

Is the total Gaussian curvature .

The same definition applies to any payable region . To compute total curvature of we add the total curvatures of each patch like 2-segment of a paving of . With the usual notation for the domain of ,

[10]5.Calculation of the Total Mean Curvature Using Matlab :

8	4	2	1	Х
2	1.5	1	0.5	у



6.Results:

The first fundamental form plays such a crucial role in the theory of surfaces that we will find it convenient to introduce a third, more modern version , all curves in equivalence class have the same normal curvature and their geodesic curvatures vanish , the second fundamental form is symmetric , the first fundamental form on a surface measures the square of the distance between two infinitesimally separated points. There is a similar interpretation of the second fundamental form as we show below. The second fundamental form measures the distance from a point on the surface to the tangent plane at a second infinitesimally separated point, to calculate the total mean curvature we use the first and second fundamental forms of the surface and possibility of calculating total mean curvature using matlab .

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Effect of Organic Manure on Growth, Yield and Fruit Quality of Barakawi Date Palms on High Terrace Soils of Northern Sudan

Fatima Ali Bashab*1, Mariam Ibnoaf Elhasan and 2, Ahmed Ali Salih3

- 1. Merowe Research Station, Merowe, Sudan
- 2-3. Director, Forestry Dept./ Agric. Res. Corporation

Abstract:-

Fertilizer trials were conducted on high terrace soils in a farmer's field at

^{*}Email:fatimabashab@gmail.com

El gurair (Merowe locality(for three consecutive seasons (2004 - 2006) with the objective of investigating the effect of organic manure fertilizer on growth, yield and fruit quality of Barakawi cultivar (Phoenix dactylifera). The treatments are 0,40,50,60, and 70kgper year. The experimental design was completely randomized using 3 replications per treatment The results showed that the optimum dose of fermented organic manure to apply is 60 kg / tree/ year, which gave the most vigorous growth, highest yield and best quality fruits (shape, size, weight, pulp/seed ratio, total. soluble solid). The best time to apply the manure is as split dose during June and November to be applied as soil.

مستخلص

أجريت تجربة التسميد في مزارع المزارعين في أراضى التروس العليا بمنطقة القرير محلية مروى عام - 2006 -2004م.

هدفت التجربة إلى دراسة تأثير السماد العضوي المخمر في الإنتاجية وتحسين النوعية في نخيل التمر صنف بركاوى. وكانت المعاملات كالاتى, الشاهد) بدون سماد40 (، 50، 60، 70 كيلو/جرام .نفذت التجربة باستخدام التصميم كامل العشوائية بثلاث مكررات لكل معاملة.

أظهرت النتائج أن الجرعة المناسبة التي تعطى أعلى إنتاجية وأجود الثمار هي 60 كلم/السنة وأحسن ميعاد للتسميد على جرعتين خلال شهري يونيو ونوفمبر.

Introduction:-

Since ancient times, date palm (Phoenix dactylifera.) has been the most dominant fruit tree in Northern Sudan. Availability of irrigation water from the River Nile and climatic conditions of the Northern and River Nile States make them ideal for date production. Barakawi is the most popular dry date cultivar in the area and constitutes about 40% of the total population of dates in the Sudan (Nixon 1969; Osman.1979; Mohamed, 1984). Date palms grow on a wide range of soils, however, high water holding capacity with good drainage is desirable (Nixon, 1951; Ahmed and Faroogi. 1972; Jagirdar. 1980). The best soils for date palms are generally sandy loams.

Date palm yields in Northern Sudan are still far below the world standards. Average yield of the cultivar Barakawi is about $18-25\ kg$ / tree, which is very low compared to the yield under good management where up to l00 kg /tree may be obtained

(Osman and Boules 1977; Mohamed, 1985). Therefore, efforts are being exerted to increase date yield in Northern Sudan through improvement of

cultural practices and promotion of extension services, and to boost production by horizontal expansion of growing date palms on high terrace soils.

Organic fertilizer offers good prospect as alternative or partial substitute for Chemical fertilizers. It can provide additional benefits, where there are longer time periods. Organic fertilizers do not only supply nutrients to plants, but promote favorable soil properties such as granulation and good tilt, giving efficient aeration, easy root penetration and improved water holding capacity. Fertilizer application has generally been found to be necessary to increase yield and improve quality of dates. Animal manures are widely used to fertilize date palms of the old world including the Northern State. This type of fertilizer seems to increase the vigor and growth rate of young palms, and raise the fruit bearing capacity of adult palms (Nixon, 1951, Hayet, 1980; Al-baker, 1972). Manuring is usually carried out in winter unless a winter cover crop is grown. in which case it is usually applied in the spring after the cover crop has been turned in (Hayet, 1980, Ahmed and Faroogi, 1972). Inorganic nitrogen sources in their various forms are also often used in date gardens. It is recommended to split nitrogen into 2-3 applications during the growing season (Hayet, 1980). While the need for fertilizer application to date palms is very crucial, in most instances, date palm growers in Northern States of Sudan do not carry out any fertilizer application programs. This justified the need for carrying out these fertilizer application trials.

Material and Methods

Experiments were carried out in a farmer's date orchard at Elgurair in Merowe Locality, Northern State, on a high terrace soil. The study covered the flowering and fruiting seasons of 2004, 2005 and 2006. The site is generally characterized by long hot and dry summer with low relative humidity.

The cultivar Barakawi date palms used for the study were about 30 years of age and planted at 8×8 m spacing. The selected palms were uniform in growth pattern and size. They received the same cultural practices, irrigation at about a month interval and no fertilization. Composite soil samples were taken from the experimented area at 0 - 30, 30 - 60 and 60 - 90 cm depths and analyzed at the laboratory of The Land and Water Research Center, Wad Medani.

A 15 years old male date palm grown at Elgurair, adjacent to the experimental site, was selected as source of pollen, to avoid xenia and meta-xenia interferences in the studies.

The experimented design used was a randomized complete block design, replicated three times, 2 palms per plot. Sheep organic manure was prepared (fermented) two months before application. It was applied as split dose during June and November every year in the following amounts: 40, 50, 60, 70 kg/tree plus the control.

At harvesting time (tumor stage), data were collected on yield /tree, number of bunches tree, number of strands /bunch and number of fruits/ strand. Data on weight of whole fruits, pulp and seeds were obtained from ten randomly selected fruits from each treatment. A vernier was used to determine length, width and flesh thickness of fruits and length and width of seeds.

Total soluble solids of fruits collected from the various treatments were determined at the "Khalal" stage by a hand refractmeter at <40° C. Total sugars, reducing sugars and sucrose percentage were estimated by Lane and Evnonn's Litrimetric Method

Results and Discussion

The analytical data of the soil of the experimental site is presented in Appendix 1. It shows that the soil is non-saline and non-sodic with slightly alkaline PH. It is poor in fertility, with low nitrogen and low CEC. Analysis of the manure(Appendix 2) showed that it contains adequate NPK (1.17% total N, 178ppm phosphorus and 805ppm potassium).

The influence of organic manure fertilizer on morphological characteristics and yield is shown in Table2. The data show that there is a highly significant difference among the treatments in the number of bunches, bunch characteristics and yield. The organic fertilizer increased the number of green leaves, number of bunches and yield over the control. (Tables 3, 4, 5 and 6 summarize the effect of fertilizer treatments on fruit and seed physical characteristics.).

The results indicate that all fertilizer doses increased fruit length, width, flesh thickness, fruit and pulp weight significantly over control (Tables3 and 4). There was consistently a significant difference in seed weight between fertilizer treatments.

The organic manure generally improved fruit quality and yield. Sixty kilogram's of manure / palm, gave the best result, while 70 kg per palm impaired all fruit characteristics and reduced yield.

The effect of different fertilizer treatments on the chemical composition of the date fruit is shown in Table 5. Generally, fertilizer application resulted in a

significant increase in total soluble solids and total sugars, reducing sugars and sucrose in the fruit, compared to control. Application of 60 kg / tree of organic manure fertilizer was superior to all other treatments.

Conclusion

From the foregoing results, it is noticed that the optimum dose of organic manure for Barakawi cultivar grown on high terrace soils is 60 kg of animal manure / year/tree.

2005					
Yield/tree (kg)	Length of strand (cm)	No. of dates/strand	No. of strands/bunch	No. of bunches/tree	Organic manures (kg/tree)
47.33 c	35.67 b	31.00 b	46.33 c	09.33 cd	40
57.67 b	37.67 b	32.00 b	47.67 b	11.33 b	50
63.00 a	42.00 a	40.67 a	50.00 a	13.67 a	60
41.33 d	31.33 b	32.33 b	44.33 d	10.33 bc	70
39.67 d	30.00 c	23.33 с	41.33 e	08.33 d	Control
1.41	0.64	0.80	0.39	0.39	S.E±
***	***	***	***	***	S.Levl
2006					
60.67 c	35.33 c	31.00 b	50.33 ab	11.33 bc	40
68.00 b	40.33 b	33.00 b	50.33 ab	13.33 b	50
77.67 a	43.67 a	39.00 a	53.33 a	15.67 a	60
67.33 b	34.67 cd	32.00 b	50.00 ab	13.33 b	70
52.67 d	32.33 d	25.33 c	46.67 b	o6.67 c	Control
1.25	0.84	1.12	1.12	0.68	S.E.±
***	***	***	*	**	S. Level

Means in the same column followed by the same letter (s) are not significantly different at P=0.05 according to Duncan's Multiple Range test. .

Table (2): Effect of organic manure on the fruit and seed physical characteristics of Barakawi cultivar (2004).

Yield/ Tree(kg)	Seed weight (g)	Seed width (cm)	Seed Length (cm)	Pulp weight (g	Fruit (g) weight	Flesh thickness (mm)	Fruit width (cm)	Fruit length	Organic Manure (kg/ha)
41.67 c	0.94 ab	0.70 a	2.82 ab	6.21 bc	7.15 ab	0.44 c	1.73 ab	4.36 bc	40
44.67 b	1.00 a	0.74 a	2.93 ab	6.78 bc	7.78 a	0.48 bc	1.97 ab	4.63 ab	50
50.67 a	0.93 ab	0.65 b	2.80 ab	7.33 ab	8.26 a	0.51 b	1.94 ab	4.73 ab	60
41.33 c	0.95 ab	0.64 b	2.96 a	7.81 a	8.43 a	0.61 a	2.00 a	4.92 a	70
3400 d	0.87 b	0.68 b	2.71 b	5.46 c	6.33 b	0.43 c	1.71 b	4.00 c	Control
0.298	0.03	0.01	0.07	0.43	0.38	0.01	0.08	0.14	SE±
***	*	*	**	NS	*	*	***	*	S.Level

Means in the same column followed by the same letter (s) are not significantly different at P=0.05 according to Duncan's Multiple Range test. .

Table (3): Effect of organic manure fertilizer on fruit and seed physical characteristics of the variety in 2005 and 2006

Seed weight (g)	Seed width (cm)	Seed Length (cm)	Yield/tree (kg)	Length of strand (cm)	No. of dates/stran d	No. of strands/bun ch	No. of bunch es/tree	Organic manures (kg/tree)
0.94 b	0.64 d	2.88 b	6.05 b	6.99 b	0.46 c	1.78 b	4.31	40
1.04 a	0.76 c	3.05 ab	6.92 b	7.96 b	0.54 b	1.81b	4.72 b	50
1.10 a	0.70 a	3.18 a	8.82 a	9.91 a	0.64 a	2.09 a	5.24 a	60
1.03a	0.69 b	3.14 a	7.16 b	8.19 b	0.53 b	1.78 b	4.70 b	70
0.85 b	0.63 d	2.57 c	1.70 c	5.55 c	0.40 d	1.66 c	4.05 d	Control
0.04	0.01	0.08	0.36	0.38	0.02	0.03	0.07	S.E±
*	**	**	**	***	***	***	***	S.Levl
			2006					
0.92 b	0.64 a	2.9 a	7.26 d	8.18 d	0.39 с	1.68 c	4.43 c	40

1.12 a	0.67 a	3.1 a	8.93 b	10.04 b	0.48 b	1.74 bc	4.77 b	50
1.19 a	0.67 a	3.29 a	10.93	12.15 a	0.60 a	2.02 a	5.30 a	60
0.98 b	0.63 a	3.03 a	8.41 c	9.39 c	4.49 b	1.79 b	4.78 b	70
0.9 b	0.63 a	3.04 a	5.97 e	6.69 e	0.33 d	1.52 d	3.98 d	Control
0.40	0.02	0.18	0.20	0.21	0.21	0.028	0.04	S.E.±
**	NS	NS	***	***	***	***	***	S. Level

Means in the same column followed by the same letter (s) are not significantly different at P=0.05 according to Duncan's Multiple Range test. .

Table (4): Effect of organic manure on chemical characteristics of Barakawi fruits (2005).

Total soluble solid	Sucrose %	Reducing sugars %	Total sugars %	Organic manure (kg/tree)
68.44 c	22.05 b	49.34 c	71.14 c	40
71.33 b	20.35 bc	51.66 b	72.27 b	50
72.99 a	19.42 c	54.42 a	73.72 a	60
67.98	22.18 b	48.80 c	70.98 c	70
97.36 d	25.06 a	45.66 d	70.72 c	cd
0.51	0.24	0.62	0.24	Control
***	**	***	***	S. Level

Means in the same column followed by the same letter (s) are not significantly different at P=0.05 according to Duncan's Multiple Range test. .

Yield/tree (kg)	Pulp weight (g)	Fruit weight (g)	Flesh thickness (cm)	Fruit width (cm)	Fruit length (cm)	Organic manure Kg / tree
49.90 d	6.17 c	7.10 c	0.43 d	1.74 c	4.37 c	40
56.77 b	7.22 b	8.25 b	0.50 с	1.84 b	4.71 b	50
63.77 a	8.69 a	9.77 a	0.58 a	2.02 a	5.09 a	60
53.33 с	7.57 b	8.33 b	0.54 b	1.86 b	4.79 b	70W

42.10 e	4.98 d	5.86 c	0.38 e	1.62 d	4.01 d	Control (No. fertilization)
0.980	0.173	0.160	0.007	0.023	0.058	SE±

Combined analysis for Fruit physical characteristics and yield (2004-2006).

Appendix (1) a-Soil Analyis data of the experimental site

ES P	SA R	Solub me I- Na		Cations Mg	O.C. (%)	N(%)	CaCO 3	C/N	EC ds m- 1	PH (paste)	Depth (m)
6	3	0.5	1.5	2.60	0.078	0.022	0.8	4	0.53	7.8	0-30
7	3	0.5	18	3.0 4	0.39 0	0.05 1	1.1	8	0.6 5	7.9	30-60
5	2	1.0	3.0	2.1 7	0.60 8	0.06 0	1.6	10	0.5 8	7.7	60-90

b-Physical Properties

15 bar	1/3 bar	HC (cm	Satura	Mechan	ical Prop	erties	
		111-1	-1 tion %		Si	FS	CS
14.6	27.0	4.6	49	25	38	15	22
11.6	22.9	4.8	43	21	32	18	29
8.9	17.7	8.8	29	10	6	15	69

Appendix (2)

Organic Manure analytical data

Phosphorus: 178.0 ppm Potassium: 805.0 ppm

Total Nitrogen: 1.17 %

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Effect of Belt-extra insecticide and Tuta-optima male attractant pheromone on tomato leaf miner (Tuta absoluta Meyrick (Lepidoptera: Gelechiidae) on Gameel variety.

Mohammed Ahmed Yousif Moh.1* and Awad elKareem Wagei-alla Murad 2

- 1. Assistant Professor, Life Sciences and Chemistry Section, College of Sciences and Technology, Abdullatif Al-Hamad University of Technology, Merowe, Sudan.
- 2. Assistant Professor, Crop protection Section, College of Agricultural Sciences, Dongola University, Sudan.
- * Email: mohdayousif@gmail.com.

Abstract:

The study was aimed to determine the effect of the belt-extra insecticide and the pheromone Tuta-optima on Tuta absoluta on the tomato variety Gameel, as the experiment was conducted in an open field near Suri district in Al-Qold county, in the northern state, Sudan, during the 2016/16 and 2016/17 seasons. The results of the three treatments on the tomato plants showed that the treatment with the insecticide and the pheromone had no significant effect during the two seasons, and the average of the affected plants was higher in the control followed by the insecticide, and the pheromone and in terms of time

effect (weeks) scored a very significant difference with a probability of 1% during the two seasons. The analysis also showed that the interaction between the treatments did not have a significant effect during the first season and had a very significant effect with a 1% probability in the second season. The results also showed that the treatment of leaves with the insecticide and pheromone had a very significant effect with a 1% probability during the two seasons. In the first season, there was no significant difference between the insecticide and the pheromone, and the difference between them and the control which was recorded the highest average followed by the pheromone, then the insecticide. Moreover, the results indicate that the treatment of fruits with the insecticide, the pheromone, and the control had a very significant effect in the first season and had no significant effect during the second season. There was no significant difference between the insecticide and the pheromone, but there was with the control which was more affected by the injury with an average of 17.47, the lowest in the insecticide 8.53 while in the second season there was no significant difference between all treatments. It was clear from the analysis that the interaction between the treatments was very significant during the first season and not significant during the second season. In terms of temporal impact (weeks), there was a very significant difference with 1% probability during the two seasons. Variation analysis showed that the treatment of healthy fruits with the insecticide, the pheromone, and the control had a very significant effect with a 1% probability during the two seasons. During the two seasons, the average of healthy fruits treated with the insecticide was 2.40 and 2.87 during the first and the second season respectively, followed by the control, which reached 2.81 and 2.13, respectively. While the average of healthy fruits treated with the pheromone was 3.20 and 4.20 during the first and second season, respectively, and the superiority of the pheromone over the insecticide was noticed. Generally, it was noticed that the number of healthy fruits decreased significantly over time. The variance analysis showed that the interaction between the three treatments was very significant during the two seasons. In terms of the insect-pest analysis, the treatment with pheromone during the weeks was significant with a probability of 5% in the first season and very significant with a probability of 1% in the second season. The average numbers of insect-pest in the first two weeks were low. From the above mentioned it was concluded that: There was no significant difference between the three treatment effects on the tomato plants. The pheromone was more effective than the insecticide, especially on tomato plant leaves. The insecticide was more effective if we consider the time factor. The pest infestation on leaves increased with the age of the plant. Both the insecticide and the pheromone had a significant effect on leaves and fruits. In general, this explains the importance of tomato crop treatment, to obtain a crop in a form and type that matches the markets. An important recommendation of getting rid of the previous crop residues and the weeds properly. The use of the insecticide and the pheromone together in the future to reduce the number of insect-pest by using the recommended dose.

Key words: Pheromone Tuta-optima, the insecticide belt-extra, the insect-pest Tuta absoluta and the tomato variety Gameel.

المستخلص:

هدفت الدراسة الى معرفة تأثير كل من مبيد بليت إكسترا (Belt-extra) والفيرمون توتا-أوبتيما (Tuta-optima) على آفة حفار أوراق الطماطم (Tuta absoluta) على صنف الطماطم جميل، حيث أجريت التجربة في حقل مفتوح بمنطقة سورى بمحلية القولد بالولاية الشمالية – السودان، خلال موسمى 2015/2016 و .2016/2017أوضحت نتائج المعاملات الثلاث على النبات أن المعاملة بالمبيد والفيرمون لم يكن لها تأثير معنوى خلال الموسمين، ونجد أن متوسط النباتات المصابة كان أعلى في الشاهد يليه ثم المبيد، ومن حيث التأثير الزمني) الاسابيع (سجل فرقا معنويا جدا باحتمالية 1% خلال الموسمين . كما أوضح التحليل أن التداخل بين المعاملات لم يكن له تأثير معنوي خلال الموسم الأول وكان له تأثير معنوى جدا باحتمالية %1 في الموسم الثاني كما أوضحت النتائج أن معاملة الأوراق بالمبيد والفيرمون كان لها أثر ا معنويا جدا باحتمالية 1% خلال الموسمين في الموسم الأول لم يكن هنالك فرق معنوى بين المبيد والفيرمون وفرق بينهما والشاهد حيث سجل الشاهد اعلى متوسط يليه الفيرمون ثم المبيد وفي الموسم الثاني كان بينهما فرق معنوي سجل الشاهد أعلى متوسط إصابة يليه المبيد ثم الفيرمون علاوة على ذلك تشير النتائج أن معاملة الثمار بالمبيد والفيرمون والشاهد كان لها تأثير معنوى جدا في الموسم الأول ولم يكن لها تأثير معنوى خلال الموسم الثاني لا يوجد فرق معنوي بين المبيد والفيرمون ولكنه يوجد مع الشاهد الذي كان أكثر تأثرا بالإصابة حيث بلغ متوسطها ,17.47 أدناها في المبيد 8.53 بينما في الموسم الثاني لا يوجد فرق بين الجميع اتضح من التحليل أن التداخل بين المعاملات كان معنوى جدا خلال الموسم الأول ولم يكن هنالك تأثير معنوي خلال الموسم الثاني ومن حيث التأثير الزمني يوجد فرق معنوي جدا باحتمالية 1% خلال الموسمين تحليل التباين بين أن معاملة الثمار السليمة بالمبيد والفيرمون والشاهد كان لها تأثير معنوى جدا باحتمالية 1% خلال الموسمين .خلال الموسمين نجد أن متوسط الثمار السليمة عند المعاملة بالمبيد بلغ 2.40 و 2.87خلال الموسمين الأول والثاني على التوالي ويليه الشاهد حيث بلغ 2.81 و 2.13على التوالي بينما نجدها 3.20 و 4.20 في الفير مون خلال الموسم الأول والثاني على التوالي وتلاحظ تفوق الفير مون على المبيد. وعموما يلاحظ أن الثمار السليمة تقل درجة ملحوظة مع الزمن . كما بين أن تحليل التباين التداخل بين المعاملات الثلاث كان معنويا جدا خلال الموسمين من حيث عدد الآفة أن المعاملة بالفير مون خلال الأسابيع كان معنويا باحتمالية %5 في الموسم الأول ومعنوي جدا باحتمالية %1 في الموسم الثاني، ويلاحظ انخفاض متوسط أعداد الآفة في الأسبوعين الاولين مما سبق نخلص الى أنه : لا يوجد فرق معنوى بين تأثير المعاملات الثلاث على النبات الفيرمون أكثر تأثيرا من المبيد وخاصة على الأوراق المبيد أكثر تأثير إذا أخذنا في الاعتبار العامل الزمني ازدياد الإصابة على الأوراق بتقدم النبات في العمر كل من المبيد والغيرمون له تأثير معنوى على الاوراق والثمار .وعموما هذا يفسر أهمية معاملة محصول الطماطم للحصول على محصول شكلا ونوعا يواكب الأسواق التوصية بأهمية التخلص من بقايا المحصول السابق والحشائش بطريقة سليمة استعمال المبيد والفيرمون معا يؤدي في المستقبل لتقليل أعداد الأفة ذلك باستخدام الجرعة الموصى بها ا

الكلمات المفتاحية :الفيرمون توتا-أوبتيما , (Tuta-optima) مبيد بليت إكسترا , (Belt-extra) آفة حفار أوراق الطماطم (Tuta absoluta) و صنف الطماطم جميل.

Introduction

Tomato product is considered the most important vegetable crop in Sudan and that due to its economics and nutritional value. It occupies about 28% of the total area under vegetable production (4). The annual production of Tomato in Sudan is 423.000 tones (1). Tomato plants are subject to infestation by the sucking insects, whitefly (Bemisia tabaci), and cotton aphid (Aphis gossypii). American bollworm (Heliothis armigera) attacks the ripped and pre-ripped fruits, contaminating them with fraises and exposing them to fungi and bacteria. Cotton leaf worm (Spodoptera littoralis) primarily damages the summer crops. It causes defoliation, but also it can bore into and feed on the interior of fruits. Leaf miner (L. trifolii) attacks also tomato leaves causing various losses (3). Recently, the South American tomato leaf miner Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) a micro lepidopteron moth with high reproductive potential was first recorded in Argentina in 1964. After its initial detection in eastern Spain in 2006, it rapidly invaded various other European countries and spread throughout the Mediterranean basin. T. absoluta has been observed in the Netherlands, France, United Kingdom, Italy, Egypt, Libya, Bahrain, Kuwait, and Saudi Arabia (7). This pest caused severe damage in tomato cultivated areas (8). T. absoluta reproduces about 10-12 generations per year. Its larvae mine the leaves feed on mesophyll tissues producing large galleries and burrows into the fruit, causing a substantial loss of tomato (9). In Sudan, T. absoluta was monitored in Khartoum, Gezira, Kassala, and Recently the pest was observed in, eastern, Western, and Northern Sudan. The infestation percentage and yield loss in greenhouses and open fields reached up to 80% (2). Control strategies for T. absoluta consisted mainly of early detection through sexual pheromone traps. Also, pheromone traps, insecticides, and cultural practices are the most important management procedures applied to mitigate the ravage damage caused by this pest. Cultural practices include the aeration of the greenhouse, the installation of mechanical barriers to stop adults from entering, and removal of old leaves. Biological control based on eggs and larval parasitoids and predators have been tested with variable success. Susceptibility of Tuta absoluta to entomopathogenic fungi and Bacillus thuringiensis has also been studied (6). Tomato leaf miner (Tuta absoluta) is very destructive to vegetable crops especially tomato resulting in 100% yield losses. It is originated from South America. Recently Tuta absoluta considered being a serious threat to tomato production in the Mediterranean region. This pest is crossing boarders and devastating tomato production both protected and open fields. The infestation of Tuta absoluta also reported on potato, Aubergine, and common beans. On the other hand, this pest has a very short life cycle and high reproductive potential with a high capability of adaptation to a wide range of climatic and environmental conditions. Tuta absoluta is a very challenging pest to control. The effectiveness of chemical control is limited due to the insect's nature of the damage as well as its rapid capability of development of insecticide-resistant strains. The use of biological factors is still largely under development and not ready to combat this pest effectively and in a costeffective way. The sex pheromone trap is used as an early detection tool. Mass trapping and lure and Kill application of pheromone have been found to be effective to control Tuta absoluta. IPM strategies are being developed in South America to control Tuta absoluta. Various active substances can be applied in combination with bio-rational control tactics. Thus, the objective of this study is to evaluate the efficacy of Belt-extra insecticide and Tuta-optima male attractant pheromone of tomato leaf miner (Tuta absoluta) on Gameel variety of tomato in Northern Sudan.

Materials & methods:

The experiment was conducted in a randomized complete block design with three replicates during the seasons 2015/2016 and 2016/2017 at a farm in Suri village, Al-Qold county ($32^{0} - 25^{0}$ E) ($32^{0} - 16^{0}$ N) in the northern state, Sudan. The routine cultural practices, disc-plowing, harrowing, leveling and ridging of the soil, followed by watering and seeding a month later at 30cm spacing between holes (5seeds of tomato Gameel variety/hole) were done. Twenty-one days after germination the seedlings were thinned to 2-3 plants/hole. The irrigation regimes were seven days and weeds were manually removed.

The treatments were, Tuta-optima (PH-937-OPTI, 0.8 mg) which is male attractant pheromone; three tabs were used in three experimental units with water traps consist of a plastic container holding water and a pheromone lure. The lure is secured above the water with a punctured tube attached at both ends of the container. A small amount of vegetable oil or soap should be added to the water to reduce the surface tension (and consequently reduce the insect's capacity to escape from the trap) and limit water evaporation (consequently reducing the frequency of water refills) (10). This type of trap

can capture large numbers of adult males without becoming saturated with insects (5). The captured individuals were counted early every 24 hours and averaged weekly, and the water in the plastic container will be replaced. The Belt Extra 175 is a newly formulated Systemic and contact insecticide used against the larval stage of lepidopterous insect pests (Tuta absoluta, Spodoptera exígua, Helicoverpa armigera) and sucking insects (Jassids, aphids and whitefly) which feed on leaves and fruits of tomato plants. This compound is used as a concentrated suspension containing 175 grams active ingredient of flupindiamide per liter product. It was applied with a knapsack sprayer at a rate of 20cc / 20 liters of water directly sprayed to tomato plants and repeated three times at 21days interval. Three non-treated experimental units were used as a control for comparison. Readings are taken in the morning every 24 hours for a period of two months from the pest incidence. Data were collected by taking ten plants randomly to calculate the number of infested plants, leaves, and fruits as well as healthy plants and their weekly average. Statistical analysis of the experimental data was done, using the analysis of variance for the completely randomized block Design (CRBD) using the method (Gomez and Gomez, 1984) and the modified Duncan's method (DMRT) was used to separate the means. All the steps of the statistical analysis were done using the computer package for statistical analysis (M-STAT-C).

Results and Discussion:

The effect on tomato plants:

The analysis of variance revealed that the treatment with the insecticide (Belt-extra) and the pheromone (Tuta-optima) had no significant effect in both seasons (Table 1). Table 2, showed that the mean of infested plants, when treated with the insecticide, was 7.19 and 7.26, while the pheromone was 6.89 and 7.00 and the control was 7.59 and 7.96 for the first and second seasons respectively.

In terms of temporal impact (weeks), a very significant difference was recorded at 1% probability during the two seasons (Table 1). The first week scored 4.44 in both seasons, with the highest rate of infestation in the last week (ninth) 9.33 in the first season, while it was 9.22 in the second season and for the rest of the weeks, the rates ranged from 5.56-8.00 in the first season and 6-8-82.00 in the second season (Table 3). There was a significant difference between

the first, the second, and the ninth week and similarly in the second season, as it differed from that in the third week.

The analysis of the results indicated that the interaction between treatments had no significant effect on the first season compared to a very significant effect on the second season at a 1% probability (Table 1). With the emphasis at Table 6, the interaction between treatments and the time factor (weeks), where the lowest mean of infestation in plots treated with pheromone was 3.00 in the first week during the first and second seasons, followed by the control with a percentage ranging from 5.00 for both seasons. Table 6 showed the difference between the insecticide and the pheromone compared to the control used, especially during the second season in the first and second week.

The effect on tomato plant leaves:

It was evident from the comparison of the treatments, that the mean of T. absoluta immature stages (larvae) on the infested leaves treated with the insecticide reached 16.83 and 18.22 on those treated with pheromones and they had similarities in the manner of infestation, while in the control the highest mean of infestation was recorded during the first season (24.22) where there was no significant difference between the insecticide and the pheromone, despite that it was between them and the control (Table 2). As for the second season, there was a significant difference between all treatments, and the highest mean was recorded in the control 28.41. Pheromones recorded the lowest mean of 17.30, followed by insecticide 22.93, and the effect of insecticide and the pheromone compared to the control was clear. In the second season, the pheromone was more effective (Table 2). The analysis showed that the time (weeks) factor had a very significant effect, at 1% probability during the two seasons (Table 1). In Table 3, where the time effect (weeks) was significantly different in the first season, where the first week was recorded the lowest injury 7.33, followed by the second week 13.00, then the third week 15.89 and the fourth 9.11, while there was no significant difference from the fifth to eighth week, the ninth week recorded the highest injury, reached 29.11. In the second season, the first week recorded the lowest mean of infestation 6.56, followed by the second 10.78, the third 16.44, the fourth 21.00, and the fifth week 23.89, while the means were ranged between 28.33 - 29.89 respectively, in the sixth and seventh week. In the eighth week, the mean was 32.44, where the ninth week recorded the highest mean of infestation reached 36.56 (Table 3). This means the older the plant, the greater the infestation. The analysis of the variance showed that the interaction between the treatments had a very significant effect, with a 1% probability throughout the two seasons (Table1). From Table 6, the pheromone recorded the lowest mean of infestation 5.33 and 3.00 during the first and second season, respectively, followed by the control 7.33 and the insecticide, which reached 9.33 during the first season. In the second season, both the insecticide and the control scored 8.33. The conclusion revealed that the pheromone was more effective in the first week while the insecticide was more effective during the rest of the weeks in the two seasons.

Table 1: The (F) calculated for the different treatments of the two seasons, 2015/2016, 2016/2017.

Inset-p Numbe		Heathy fruits		Infested Fruits	i	Infeste Leaves		Infested	d plant	Treatmen t
2nd seaso n	1st seaso n	2nd seaso n	1st seaso n	2nd seaso n	1st seaso n	2nd seaso n	1st seaso n	2nd seaso n	1st seaso n	
-	-	** 22.45	** 14.68	ns 2.10	** 129.80	** 249.7 8	** 15.82	ns 6.14	ns 3.87	Insecticid e/ Pheromo ne/ control
** 10.41	* 6.96	** 19.92	** 40.93	** 111.66	** 133.06	** 115.1 9	** 61.17	** 39.59	** 14.21	Weeks (Time)
-	-	** 3.32	** 5.87	ns 0.58	** 12.47	** 3.52	** 8.72	** 2.74	ns 0.66	Interactio n

ns: not significant at P = 5 %

Table 2: The effect of the insecticide, the pheromone on the means of the insect-pest infestation on the tomato plants, leaves and fruits during the two seasons 2015/2016, 2016/2017.

Inset-pes Number	st	Heathy fruits		Infested Leaves		Infested plant		Treatment
2nd season	1st seaso n	2nd seaso n	1st season			2nd season	1st season	
7.00 a	6.89 a	2.87 b	2.40 b	22.93 b	16.85 b	7.26 a	7.19 a	Insecticide

^{* =} significant at P = 5 %

^{** =} significant at P = 1 %.

28.41 a	24.22 a	7.96 a	7.59 a	12.73 a	10.13 b	17.30 c	18.22 b	Pheromone
2.13 b	2.81 ab	18.13 a	17.47 a	28.41 a	24.22 a	7.96 a	7.59 a	control
17.12	14.95	12.34	12.97	2.13 b	2.81 ab	18.13 a	17.47 a	CV %
0.22	0.32	0.22	0.10	0.32	0.99	0.20	0.18	± SE

Means having the same letter (letters) on the same column were not significantly

different at P= 5 %.

CV: Coefficient of Variation.

SE: Standard Error.

Table 3: The temporal effect (weeks) on the means of the infested tomato plants and leaves during the two seasons 2015/2016, 2016/2017.

Infested leave	Infested leaves In		Infested plants	
2nd season	1st season	2nd season	1st season	
6.56 b	7.33 f	4.44 c	4.44 d	1 st
10.87 g	13.00 e	6.00 d	5.56 c	2 nd
16.44 f	15.89 d	6.89 c	7.11 b	3 rd
21.00 e	19.11 c	7.89 b	7.33 b	4 th
23.89 d	22.67 b	7.78 b	7.78 b	5 th
28.33 c	22.56 b	8.11 b	8.00 b	6 th
29.89 с	24.11 b	8.11 b	7.78 b	7 th
32.44 b	24.11 b	8.22 b	7.67 b	8 th
36.56 a	29,11 a	9.22 a	9.33 a	9 th
12.34	12.97	9.20	15.77	CV %

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Means having the same letter (letters) on the same column were not significantly different at P=5 %.

The effect on yield of tomato plants (Gameel variety):

The analysis of variance showed that the insecticide, the pheromone, and the control treatments had a very significant effect during the first season, and had no significant effect during the second season (Table 1). There was no significant difference between the insecticide and the pheromone, but there was with the control that had been affected with the infestation reached 17.47, while in the second season there was no significant difference between all treatments (Table 2). Whereas, the mean of infested fruits from plants in plots treated with the insecticide and the pheromone was 8.53 and 10.13. respectively, during the first season, and the control was more affected by the injury, reached 17.47. As for the second season, the mean of the infested fruits treated with the insecticide, the pheromone, and the control was 14.87, 12.73, and 18.13, respectively. In terms of temporal effect, a very significant difference was found with a 1% probability during the two seasons (Table1). There was a significant difference between the weeks (Table 4). The fifth week recorded the lowest mean, reached 7.78 and 5.56 in each of the first and the second season, respectively, while the ninth week recorded the highest mean of infestation for both seasons, 20.89 and 27.44 for the first and second season, respectively. For the rest of the weeks, the mean ranged from 8.89 -16.22 for the first season, while for the second season, it was ranged between 9.78 and 20.00, thus the infestation level increases with the progress of the season. The interaction between the treatments was significantly different during the first season and not during the second season with a 1% probability (Table 1). With regard to the healthy fruits, a significant difference was recorded between means of the insecticide, the pheromone treatments compared to the control (Table 1). From the observations, there was no significant difference between the insecticide and the control, but between them and the pheromone during the two seasons. Generally, the healthy fruits decreased significantly with time (Table 4), and the analysis of variance showed that the interaction between the three factors was very significant during the two seasons (Table 1).

The effect on the number of the insect-pest (Tuta absoluta):

The analysis of variance showed that the treatment with the pheromone during the weeks was significantly different with a probability of 5% in the first season and very significantly different with a probability of 1% in the second season (Table 1). No significant difference between the averages (means) recorded in the first, the second, the sixth the seventh and the eighth week, and the ninth with a significant difference between them and the aforementioned weeks in the first season, while in the second season there is no significant difference between the first and second week and between the third, sixth, seventh and ninth week, as well as between the fourth and fifth. Whereas, the first and eighth week were recorded the lowest average (mean) as 9.33 and 13.00 respectively, and throughout the second, the sixth and the seventh week was ranged between 15.00-16.67, followed by the fourth week reached 22.67. Whereas, the third and fifth weeks were recorded the highest averages (means) of 28.67 and 25.00, respectively, and the ninth week was 24.33 during the first season (Table 5). As for the second season, the first and the second week scored the lowest average(mean) of 6.67 and 11.33 respectively, followed by the fourth and fifth week means reached 19.00 and 19.33, respectively. The average number of the insect-pest (Tuta absoluta) infested tomato fruits during the sixth, the seventh and the ninth week was ranged from 23.00 to 25.67, followed by the third week, which amounted to 26.33, and the eighth week was recorded the highest average of 29.00 (Table 5).

Table 5 showed that the average number of the insect-pest was decreased in the first two weeks during the two seasons. In spite of that, there was a fluctuation in the numbers of the insect-pest in the remainder of the weeks, which made a high dispersion rate (CV: 19.20 and 22.28 %) and a standard error of 2.44 and 2.26 for the two seasons.

Table 4: The effect of weeks (time) on the means of the healthy and the infested tomato fruits during the two seasons 2015/2016, 2016/2017.

Healthy fruits		Infested fruits	i	Weeks
2nd	1st	2nd	1st	
season	season	season	season	

4.67 a	5.11 a	5.56 e	7.78 e	5 th
3.78 b	5.56 b	9.78 d	8.89 d	6 th
3.44 c	5.56 b	15.44 c	11.44 c	7 th
2.56 c	2.44 b	20.00 b	16.22 b	8 th
0.89 d	1.34 c	27.44 a	20.89 a	9 th
31.41	23.22	17.12	14.95	CV %
0.32	0.22		0.60	± SE

Means having the same letter (letters) on the same column were not significantly different at P=5 %.

Table 5: The effect of the pheromone on the means of the insect-pest (Tuta absoluta) number on tomato plants during the two seasons 2015/2016, 2016/2017.

Number of the i	Weeks	
2 nd season	1 st season	
6.67 c	9.33	1 st
11.33 c	15.00 c	2 nd
26.33 ab	28.67 a	3 rd
19.00 b	22.67 ab	4 th
19.33 b	25.00 a	5 th
23.00 ab	16.00 c	6 th
23.33 ab	16.67 c	7 th
29.00 a	13.00 c	8 th
25.67 ab	24.33 a	9 th

19.20	22.28	CV %
2.26	2.44	± SE

Means having the same letter (letters) on the same column were not significantly different at P= 5 %.

Table 6: The effect of the interaction between the treatments and the time factor (weeks) on the means of the infested tomato plants and leaves during the two seasons 2015/2016, 2016/2017.

Infested lea	aves	Infeste	ted plant Treatments		ts
2nd season	1st season	2nd season	1st season		
8.33	9.33	5.33	5.33	1st week	The Insecticide
13.00	17.67	6.67	5.00	2nd	
20.00	17.33	7.00	7.33	3rd	
23.67	16.67	7.33	7.33	4th	
24.67	19.67	7.33	7.33	5th	
27.67	17.67	7.67	7.67	6th	
28.00	17.67	7.67	7.67	7th	
29.67	16.00	7.67	7.67	8th	
31.33	19.67	8.67	9.33	9th	
3.00	5.33	3.00	3.00	1st week	The pheromone
6.33	8.67	4.33	5.00	2nd	

9.67	12.67	6.33	7.00	3rd	
14.00	16.33	7.67	7.33	4th	
17.00	20.00	7.67	7.67	5th	
20.67	20.67	8.00	8.00	6th	
25.00	23.00	8.33	7.67	7th	
28.00	26.33	8.33	7.67	8th	
31.67	31.00	9.33	8.67	9th	
8.33	7.33	5.00	5.00	1st week	Control
13.00	12.67	7.00	6.67	2nd	
19.67	17.67	7.33	7.00	3rd	
25.33	24.33	8.67	7.33	4th	
30.00	28.33	8.33	8.33	5th	
36.67	29.33	8.67	8.33	6th	
36.33	31.67	8.33	8.00	7th	
39.67	30.00	8.67	7.67	8th	
46.67	36.67	9.67	10.00	9th	
12.34	12,97	9.20	15.77	CV %	
1.63	1.48	0.39	0.66	± SE	

Discussion:

In Italy, in 2012, Dispersal pheromone was used at rate of 60 grams active ingredient per hectare in greenhouses, and the results showed a decrease in the percentage of males in traps by 93-97%, as well as a decrease in the percentage of infestation in leaves by 57-85%, and also in fruits, the infestation rate decreased 62-89% compared to the pheromone untreated greenhouses (11). This was consistent with our findings on the effect of the pheromone in reducing the insect-pest numbers.

In a field study, Bulletin (12) mentioned that in the open tomato fields, a comparison between two control systems, the first system depends on integrated pest

management and another based on traditional pesticides, where in the first system water pheromone traps were used at a rate of 12 traps per acre and fired predator eggs and small larvae of Nesidiocoris tenuis intensively and the use of pesticides according to the size of the infestation and traps readings. The second control system was based on the frequent use of the conventional insecticides. The results indicated that the percentage of infestation in the leaves of the plant was 20% in the first system compared to 98% in the second system, and the percentage of infection in fruits was 18% in the first system and 46% in the second system. This confirmed the results and findings of this study, especially if the insecticide and the pheromone are used together, hence the effect will be stronger.

Conclusion and recommendations:

The Conclusion:

Both the insecticide and the pheromone had a significant effect on leaves and fruits. The Pheromone was more effective than the insecticide, especially on leaves. The insecticide was more effective if we consider the time factor. Increased injury to the leaves as the plant age progress.

The recommendations:

- -Getting rid of the previous crop residues and weeds in a proper way.
- -Soil plowing and exposure to sunlight to kill the insect-pest immature stages.
- -The use of hygienic seedlings free from inset-pests such as tomato leaf miner and whitefly.
- -Not planting solanaceous plants near tomato farms.
- -Screening and disinfection tools for harvesting, packing and protection of the crop from insect-pests.
- -The necessity of minimizing the use of insecticides to prevent the development of insect-pest resistance and to maintain the natural enemies of the insect-pest.
- In the future, the use of the insecticides and the pheromones together will reduce the numbers of the insect-pest.

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Critical period for weed control in okra vegetable (Abelmeschus esculentus (L) Moench) in Northern State, Sudan

Mukhtar Abdel Aziz Mohamed Osman *1; Suhair Mohamed Elamin Ahmed.² , Gamar Elniaama Adam Ibrahim³, Amal Abdel Haleem Nasurkheyri⁴

- 1. Faculty of Agricultural studies, Shambat, Khartoum, Sudan University OF Science & Technology-Sudan
- 2. Ministry of Agriculture and Animal Resource, Nile River State, Sudan
- 3. Ministry of Agriculture and Animal Resource, Northern State, Sudan
- 4. Faculty of Agricultural Science, El Selaim, University of Dongola, Sudan
- *E: mail: mukhtarazizm@gmail.com

مستخلص

أجريت تجربة المنافسة لموسمين صيفيين متعاقبين 2014و 2015بقرية الترعة—وحدة شرق النيل—محلية دنقلا — الولاية الشمالية — السودان، الواقعة بين خطى عرض 16 و 200شمالاً وخطى طول 200 شرقاً لتحديد الفقد في إنتاجية القرون الرطبة الناجم من منافسة الحشائش وتحديد الفقرة الحرجة لمكافحة الحشائش في البامية وسنف خرطومية تمت زراعتها في 23 فيراير في الموسمين الصيفيين وشمل هذا البحث 12 البامية والتي صممت بالتصميم العشوائي للقطاعات، بأربع مكررات ورك المحصول خالياً من الحشائش الفترات 2 ،4 ،6 ،8 ، 10 أسابيع بعد زراعة المحصول ثم ترك موبوءاً حتي الحصاد أو ترك موبوءاً لنفس الفترات ثم ترك خالياً من الحشائش عريضة الأوراق كانت سائدة في موقع التجربة وضح التحليل المشترك تضمينها كشواهد للمقارنة والحشائش عريضة الأوراق كانت سائدة في موقع التجربة وضح التحليل المشترك للموسمين الصيفيين إلى أن النمو غير المحدود للحشائش قلل معنوياً انتاجية البامية بتقليل فترة منافسة الحشائش ونق الموسمين الصيفيين إلى أن النمو غير المحدود للحشائش بينما تزيد إنتاجية البامية بتقليل فترة منافسة الحشائش وققاً لهذا البحث كانت بين الأسبوعين السادس والثامن بعد الزراعة في الموسمين الصيفيين وققاً لهذا البحث كانت بين الأسبوعين السادس والثامن بعد الزراعة في الموسمين الصيفيين .

Aastract:

The competition experiment was conducted for two consecutive summer seasons(2014, 2015) at Altraa village, Sharg Elneel Unit, Dongola Locality, Northern State – Sudan, located within latitude 16° and 22° N and longitude 20° and 32° E., to determine fresh pod yield loss due weed competition and to determine critical period of weed control in okra vegetable. Okra variety, khartuomia, was sown on 23 February in both summer seasons. This research comprised 12 treatments which arranged in randomized block design, with four replicates. The crop was kept weed-free for the first 2, 4, 6, 8, 10 weeks after crop sowing and then remained weedy till harvest or kept weedy for the same periods and then remained weed-free till harvest. Weed free and weedy treatments till harvest were included as controls for comparison. Broad-leaved weeds were predominant in the experimental site. Combined analysis of both

summer seasons showed that, growth components were significantly reduced by weed competition under full season weed infestation treatment. Combined analysis of both summer seasons indicated that, unrestricted weed growth significantly reduced fresh pod yield (kg/fed) by 72.81% and this reduction mainly affected by the duration of weed competition, whereas the okra vegetable fresh pod yield increased when the duration of weed competition decreased. Also combined analysis of both summer seasons showed that, the critical period for weed control in okra vegetable according to this investigation was between 6 and 8 weeks after sowing.

Key words: Yield loss, weed-free, infestation and duration of completion.

Introduction:

Okra (Abelmeschus esculentus (L) Moench) is one of the most important and popular vegetables grown in the world. It is a member of the plant family Malvaceae[1 and 2]. The world production of okra as fresh fruit vegetable is estimated at 6 million tonnes per hectare[3]. In the Sudan it is ranking third after onion and tomato with annual average area and yield of 58014 feddans and 291376 tons, respectively. It grows well under irrigation and rainfed area, in most parts of the country[1 and 2]. It is grown mainly for its green pods which are used as vegetable, fresh canned cooked with meat(weika) making a favorable and popular dish by most Sudanese(umrogaiga and tagalia), or conserved by drying and grinding into powder. The leaves are also cooked in many areas. It is a typical food in combination with sorghum bread(kisra). The seeds, roasted and ground to powder, are used as a substitute of coffee. Okra is used principally in soups and stews. It is grown in the tropical and subtropical area, almost in all parts of the country. It's main producing countries are India, Nigeria, Pakistan and Ghiana, where India at the top with a total production of 3,550,000 metric tons(Mt)[4].. One of the main problems that affect yield and quality of okra is weed interference and their competition with the crop. Weeds in okra must be controlled[5]. A critical period for weed control(CPWC) is defined as the period in the crop growth cycle during which weeds must be controlled to prevent unacceptable yield losses[6].

In Sudan okra received little attention and the available information is inadequate especially in area of weed competition. Thus, this study was conducted during two consecutive summer seasons of the years 2014 and 2015 at Altra Village-Dongola locality-Northern State-Sudan to assess the

magnitude of fresh pod yield losses due to the weed infestation and to determine the critical period of weed control in Okra vegetable.

Materials and Methods:

A field experiment was conducted during two consecutive summer seasons of the years 2014 and 2015 at Altra Village-Dongola locality-Northern State-Sudan. The area is located within latitudes 16° and 22° N, and longitude 20° and 32° E.,[7]. Dongola locality is a true desert, is characterized by extremely high temperatures and radiation in summer, low temperature in winter, scarce rainfall and high wind speed. The mean maximum and minimum temperatures are 36.8 and 19.5°C, respectively. The climate is hyper arid with a vapor pressure of only 10.8 mb and a relative humidity of less than 20%[7]. The soil in the experimental site is a sandy clay loam, with 57.34% sand, 19.83% silt and 22.50% clay[8].. In each season the experimental site was ploughed, disc harrowed, leveled and divided into plots. It was comprised of 12 treatments arranged in a randomized block design, with four replications. Plot size was 3x3.5 m. Each plot was made of five rows, each was 3.5 meters long. Okra, variety khartuomia was planted by hand in rows on flat, three seeds/hole in rows 70 cm a part and 25 cm between holes, on 23 February for both summer seasons. The seedlings were later thinned to two plants per hole two weeks after planting. The treatments involved weed free plots for 2, 4, 6, 8, 10 weeks after sowing and weedy plots for 2, 4, 6, 8, 10 weeks after sowing, weedy for 0 week and weed free for 0 week were included as controls[5]. Irrigation was applied at 7 - 10 days interval depending on temperature and other environmental conditions. Nitrogen fertilizer, as urea, was applied at a rate of 2 N(80 lb of nitrogen/fed). At ten weeks after sowing ten plants were randomly selected from the three inner rows in each plot to determine plant height (cm), number of branches/plant, number of leaves/plant, leaf area index/m2 and shoot dry weight(g)/plant. At each picking ten plants were randomly selected in each plot to determine mean number of pods/plant and mean fresh pod yield(kg/fed). Two rows in each plot were left unpicked or unharvested until the harvest, ten plants were randomly selected in each plot from those rows which were left unharvested, their pods were cut and threshed in bulk to determine number of seeds/pod and 100 seed weight(g)[9 and 5].

The procedure described by[10] was used to estimate the combined analysis of variance(ANOVA), which was carried out on data obtained using the statistical analysis system(SAS) computer package for SAS Institute Inc.,

1990, to detect significant effects among the treatments and populations compared. Mean squares for treatments or populations were calculated. Simple statistics including mean, standard deviation, standard error and coefficient of variation(C. V.%) were also calculated.

Results and DISCussion:

Okra vegetable plants were attacked by aphids in both summer seasons which controlled by folimat. The infection by aphids was heavy in the first summer season. The weed flora in the experimental site consisted of grassy and broad-leaved weeds. In both summer seasons broad-leaved weeds were predominant in the experimental site. The same result was obtained by[11]. The predominant weed species in the experimental site were

Chenopodium album (L.), Malva parviflora (L), Convolvulus arvensis (L.), Amaranthus graecizans, Sorghum arundinaceum, Gynandropsis gynandra (L.) Briq, Sinapis arvensis (L.), Tribulus terrestris (L.), Datura stramonium (L.), Cynodon dactylon (L.) Pers, Cyperus rotundus (L.), Eruca sativa, Portulaca oleracea L., Dactyloctenium aegyptium (L.) Beauv., Sporobolus pyramidatus (Lam.) Hitchc., Sonchus oleraceus, L. Hyoscyamus reticulates, Echinochloa colona (L.) Link, Tephrosia apollinea (Del.), Cassia italica (Mill.) Lam. Ex Steud, Calotropis procera (Ait.) Ait. f., Aerva javanica (Burm. f.), Rhynchosia memnonia (Del.) cooke and Lotus arabicus L.

Combined analysis of both summer seasons showed that, growth components were adversely affected by weed competition. Plant height(cm)/plant was significantly reduced under full season weed infestation treatment. The same trend was observed for the number of branches/plant, number of leaves/plant, leaf area index/m2 and shoot dry weight (g)/plant(Table 1). Similar results were reported by[12 and 13].

Table 1. Influence of duration of weed interference on growth components during summer seasons 2014 and 2015 combined

Shoot dry weight (g)/plant	leaf area index in m2	Number of leaves/ plant	Number of branches /plant	plant height (cm)/plant	Treatments
32.1 bcde	6.6 c	24.6 c	2.1 de	86.6 abcd	WF 2 weeks
32.6 bcde	8.7 bc	28.4 c	2.3 cde	88.6 abc	WF 4 weeks
32.1 bcde	9.8 bc	30.1 bc	1.9 e	84.6 abcd	WF 6 weeks
33.9 bcd	12.4 ab	36.0 ab	2.8 bcd	92.6 ab	WF 8 weeks

46.0 a	15.2 a	42.9 a	3.3 ab	91.8 abc	WF10 weeks
38.5 abc	14.5 a	37.0 ab	2.9 b	93.9 a	WD 2 weeks
40.1 ab	14.0 a	36.3 ab	2.8 bc	97.5 a	WD 4 weeks
37.4 abc	12.0 ab	36.4 ab	2.9 b	79.1 cde	WD 6 weeks
27.5 cde	10.1 bc	37.0 ab	3.0 ab	75.4 de	WD 8 weeks
23.8 de	8.7 bc	38.0 a	3.6 a	67.9 e	WD10 weeks
43.4 ab	15.8 a	41.4 a	3.3 ab	94.4 a	Weed free full
21.5 e	6.3 c	24.5 c	2.0 de	80.0 bcde	Weedy full
30.9%	30.7%	18.3%	23.2%	13.3%	SE±
5.3	1.7	3.1	0.3	5.7	CV%

Treatment means with the same letters are not significantly different at p(0.05) according to Duncan's Multiple Range Test.

Weed free for = WF

WD = Weedy for

Combined analysis of both summer seasons indicated that, unrestricted weed growth significantly reduced okra vegetable fresh pod yield(kg/fed.) by 72.81% compared to the weed free full season treatment(Figure 1). This result could be attributed to the presence of weeds which compete with the okra vegetable crop for essential mineral nutrients, water and light which reduced plant growth parameters and reflected in decreased okra vegetable fresh pod yield (kg/fed.). Similar results were found by[14; 15; 16; 17; 18 and 19].

The reduction in okra vegetable fresh pod yield due to weeds interference occurred mainly through reduction in yield components including number of pods/plant, number of seeds/pod and 100 seed weight(Table 2). This result could be attributed to the presence of weeds which compete with the okra vegetable for essential mineral nutrients, water and light which reduced plant growth parameters and reflected in decreased fresh pod yield. Results of this investigation showed that okra vegetable fresh pod yield increased when the duration of weed infested period decreased. The same result was found by [14; 20 and 18]. The critical period for weed control(CPWC) in okra vegetable in this research seems to be between 6 and 8 weeks after sowing (Figure 1). This result nearly agreement with those obtained by [12] who reported that the

critical period of weed interference in okra was between 3 and 16 weeks after planting;[5] who showed that, the critical period of weed control in okra was between 2 weeks after planting until harvest; [15] who said that, the critical weed-free period was between 2-8 weeks after sowing in okra; [21] who report that critical level in okra was 40 days after sowing and [19] who mentioned that, the critical period of weed competition in okra was between 2 to 6 after sowing. The result obtained in this investigation is not similar to those found by [22] Who reported that, the critical period of weed interference in okra was 36 days after sowing;[5] who depicted that, the critical period of weed control in okra was between 2 and 4 weeks after sowing and [13] in Urquay who reported that, the critical period for weed competition in between 20 to 30 days after planting. This slight differences in the critical period of weed control in okra is expected because the critical period of weed control is influenced by many factors such as weed infestation, season, weed species, the environment, plant density, time of competition, soil fertility and crop cultivar.

Figure 1. Effect of weed competition on fresh pod yield (kg/fed) during summer seasons 2014 and 2015 combined

Table 2. Influence of duration of weed interference on fresh pod yield components during summer seasons 2014 and 2015combined

100 seed weight (g)	Number of seeds/pod	Number of pods/plant	Treatments
5.750a	56.53b	15.59bcd	WF 2 weeks
6.000a	66.25a	17.81abc	WF 4 weeks
5.500a	65.80a	17.17abc	WF 6 weeks
5.500a	62.78ab	16.99abc	WF 8 weeks
5.875a	61.53ab	19.76a	WF 10 weeks
5.50a	66.28a	17.79bc	WD 2 weeks
6.000a	64.22ab	19.09a	WD 4 weeks
6.000a	63.83ab	16.99abc	WD 6 weeks
5.500a	62.85ab	16.02bc	WD 8 weeks

5.750a	59.83ab	13.07d	WD 10 weeks
5.75a	66.40a	18.39ab	Weed free full
5.750a	61.13ab	15.52cd	Weedy full
14.80%	11.90%	14.20%	SE±
0.4171	3.7509	1.2117	CV%

Treatment means with the same letters are not significantly different at p(0.05) according to Duncan's Multiple Range Test.

Weed free for = WF

WD = Weedy for

Conclusions and Recommendations:

The following conclusions were obtained:

- i. Okra vegetable fresh pod yield reduction by weed competition was directly related to the duration of weed interference.
- ii. Unrestricted weed growth significantly reduced fresh pod yield(kg/fed) by 72.81%.
- iii. The critical period for weed control in okra vegetable is between 6 and 8 weeks after planting in both summer seasons.

The following recommendations were obtained:

- i. Weed control in okra vegetable should be carried out by post-emergence herbicides at 6 weeks after sowing.
- ii. Removing weeds in okra vegetable should be carried out from 6 to 8 weeks after sowing.

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Effect of different levels of nitrogen fertilizer and watering frequencies under two levels of Striga seed infestation on Sugarcane variety Co6806.

Mohammed Ahmed Yousif Moh. 1*

¹Assistant Professor, Life Sciences and Chemistry Section, College of Sciences and Technology, Abdullatif Al-Hamad University of Technology, Merowe, Sudan.

* Email: mohdayousif@gmail.com

Abstract:

A factorial experiment, laid out in a randomized complete block design with three replicates was set up from January/2007 to Feb./2008, at Kenana Sugarcane Research Center to study the effect of different levels of nitrogen fertilizer (0.0, 2.5 and 5.0N) and watering frequencies (7, 10 and 12 days) under two levels of striga seed infestation (0.02 and 0.04 gm). Eighty-one (81) halves of plastic drums each of (60/2*22/7*90 cm) in size were used as pots. Two eyedbud sets of the variety Co6806 were sown/each pot. A month after the crop plants emerged, the pots were artificially infested with the striga heronmthica seeds at 1500 and 3000 germinable seeds/pot respectively (approximately 0.02 and 0.04 gm/pot i.e. 300 and 600gm/ fed.). The results recorded, tabulated and analyzed according to Duncan's multiple range test, showed that at 10 days watering interval, lower numbers of emerged striga plants were observed at the rate of 5.0N fertilizer, While at 12 days watering frequency under 0.02gm striga seeds / pot, the number of emerged striga plants decreases with the increase of the nitrogen level and the reverse with the sprinkled striga seeds at 0.04 gm / pot. Generally, all the striga harvest components showed a decrease with the increase of the nitrogen level applied at 2.5N and 5.0N to the pots of 10 and 12 days watering frequencies inoculated with 0.02g/pot and the reverse with 0.04gm/pot inoculation.

Key words: Nitrogen Fertilizer, Watering Frequencies, Striga and Sugarcane.

المستخلص العربي:

أجريت التجربة العاملية التي تم وضعها في تصميم قطعة كاملة عشوائية مع ثلاث مكررات من يناير / 2007 إلى فبراير / شباط 2008، في مركز أبحاث قصب السكر / كنانة، لدراسة تأثير مستويات مختلفة من سماد النيتروجين (0.0 , 2.5 و 0.5 م). والري علي فترات (7 , 10 و 12 يومًا) تحت مستويين من الإصابة ببذور طفيل البودا (0.02 و 0.04 جم). واستخدام واحد وثمانين (81) نصف برميل من البلاستيك بحجم (2/60 * 7/22 * 90 سم) كأواني حاملة للتربة حيث تمت زراعة قطعتين من القصب كل قطعة تحتوي على ثلاث سلاميات ذات برعمين من العينة 2060. بعد شهر من ظهور النباتات، تمت إضافة بذور طفيل البودا بمعدلين 1500 و 3000 بذرة قابلة للإنبات على التوالي (حوالي 0.02 و 0.04 جم / المعاملة أي 300 و 600 جم / فدان). أظهرت النتائج التي تم تسجيلها وتبويبها وتحليلها وفقًا لاختبار دنكانز (Duncan's) متعدد المدى، أنه عند فاصل الري لمدة 10 أيام، لوحظت أعداد أقل من نباتات طفيل البودا الناشئة بمعدل سماد N5.0، بينما في 12 يومًا فترة الري تحت 0.02 جم من بذور طفيل البودا / المعاملة، ينخفض عدد نباتات طفيل

البودا الناشئة مع زيادة مستوى النيتروجين والعكس مع بذور طفيل البودا مرشحة عند 0.04 جم/ المعاملة. بشكل عام، أظهرت جميع مكونات حصاد طفيل البودا انخفاضًا مع زيادة مستوى النيتروجين المطبق عند N2.5 و N5.0 على المعاملات ذات فترات الري 10 و12 يومًا المحقونة بـ 0.00 جم/ المعاملة والعكس مع 0.04 جم/ المعاملة.

الكلمات المفتاحية: سماد النيتروجين، فترات الري، طفيل البودا وقصب السكر.

Introduction:

Parasitic Striga species (Family Scrophulariaceae) thrive on degraded soils, the majority of soils in tropical Africa. They occur worldwide, in Africa (native continent of the genus), Asia, America and Australia. Literature review indicates *S. asiatica* (L.) Kuntze, *S. gesnerioides* (Willd.) Vatke and *S. hermonthica* (Del.) Benth. as the species currently causing agricultural problems. S. asiatica and *S. hermonthica* parasitize cereal crops in contrast with *S. gesnerioides* which parasitizes leguminous plants like cowpea (*Vigna unguiculata* (L.) Walp. and also plants of the families Agavaceae, Convolvulaceae and Euphorbiaceae. Parasitism by *Striga* may inflict up to 100% yield loss. Striga is a parasitic weed which constitutes one of the most important biotic constraints to the production of food crops in Africa and the Middle East. It may cause yield losses of up to 80% in the staple food and industrial crops of the region, including cereals, such as sorghum, pearl millet, finger millet, maize, rice, wheat, and sugar cane, and some broadleaf crops, such as cowpeas, sunflower, soybean, groundnut, tobacco, and various cultivars of beans.

Sugarcane (Saccharum Spp.) is a perennial plant, which belongs to the grass family Poaceae. It is essentially a tropical plant characterized by a wide planting space, a long growing season and adaptation to different climatic zones. However, sugarcane is grown under conditions of high temperature, frequent irrigation and substantial amounts of herbicides. These conditions coupled with the perennial nature of the crop favor intensive growth of weeds particularly before the crop reaches its full canopy stage to curtail further growth of weeds [11]. Like tropical cereals and legumes, sugarcane crop is vulnerable to parasitism by striga spp. Attacks by witch weed on sugarcane has always been regarded as minor, but depending on the variety, tremendous losses could occur. Sugarcane varieties vary greatly in their reaction to witch weed attacks. Of the commercial varieties grown in Kenana, Co6806 and CoC671 were observed to be the most susceptible to witch weed, while the varieties Co997 and Co775 are less susceptible. In the late seventies and early eighties when all the cane fields of Kenana were under the variety Co527, witch weed had represented a problem, but only after the introduction of the variety Co6806 that the parasite flared up, to become a constant pest in the cane fields. In the rainy season of 1996 for instance, the cane area lost to witch weed parasitism was estimated at 200 hectares in the plantations of Kenana Sugar Company. Witch weed was strongly believed to worsen in the future as the parasite grows and disperses seeds with limited control efforts. It is now evident that the source of witch weed seeds is within the estate which could be seen growing during the rainy seasons along canal banks and in the cut-out areas and lines separating cane fields and sectors.

Striga incidence is influenced by soil type, fertility and rainfall. Permanent mono-cropping and lack of suitable crop rotation, impoverished soils and reduced rainfall, incorrect cultural practices (including the use of crop seeds infested by parasitic weed seeds) and the lack of other preventative measures are the major factors favoring continuous interference of parasitic weeds with several crops.

Striga management using a single control method is less effective [7]. A combination of several options can be efficient and economical with better control of Striga [9]. Cultural practices improve sorghum growth rate, and retard parasite seed germination and seedling development [8]. These practices include crop rotation [12]; mixed cropping [8:13]; water management [8], fertilization [5] and weeding [6]. Early planting following the main rains minimizes Striga in the semi-arid regions because it allows escape from heavy Striga infestation, which often happens almost two months after planting [4]. The high prices of herbicides, their limited availability, and the lack of technical knowledge on the use of agrochemicals for weed and pest management are among the main reasons for their limited use in sorghum production [3]. Researchers in Africa started to work intensively on Striga control from 1940 onwards. Efforts have been intensified during the last three decades [2]. However, it proved to be difficult to find selective products to control the parasite. Of all products tested 2, 4-D, MCPA. dicamba and chlorsulfuron, as post-emergence treatments, each alone or when preceded by nitrogen proved to be effective against the parasite. Germination stimulants viz ethylene, ethephon, strigol and strigol analogus, proved to be highly effective in inducing suicidal germination of the parasite under laboratory conditions. Under field conditions they were either unstable and/or highly expensive [1]. The most effective approach is the integration of cultural and chemical control measures that are economically feasible. **Objectives:** To Study the effect of:

- The different levels of nitrogen fertilizers on striga infestation.
- The Frequency of watering on striga infestation in sugarcane.
- The different levels of Striga Seed Infestation on Sugarcane Variety.

MATERIALS AND METHODS:

A factorial experiment, laid out in a randomized complete block design with three replicates was set up from January/2007 to Feb./2008, at Kenana Sugarcane Research Center to study the effect of different levels of nitrogen fertilizer (0.0, 2.5 and 5.0N) and watering frequencies (7, 10 and 12 days) under two levels of striga seed infestation (0.02 and 0.04 gm). Eighty-one (81) halves of plastic drums each of (60/2*22/7*90 cm) in size were used as pots. Two eyed-

bud sets of the variety Co6806 were sown/pot. A month after the crop plants emerged, the pots were artificially infested with the *striga heronmthica* seeds at 1500 and 3000 germinable seeds/pot respectively (approximately 0.02 and 0.04 gm/pot i.e 300 and 600gm/fed.). The striga seeds were mixed with sandy silt soil, sprinkled on the top 5 centimeters of the soil in the pots, closer to the crop roots.

Striga infestation was assessed by 3 days, counting the number of emerged, flowered plants from the time of first parasite emergence until 16 weeks after planting (WAP). The cane crop was harvested 12 months from the time of planting. The moisture content and the water required / pot (per feddan) were carried out by sampling the soil of the pot trial just pre and two days' post irrigation of each pot and then ovened for drying under 105°C for 48 hours. Data were recorded, tabulated, analyzed and means separation according to Duncan's multiple range test.

Results and discussion:

The effect on the emerged striga harvest components:

At 7 days watering frequency the number of emerged striga plants increases with the increase of the nitrogen fertilizer and the striga seed rates inoculated on the pots (Table 1 and Fig 1, 2 and 3). Where as, at 10 days watering interval, lower numbers of emerged striga plants were observed at the rate of 5.0N fertilizer (Table 1 and Fig 4, 5 and 6). These numbers were increased with the increase of striga seed rate. While at 12 days watering frequency under 0.02gm striga seeds / pot, the number of emerged striga plants decreases with the increase of the nitrogen level and the reverse with the sprinkled striga seeds at 0.04 gm / pot (Table 1 and Fig 7, 8 and 9). Generally, all the striga harvest components showed a decrease with the increase of the nitrogen level applied at 2.5N and 5.0N to the pots of 10 and 12 days watering frequencies inoculated with 0.02g/pot and the reverse with 0.04gm/pot inoculation (Table 1).

Table (1): The effect of irrigation intervals, fertilization and the seed rates used on the striga plants growth and yield parameters (means).

igation terval- days	Nitrogen level kg/ fed	Striga harvest components (means)											
		0.00 gm Striga seeds/pot				0.	02 gm St	0.04 gm Strig					
		NESPs	HSP	DWSP	Caps./SP	NESPs	HSP	DWSP	Caps./SP	NESPs	HSP		
	0.0N	0	0	0	0	8 a	35ab	2.75bcd	43 ab	15 b	49ab		

lays	2.5N	0	0	0	0	12 a	22ab	1.07 cd	38 abc	20 ab	60 a
(25% pletion)	5.0N	0	0	0	0	12 a	38ab	2.31bcd	43 ab	37 a	44ab
0 days	0.0N	0	0	0	0	8.0 a	28b	3.96 bc	38 abcc	21 ab	48ab
(50%	2.5N	0	0	0	0	8.0 a	50 a	3.06 bc	62 a	14 b	47ab
pletion)	5.0N	0	0	0	0	2.0 a	13ab	6.7 a	31 abc	17 b	37ab
	0.0N	0	0	0	0	9.0 a	20ab	2.02bcd	28 abc	15 b	26ab
3 days	2.5N	0	0	0	0	3.0 a	4.0 b	0.67 cd	13 bc	19 ab	19 b
(75% pletion)	5.0N	0	0	0	0	0.0 a	0.0 b	0.0	0.0 с	30 ab	37ab
b						17.44	33.27	2.534	35.53	17.40	33.3

0.0N: 0.0 kg. 2.5N: 100 kg. 5.0N: 200 kg urea. NESPs: Number of Emerged Striga Plants/pot. HSP: Height of Striga Plant/pot(cm). DWSP: Dry Weight of Striga Plant/pot(gram). Caps./SP: Capsules number /Striga Plant/pot. Each figure is a mean of three replicates. Means were separated according to Duncan's multiple range test.



Fig. 1: 7days, 0.0N and (0.04, 0.0 and 0.02gm striga seeds.



Fig. 2: 7days, 2.5N and (0.04, 0.0 and 0.02gm striga seeds.



Fig. 3: 7days, 0.0gm striga seeds and (0.0, 2.5 and 5.0N).



Fig. 4: 10 days, 0.0N and (0.04, 0.0 and 0.02gm striga) seeds.



Fig. 5: 10 days, 2.5N and (0.04, 0.0 and 0.02gm) striga seeds.



Fig. 6: 10 days, 5.0N and (0.02, 0.04 and 0.0gm) striga seeds.



Fig. 7: 12 days, 5.0N and (0.0, 0.02 and 0.4gm) striga seeds.



Fig. 8: 12 days, 0.02mg striga seeds and 2.5 and 5.0N



Fig. 9: Rows from left to right treated with 0.02, 0.04 and 0.0 gm striga seeds.

The effect on the cane yield components:

The cane yield decreases with the increase of striga seed rate and increases with the increase of the nitrogen level and watering frequencies. This agreed with Xu et al., 2012, who illustrated that, Nitrogen (N) is closely related to plant growth and development and affects cell regulation and metabolism. The supply of N determines the crop yield. Higher yield was obtained from the treatment of 12 days watering frequency combined with 5.0N level of

nitrogen in comparison with the other levels and treatments of the other factors. The treatment of the watering frequency 12 days plus 5.0N inoculated with 0.02 gm striga seeds /pot out-yielded the 7 and the 10 days' treatments at the same level of nitrogen by 1.3 and 0.8 kg, respectively. But under 0.04 gm *striga* seeds rate, the difference is smaller compared to that of the same watering frequencies and nitrogen levels, 0.42 and 0.52 kg, respectively (Table 2).

Table 3 showed the differences in moisture content and water required during March and Dec.2007, between the three watering frequencies.

Table 2: The cane Plant height (m), population and weight kg / pot. (means)

Cane plant harvest components (means)

Nitrogen

Irrigation

interval-	level kg/	0.00 gı	m Striga se	eeds/pot	0.02 gm	ı Striga s	0.04 gm Striga		
days	fed	Height	Populat	Weight	Height	Populat	Weight	Height	Popula
		(m)	-ion	Kg/pot	(m)	-ion	Kg /pot	(m)	-ion
		()	No./pot			No./pot			No./po
	0.0N	1.12 a	4 d	1.08 b	0.54 ab	3.3 b	0.5 a	0.22 a	2.3 a
7 days	2.5N	1.40 a	5.7 d	1.5 b	0.51 ab	4.7 ab	0.6 a	0.28 a	2.8 a
	5.0N	1.47 a	16.3 ab	4.1 a	0.54 ab	5.0 ab	0.6 a	0.32 a	3.3 a
10 days	0.0N	1.39 a	6.7 cd	1.5 b	0.23 b	4.0 b	0.5 a	0.19 a	2.0 a
10 days	2.5N	1.47 a	9.0 bcd	1.8 b	0.48 ab	3.0 b	0.5 a	0.21 a	2.3 a
	5.0N	1.61 a	14.6 abc	3.1 ab	1.14 a	11.3 ab	1.3 a	0.31 a	3.0 a
10.1	0.0N	1.25 a	7.0 cd	1.9 b	0.59 ab	7.0 ab	0.8 a	0.28 a	3.0 a
12 days	2.5N	1.46 a	18.8 a	4.4 a	1.04 ab	7.0 ab	1.2 a	0.40 a	3.0 a
	5.0N	1.43 a	18.7 a	4.8 a	1.29 a	12.6 a	1.9 a	0.66 a	4.7 a
LSD		0.8737	8.495	2.145					

[.] Each figure is a mean of three replicates. Means were separated according to Duncan's multiple range test.

Table 3: Moisture content of the striga pot trial

Moisture Content											Wa		
March 07						Dec-07						March 07	
										7	10		
7 days 10 days		lays	12 days		7 days		10 days		12 days		days	days	
Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	Pre-	Post	150.8	257.3
irrig.	irrig.	irrig	irrig	irrig	irrig	irrig	irrig	irrig	irrig	irrig	irrig.		
32.5	40.6	28.1	36.1	24.6	39.6	34.1	40.1	32.5	40.3	30.7	40.1		

Figures are the means of three replicates.

Conclusion:

- The number of emerged striga plants increases with the increase of the striga seed rate inoculated.
- At the range of 10 12 days watering intervals the number of emerged striga plants decreases with the increase of the level of nitrogen applied.
- The cane yield increases with the increase of the watering interval and the level of nitrogen, but the reverse with the striga seed rate inoculated.

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