ISSN No:-2456-2165

Effects of Neem, Heglig Aqueous Extracts and Nitrogen Doses on *Striga hermonthica* (DEL*)* on Wheat (*Triticum aestivum* L.)

Mukhtar Abdel Aziz Mohamed Osman[1] and Ammar MS Abdalla[1*]
Department of Crop Protection, Faculty of Agricultural Sciences (FAS), University of Dongola, Sudan

*Corresponding Author: Ammar MS Abdalla,
Department of Crop Protection, Faculty of Agricultural Sciences,
University of Dongola, Dongola, North State,
Sudan

Abstract:- A pots experiment was conducted during the two consecutive winter seasons 2019/2020 and 2020/2021 at the demonstration farm, Collage of Agricultural studies, (CAS), Shambat, Sudan University of Science and Technology, Khartoum Bahri Locality, Khartoum state, Sudan (Latitude15° 40` N and Longitude 32° 23` E,) to evaluate two botanical aqueousextracts (Neem leaves, Heglig seeds) and three levels of nitrogen on *S.hermonthica* incidence and growth and yield of wheat.

Combined analysis of both winter seasons showed that Striga emergence increased with the increasing number of weeks after sowing, Neem 10%, Heglig 10% and Nitrogen 80 lb/fed., were the best treatments which achieved significantly lowest number of Striga emergence, lowest Striga shoot fresh weight (g)/plant, shoot dry weight (g)/plant. and gave comparable to that obtained by the Striga free control. Neem 10% and nitrogen at 80 lb/fed., were the best treatments which achieved significantly highest wheat shoot fresh weight (g)/plant, shoot dry weight (g)/ plant and gave comparable to that obtained by Striga free control treatment. Nitrogen at 80 lb/fed.Only the best treatment, which achieved the highest number of tillers/plants and gave comparable to that obtained by Striga free control treatment. Neem 10% and nitrogen at 80 lb/fed., significantly increased wheat plant height (cm) and they were the best treatments, which achieved comparable to that obtained by the Striga free control treatment.

A combined analysis of both winter seasons indicated that *Striga* significantly reduced wheat grain yield by 14.58%. Within all treatments nitrogen at 80 lb/fed, was the best treatment which gave the highest wheat grain yield and gave comparable to that obtained by Striga free controltreatment, followed by Neem 10%. Nitrogen at 80 lb/fed, significantly increased wheat grain yield (kg/fed.,) by 38.02%.

Keywords:- *Emergence; Free; Incidence; Increased; Reduced.*

I. INTRODUCTION

Wheat (*Triticum aestivum* L) belongs to the family Poaceae, Global wheat production is concentrate mainly in Australia, Canada, China, India, Pakistan, Russia, Turkey and the United States of America (FAO, 2013). It has the largest cultivated area among the various crops. It is the third most-produced cereal after maize and rice (FAO, 2003), in Sudan It is grown in Northern State, Nile Valley State, El Jezira State and White Nile State. The importance of wheat yield is due to the quality of bread. Wheat is used as good food for animals. It is used in the manufacture of bread and pastries (FAO, 2013).

*S. hermonthica (*Del*)* is a root parasitic weed, belongs to the Orobanchaceae family and is an imperfect parasite because it can photosynthesize after it appears above the soil surface (Osman, 2019). Striga spp., are obligate hemiparasitic plants that attach to the roots of their hosts to obtain water, nutrients and carbohydrates (parker and Riches, 1993). Striga has been a serious problem of cereal and legume crops among farmers in sub-Saharan Africa (Atera et al., 2011).

Seeds are dispersed by cattle, wind, water and shared use of contaminated farm implements and contamination of sowing seed (Press et al, 1999).

Botanical extracts will be pest control compounds such as *Azadirachtaindica*. The current study is designed to explore new environmentalfriendly to control parasitic weeds that to replace highly toxic herbicides (Ahmed, *et.*a.l, 2001).

Generally there is a lack of information on the effects of Neem, Heglig extracts, and nitrogen doses on *S. hermonthica*, thus this research was carried out to determine the effects of different concentrations of aqueous extracts of Neem, Heglig and different doses of nitrogen on *S. hermonthica* and growth and yield of wheat.

ISSN No:-2456-2165

II. MATERIALS AND METHODS

A pots experiment was conducted during the two consecutive winter seasons 2019/2020 and 2020/2021 at the demonstration farm, Collage of Agricultural studies, (CAS), Shambat, Sudan University of Science and Technology, Khartoum Bahri Locality, Khartoum state, Sudan (Latitude15° 40` N and Longitude 32° 23` E,) (Babiker, *etal*. 2013) to evaluate two botanical water extracts (Neem leaves, Heglig seeds) and three levels of nitrogen on *S.hermonthica* incidence and growth and yield of wheat.

Neem leaves were collected from Shambat in Khartoum Bahri and Heglig seeds were collected from National Tree Seeds Center. The plants materials were washed and dried at room temperature and were separately ground into fine powder (<1mm) and stored until use.

Plantaqueous extracts at 10% concentrations were obtained by pickling at room temperature. Ten grams of powdered part of plant material were placed in a 250 ml glass beaker with 100 ml of sterile distill water for 24 hours and each suspension was then filtered through two tools, the first (nylon cloth) served to move big debris and the second (filter paper) to set an homogeneous solution, other concentrations (5% and 2.5%) were obtained from 10% concentration (Yonli et al, 2010).

Wheat cultivar (Nile Valley) seeds were obtained from Elobied Research Station, Agricultural Research Corporation. The seeds were placed in six beakers (three concentrations of the *Neem* water extract and three concentrations of the *Heglig* water extract); beakers were placed at room temperature for eight hours before planting. The seeds of controls were placed in beakers containing sterile distilled water.

The pots experiment was conducted under artificial *S. hermonthica* infestation. Artificial infestation soil was achieved by mixing two grams of *Striga* seeds with 1kg soil. The required level of Striga seeds (20 mg/pot) was obtained by taking 10 grams of mixed soil and *Striga* seeds. Striga seed soil mixture was added to *S. hermonthica* free soil and thoroughly mixed by hand.

Wheat cultivar (Nile Valley) seeds were treated with three concentrations of *Neem* and three concentrations of *Heglig* aqueous extracts and were sown on 223rdDecember, five seeds/pot, later thinned to two plants per pot at three weeks after sowing. Two botanical extracts *(Neem* and *Heglig*) and nitrogen in the form of urea were used at different single doses.In addition, two controls were used, the first was negative control treatment which contained (0mg) of Striga seeds, and the second was positive control (20 mg) of Striga seeds, both controls were used for comparison.

This experiment includes 11 treatments arranged in a randomized complete block design (RCBD), with three replicates: Neem, 2.5%, 5.0% and 10%; Heglig, 2.5%, 5.0% and 10%; and Nitrogen at (40, 80 and 120 Ibs/fed), in the form of urea; negative control treatment (*Striga* free) and Positive control treatment (20mg of *Striga* seeds).

Striga growth components including the number of Striga emergences were carried out at 6, 10 and 14 weeks after sowing (WAS). At harvest,*Striga* plants collected from each treatment were harvested, weighted to determine fresh weight, then air-dried and weighted to determine dry weight.

The two plants of wheat were taken at flowering to determine growth parameters including shoot fresh weight (g)/plant shoot dry weight (g)/plant, plant height (cm) and number of tillers/plant.

At the harvest,1000-grain weight (g) and grain yield (kg/fed.) were recorded.

The procedure described by Gomez and Gomez (1984) 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 square for treatments or populateswas calculated. Simple statistics including mean, standard deviation, standard error and coefficient of variation (C. V) were also calculated.

III. RESULTS AND DISCUSSION

Recent approaches to control crop parasites are oriented towards exploring new alternative sources of herbicides less hazardous and inexpensive. Researchers have indicated that, the plant kingdom is characterized by the presence of chemical substances, in the form of natural products that are used to combat parasitic weeds attack by eliciting strong physiological responses in various stages of parasite lifecycle. Botanical chemicals might be a promising source of parasites control compounds such as Neem and Heglig. The current study aimed at exploring new environmental friendly chemicals to control *Striga* on wheat.

Striga count made at 6, 10 and 14 weeks after sowing (WAS) showed that, Striga emergence increased with increasing of the weeks. Statistical analysis showed that, all treatments at 6, 10, and 14 weeks after sowing significantly reduced number of Striga emergence as compared to the Striga control treatment (Table.1). Neem 10%, Heglig 10% and nitrogen 80 lb/fed., were the best treatments, which achieved lowest number of Striga emergence and gave comparable to that obtained by the Striga free control (Table 1). Possible reason for this, the presence allopathic effects of concentrations, might be attributed to the hormone –like properties of allelo-chemicals of plants extracts such argelin. Also, possible reason for this could be due to *Striga* seeds cannot germinate in the absence of a chemical stimulant, because Nitrogen decreases stimulant production by the host plant. Similar results were found by Osman (2019). Although this result was in line with that obtained by Rashida *etal*. (2017) and Dugje et al., (2008), who indicated that, application of nitrogen fertilizer is generally beneficial in delaying emergence, reduced the severity of *S. hermonthica* and obtaining stronger crop growth.

ISSN No:-2456-2165

Treatments	Number of Striga (plants/pot)		
	6 **weeks after sowing**	**10 weeks after sowing**	**14 weeks after sowing**
Neem 2.5%	1.33 b	1.67 b	2.33 b
Neem 5%	1.00 b	1.67 b	1.67bc
Neem 10%	1.00 b	1.00 c	1.33 c
Heglig2.5%	1.00 b	1.67 b	2.33 b
Heglig5%	1.33 b	1.67 b	2.33 b
Heglig10%	1.00 b	1.33 c	2.33b
Nitrogen 40 lb/fed.	1.00 b	1.67 b	2.33 b
Nitrogen 80 lb/fed.	1.00 b	1.00 c	1.00 c
Nitrogen 120 lb/fed.	1.00 b	1.67 b	2.33 b
Striga free control	1.00 b	1.00 c	1.00 c
Striga control	2.67 a	3.00 a	3.67 a
CV	16.33	17.42	12.76
SE±	0.14	0.27	0.33

Table 1: Effects of Neem, Heglig aqueous extracts and Nitrogen doses on *Striga* emergence (plants/pot), combined

* Means followed by the same letter (s) within each column do not differ significantly at 5% level of probability according to DMRT

Allbotanicalaqueous extracts and Nitrogen concentrations treatments significantly decreased Striga shoot fresh and shoot dry weights (g) as compared to *Striga* control treatment (Table 2). Neem 10%, Heglig 10%, Nitrogen 80 lb/fed., and Striga free control where the best treatments, which achieved lower Striga, shoot fresh weight (g) and shoot dry weight (g). Neem 10%, Heglig 10%, and Nitrogen 80 lb/fed., gave Striga shoot fresh weight (g) and shoot dry weight (g) comparable to that obtained by Striga free control treatment (Table 2). The same results were found by Li *et al.* (2010).

Treatments	Striga shoot fresh weight (g)	Striga shoot dry weight (g)
Neem 2.5%	4.67 b	3.00 b
Neem 5%	1.87 cd	1.67 d
Neem 10%	1.00 de	1.00 e
Heglig2.5%	3.20 bc	2.13 cd
Heglig5%	3.00 bcd	2.10 d
Heglig10%	1.00 de	1.00 e
Nitrogen 40 lb/fed.	4.67 b	2.67 bc
Nitrogen 80 lb/fed.	1.00 de	1.00 e
Nitrogen 120 lb/fed.	1.87 cd	1.67 d
Striga free control	1.00 de	1.00 e
Striga control	9.17 a	4.77 a
CV	18.02	27.14
SE±	0.69	0.19

Table 2: Effects of Neem, Heglig aqueous extracts and Nitrogen doses on Striga shoot freshandshoot dry weights (g), combined

* Means followed by the same letter (s) within each column do not differ significantly at 5% level of probability according to DMRT

Neem 5% and 10%, Heglig 10% , all rates of nitrogen and Striga free control significantly increased wheat shoot fresh and and dry weights (g)/ plant as compared to the Striga control treatment (Table 3). Neem 10% and nitrogen at 80 lb/fed. were the best treatments which achieved highest wheat shoot fresh and shoot dry weights (g)/ plant and gave comparable to that obtained by Striga free control treatment (Table 3). Similar findings were mentioned by Adagba *et al.* (2002) and Teka (2014).

Allbotanicalaqueous extracts (except Neem 2.5%) and Nitrogen at all three rates treatments significantly increased number of tillers/ plant as compared to the Striga control treatment. Nitrogen at 80 lb/fed, was the best treatment, which achieved highest number of tillers/ plant, comparable to that obtained by Striga free control treatment (Table 3).

Neem 10% and nitrogen at 80 lb/fed., significantly increased wheat plant height (cm) as compared to the Striga control treatment and they were the best treatments, which achieved comparable to that obtained by the Striga free control treatment (Table 3). Similarly, result was obtained by Lagoke and Isah (2010).who showed that, fertilizer application had significant effect on height of crop as well as shoot count and dry matter of production. The application

ISSN No:-2456-2165

of high nitrogen (N) increased the performance of cereal crops under Striga infestation. This is due to the fact of that nitrogen reduced the severity of Striga attack while simultaneously increasingly the host performance. Also Ikie et al. (2006) pointed that, other advantageous effect of fertilizers include increasing soil nitrogen and other nutrients, the organic matter of the soil and increasing soil moisture holding capacity.

Treatments	Shoot fresh weight (g)/ plant	Shoot dry weight (g)/ plant	Number of tillers/ plant	Plant height (cm)
Neem 2.5%	7.17 f	3.07 f	2.33 d	52.93 de
Neem 5%	11.77 c	4.97 bc	6.67 b	40.53 g
Neem 10%	13.00a b	6.00 ab	6.00 bc	56.97 ab
Heglig2.5%	8.33 ef	3.30 ef	6.33 bc	44.07 f
Heglig5%	7.40 f	3.53 def	5.33 c	44.07 f
Heglig10%	8.67 e	4.13 cde	6.33 bc	55.03 bcd
Nitrogen 40 lb/fed.	9.27 de	4.33 cd	6.33 bc	40.50 g
Nitrogen 80 lb/fed.	13.93 a	6.17 a	9.00 a	58.53 a
Nitrogen 120 lb/fed.	9.73 d	4.10 cde	6.33 bc	55.90 abc
Striga free control	13.97 a	5.57 b	8.67 a	56.83 ab
Striga control	7.40 f	3.07 f	2.67 d	53.40 cde
CV	5.65	11.57	12.31	3.25
SE±	0.32	0.30	0.43	0.94

Table 3: Effects of Neem, Heglig aqueous extracts and Nitrogen doses on wheat growth parameters, combined

* Means followed by the same letter (s) within each column do not differ significantly at 5% level of probability according to DMRT

Combined analysis of both winter seasons showed that, all treatments did not significantly increased 1000-grain weight (g) as compared to the *Striga* control treatment. Combined analysis of both winter seasons indicated that, *Striga* significantly reduced wheat grain yield by 14.58% compared to the *Striga* free control (Table 4). Similar result was obtained by Ejeta, (2007) who reported that, parasitic plants are acquired the ability to obtain nutrition from host plants and have adapted to prefer less fertile soil and consequently cause considerably loss to the crop. Also the same result was mentioned by Rodenburg et al, (2006) and Gurney et al, (1999) who reported that. Striga infestation can result in a large reduction in the cop grain yield. The result was in line with that obtained by Atera et al, (2011) who said that, farmers have reported losses between 20% and 80%, and are eventually forced to abandon highly infested field.Also similar result was found by Haussmann et al. (2000) who indicated that grain yield losses even can reach 100% in susceptible cultivars under a high infestation level and drought conditions.

Neem 10%, Nitrogen at 80 and 120 lb/fed., and Striga free control significantly increased wheat grain yield (kg/fed.,)as compared to the Striga control treatment (Table 4). Within all treatments nitrogen at 80 lb/fed., was the best treatment, whichgave highest wheat grain yield and gave comparable to that obtained by Striga free controltreatment (Table 4). Nitrogen at 80 lb/fed., significantly increased wheat grain yield (kg/fed.,) by 38.02% as compared to the Striga control treatment (Table 4). The grain yield (kg/fed.) increased when the level of nitrogen increased. These results might be due to the increase up of grain yield attributing characters and nutrient uptake of the crop under these levels as well as reduced *Striga* infestation at high application levels. These findings are in agreement with those obtained by Hugar *et al*. (2010) who reported that, the grain yield increased when the level of nitrogen increased. Although these results are in line with those obtained by Oswald (2005) who said that, low levels of *Striga* infestation are often associated with high soil fertility. The same findings were found by Hugar, *et al.*, (2010) who indicated that, nitrogen at high rates suppresses Striga infestation, while at low rates enhances emergence of the parasite. Similar findings were found by Teka (2014) and Rashida *et al.* (2017).

ISSN No:-2456-2165

Treatments	1000 grain weight (g)	Wheat grain yield (kg/fed.)
Neem 2.5%	35.33 a	6.00 e
Neem 5%	39.67 a	4.00 f
Neem 10%	45.00 a	9.33 b
Heglig2.5%	38. 67 a	7.00 de
Heglig5%	35.67 a	4.67 f
Heglig10%	41.67 a	7.67 cd
Nitrogen 40 lb/fed.	36. 67 a	8.33 bc
Nitrogen 80 lb/fed.	43.33 a	11.00 a
Nitrogen 120 lb/fed.	35.67	9.33 b
Striga free control	39. 00 a	10.67 a
Striga control	37.67 a	7.97 c
CV	8.82	9.01
SE±	0.59	0.40

Table 4: Effects of Neem, Heglig aqueous extracts and Nitrogen doses on wheat yield(kg/fed), combined

* Means followed by the same letter (s) within each column do not differ significantly at 5% level of probability according to DMRT

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions:

- Neem and Heglig aqueous extracts reduced *Striga* emergence, *Striga* fresh and dry weights, this means these two botanicals have effect on *Striga* emergence and growth.
- Nitrogen alone effectively reduced emergence and suppressed *Striga* emergence.
- Effectiveness of these two botanical aqueous extracts and nitrogen levels increased by increasing concentrations, and levels.

B. Recommendations:

- Use Nitrogen at 80 lb. /fed., to control *Strigahermonthica*and decreased their effect on wheat growth and yield.

REFERENCES

[1.] Adagba, M. A.; Lagoke, S. T. and Imolehin, E. D. (2002).Nitrogen effect on the incidence of Striga hermonthica (Del.) Benth in upland rice.*Agron.Hungarica. 50:145-150.*

[2.] Ahmed N. E., Sugimoto, Y.; Babiker, A. G.; Mohamed, O. E.; Inanaga, S. and Nakajima, H. (2001).Effects of Fusariumsolani isolates and metabolites on *Striga* germination.*Weed Sci. 49: 354–358.*

[3.] Atera, E. A.; Itoh, K. and Onyango, J. C. (2011). Evaluation of ecologies and severity of *Striga* weed on rice in sub-Saharan Africa. Agr.and Biol. *J. of N. America, 2: 752-760.*

[4.] Babiker, M. M.; Elamin, S. E. and Mukhtar, A. M. (2013).Impact of herbicides Pendimethalin, Gesaprim and their combination on weed control under maize *(Zea mays L.). Journal of applied and industrial sciences, 1(5): 17 – 22.*

[5.] FAO, (2003). Yearbook production, (56) FAO statistics, series No. 176. Food and agriculture organization of the Unite Nation, Rome.

[6.] FAO, (2013).Food and Agriculture Organization of the United Nations Crop Prospects and food situation.

[7.] Ejeta, G. (2007). The *Striga* scourge in Africa: a growing pandemic. In: Ejeta, G. and Gressel, J. (eds.). Integrating new technologies for *Striga control*: Towards ending the *witch-hunt,pp.3-16.*

[8.] Gomez, K. A. and Gomes, A. A. (1984). *Statistical procedures for Agricultural research, 2nd Edition. John Wily and Sons, Inc. New York.*

[9.] Gurney, A. L., Press, M. C. and Scholes, J. D. (1999).Infection time and density influence the response of sorghum to the parasitic angiosperm *Striga hermonthica. New phytol, 143: 573-580.Hearne, S. J. (2009). Control –the Striga conundrum. Pest manage. Sci. 65: 603–614.*

[10.] Haussmann, B. I.; Geiger, H. H.; Hess, D. E., Hash, C. T. and Bramel, P. (2000).Application of molecular markers in plant breeding. Training manual for a seminar held at IITA. *International Crop Research Institute for the Semi-Arid Tropics (ICRISAT).Patancheru 502324, Andhra paradesh, India.*

[11.] Hugar, A. Y.; Jayadeva, H. M.; Rangaswamy, B. R.; Shivanna, S. and Handrappa, H. (2010). Assessing the effect of nitrogen and harvesting stages on yield and yield attributes of sweet sorghum genotypes. *Agricultural Science, 30 (2): 139 – 141.*

[12.] Lagoke, S. T. O. and Isah, K. M. (2010).Reaction of maize varieties to Striga hermonthica as influenced by food legume intercrop, spacing and split application of compound fertilizer. *Nig. J. Weed Sci., 23: 45-58*

[13.] . Li, Z. H.; Wang, Q.; Ruan X.; Panand, C. D. and Jiang, D. A. (2010).Phenolics and plant allelopathy. *Molecules, 15: 8933-8952.*

[14.] Ikie, F. O.; Schulz, S.; Ogunyemi, S.; Emechebe, A. M.; Togun, A. O. and Berner, D. K. (2006).Effect of soil sterility on soil chemical properties and Sorghum performance under*Striga* infestation.*World J. Agric. Sci., 2(4):367-371.*

[15.] Osman, Y. M. Y. (2019). Effect of Hargel, Jatropha aqueous extracts and Nitrogen fertilization on *Striga* and growth and yield of Sorghum. M. Sc., thesis. Sudan University of Science and Technology, Sudan.

[16.] Oswald, A. (2005). *Striga control—technologies and their dissemination. Crop Prot., 24: 333-342.*
[17.] Parker, C. and Riches, C. G. (1993).Parasitic weeds of the world: Biology and control. *CAB International, Wallingford, U. K. pp. 332.*
[18.] Press, M. C.; Gurney, A. J. and Schools, J. (1999). Control of Striga on maize and Sorghum, nitrogen crop genotype interactions. Haustorium parasitic plants. News, 36: 1- 3.
[19.] Rashida, A.; Elfatih, A.; Amani, H. E. and Babiker, A. G. T. (2017).Influence of nitrogen, chlorsulfuron and triclopyr on management of *Striga hermonthica* on Sorghum. *International journal of agriculture & environmental science (IJAES), (4) 6: 32 – 37.*
[20.] Rodenburg, J.; Bastiaans, L. and Kropff, M. J. (2006).Characterization of host tolerance of*Strigahermonthica.Euphotic, 14: 353-365.*
[21.] Teka, H. B. (2014). Advance research on *Striga* control: A review Ethiopia Institute of Agriculture Research. *African journal of plant science, VOL.8 (11): 492-506.*
[22.] Yonli, D.;TraoreH.; Sereme P. and Sankara P.(2010). Use of local plant aqueous extracts as potential bio-herbicides against *Striga hermonthica* (Del.) Benth. in Burkina Faso. *Asian journal of crop science, 2: 147-154.*