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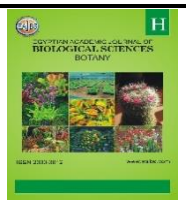

Effects of Mixing Powdered Dry Neem Leaves and Seeds with Dry Cow Manure on The Yield of *Sorghum bicolor* L. Grown in Soil Infested with The Parasite *Striga hermonthica* in the Koundoul City, Chad

Hamza A. Ousman[1*], Elshiekh A. Ibrahim[2], Beunon Tchimbi[1] and Gamar M.G.[1]

[1]Department of Life and Earth Sciences, Higher N'Djamena Institute for training teachers. P. O. Box: 460, N'Djamena, Chad.

[2]Department of Crop Science, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Elobeid, Sudan.

[*]E-mail: aziberousmanhamza@gmail.com

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ABSTRACT

During the main cropping season of 2019, the experiment was conducted in the Koundoul city of Chad, at longitude (35" 58' 11˚ N) and latitude (00" 09' 15˚ E). This study included only *Sorghum bicolor* L. plant type (Abo Drisha) that was treated with neem leaves and seeds powders in addition to dry cow manure. The treatments were grouped according to the randomized complete block design (RCBD) in three replicates, using plastic bags. The results of our experiment explained that the treatment with dry cow manure alone significantly (5% level) improves the growth and productivity characteristics of *Sorghum* seeds, which are represented by the length of the plant (107cm), number of leaves (16 L/P), leaf surface area (657dm^2), weight of 100 grains (208g), number of grains (2469) and their weight (41g) in one kernel, and the dry weight of shoot (47g), compared to other treatments. Our results also showed that the treatment with dry cow manure and powder of dried neem leaves recorded the lowest significant value (100%) in the flowering stage which reached 83 days from the date of planting, while the treatment with a mixture including dry cow manure and the powder of dried neem leaves and seeds achieved the highest significant levels for the kernel weight and its perimeter as 108g and 24cm, respectively. It also recorded the lowest significant value for the number of *Striga hermonthica* parasites (5 p), their height (27cm), their branch number (3b), and their dry weight (12g). The present study concluded that using a mixture of dried cow manure with powdered neem leaves and seeds is the most effective inhibitor of *S. hermonthica*, while dry cow manure is the best fertilizer for seeds, therefore, we recommend using this mixture as a powder to control the spread of parasites and using dry cow manure as an organic fertilizer for *S. bicolor*.

INTRODUCTION

Sorghum (*Sorghum bicolor* L. Moench), which belongs to the Poaceae family is the fifth most important grain crop globally in terms of cultivated area and productivity Saleh *et al*. (2017). *S. bicolor* is the main food, particularly in arid and semi-arid tropical regions of the world, especially in many parts of Africa and Asia and is considered one of the important strategic cereal crops for more than 500 million people Ibrahim *et al*. (2019),

Yassin and abd (2017) and Hamza *et al*. (2021). The largest producers of *Sorghum* crop in the world during the last five years are America, Nigeria, Mexico, India, Sudan and Ethiopia, respectively., while Chad was the fourteenth producer of *Sorghum* during this period, and 1.48 tons of crop produced in the country as estimated by FAO (2020). Although *Sorghum* is an indigenous crop of Chad, its productivity is limited due to many problems that face it Ministry of Agriculture (2020).

Weeds are one of the most important pests and threats that lead to yield losses ranging from 65-70%. *Striga hermonthica* is an obligate species of the *Orobanchaceae* family and also, has also become one of the major parasites that infect staple crops (*Sorghum, maize, millet,* and *rice*) and cause a significant decline in growth and productivity, like in semi-arid areas Olmstead *et al.*(2001). Annually 21 million hectares of area are infested with the *Striga* parasites in Africa and causing 4.1-million-ton losses in grain production Ousman (2013). In Chad, the spread of parasites has been observed since 1980, and currently, the parasite prevails in all agricultural lands, causing a clear drop in crop productivity that may reach more than 90% in some highly affected areas Hamza *et al.* (2021).

S. hermonthica is a witch weed that is difficult to control due to the nature of growth and biology of the parasite, as one *Striga* plant produces thousands of seeds, ranging from 5,000 to 85,000 seeds, and it can remain dormant in the soil for more than 10 years, in addition to the fact that the seeds only grow when the root of the host plant produces a germination-stimulating substance Babiker (2007). For this, *Sorghum* crops must be protected and improved in order to increase their growth and productivity per area by using modern practical methods to eliminate the *S. hermonthica*, inhibit the germination of its seeds, or limit its spread. Therefore, this research aims to investigate the effect of organic fertilization on reducing the *Striga* parasites and improving the growth of *S. bicolor* (plant type of Abo Drisha) which is infected with *S. hermonthica*.

MATERIALS AND METHODS

1. Study, Sampling Locations and Experimental Design:

In the Koundoul City of Chad country, located at longitude (35" 58' 11˚ N) and latitude (00" 09' 15˚ E), the current experiment was carried out in 2019 during the crop season. This study was performed on a plant type of *Sorghum* called Abo Drisha which was obtained from Am Timan city in Chad. It is well known that this plant type (Abo Drisha) is highly susceptible to parasitic invasion by the *Striga*. Through using the randomized complete block design (RCBD), the treatments were set up in three replications which included, dry cow manure, powder of dry neem leaves and seeds. Between March and April 2019, we collected neem seeds from neem trees that were in N'Djamena. All seeds were dried in a dark and open-air room. After being dried, they were purified from contaminants and manually ground into powder which was then kept in a clean, dry plastic bag until needed. In June 2019, neem leaves were taken from the same trees from which the seeds were collected. They were dried, ground and stored using the same technique as before.

The dried cow manure was obtained in February 2019 from a cow breeder's barn in the Koundoul city and stored in bags until usage without fermentation. In our experiment, 27 plastic bags (each with a 15 kg soil capacity) were used. Then, 3/4 of each bag was filled with soil and, the bottoms of all bags were perforated to empty the extra irrigation water. The *S. hermonthica* was present in the soil used for the experiment, which was taken from the study area itself. In contrast, the soil (control), which was free of *Striga* seeds, was taken from another area that wasn't infected by the parasite.

Five seeds of *S. bicolor* (Abo Drisha plant type) were planted in each bag and the bags were watered directly. We irrigated the plant every 3 days until the end of the season.

Ten days after sowing, the plants under study were thinned to two plants to reduce competition, and the treatments were added five days after the thinning. The treatments were estimated to be 20 tons/ha for dry cow manure powder, dry neem leaves powder and 10 tons/ha for dry neem seeds powder. In detail, Table (1), shows the treatments that were used in the study. The results were evaluated from three randomly chosen plants (one plant from each bag).

The characteristics that were examined included *Sorghum* plant height and number of leaves per plant, these measurements were made regularly every two weeks after planting, but the leaf surface area of plants was measured twice during the study. The other measurements involved the number of days (100% flowering), the weight of each kernel, the weight of 100 grains, the number of grains per kernel, the perimeter of the kernel, and the dry weight of seedlings. In addition, the measurements of the *Striga* were taken, including the number of parasites, their length, their dry weight, number of parasite branches.

Table 1: Experimental treatments.

No	Treatment
1	Control (without any treatment)
2	*S. hermonthica*
3	Powder of dry cow manure (20 ton/ha)
4	Powder of dry neem leaves (20 ton/ha)
5	Powder of dry neem seeds (10 ton/ha)
6	Powder of dry cow manure + Powder of dry neem leaves
7	Powder of dry cow manure + Powder of dry neem seeds
8	Powder of dry neem leaves + Powder of dry neem seeds
9	Powder of dry cow manure + Powder of dry neem leaves + Powder of dry neem seeds

Note; ha: hectares are units of area in the metric system equal to 10,000 m^2.

2. Statistical Analysis:

The obtained data related to *Sorghum* plant and *S. hermonthica* were analyzed using the statistical programme M-Stat-C. Duncan's Multiple Range Test (DMRT) (1955) was used to separate the means at p = 5%. Means not followed by the same letter differ significantly, while, the means followed by the same letters do not differ from each other significantly.

RESULTS AND DISCUSSION

1. Effects of Dried Neem Leaves, Seeds, And Dried Cow Manure on *Sorghum* (Abo Drisha) Height (cm), Number of Leaves (L/P), and Leaf Surface Area (dm^2):

The dry cow manure treatment and the treatment free of the *S. hermonthica* recorded the highest *Sorghum* lengths of 107 and 97.67 cm, respectively. In contrast, the treatment contained powder of dry neem leaves and plants treated with *S. hermonthica* had the shortest lengths, 66.00 and 58.33 cm, respectively, (Table 2). In comparison to the other treatments, the dry cow manure treatment alone exerted significant (p = 5%) differences in plant height. This might be because the fertilization with dry cow manure increased the number of stem nodes and internodes length, which was positively reflected in plant height, this result is consistent with the observation of Alibu (2019). Recording the tallest plant heights in treatments with dry cow manure alone and a mixture of dry cow manure with dry neem seed powder may be due to the fact that these fertilizers provided essential elements in the soil, which contributed to the increase in plant height at this time. The fertilization also played a role in plowing the soil, improving its physical properties, which in turn promoted soil aeration, and increased its ability to conserve moisture despite the infection of these plants

with *S. hermonthica*. The good impact of fertilization in reducing the number of *S. hermonthica* in the experiment may have contributed to some of the results. However, from the first to the last week, the shortest lengths of *Sorghum* plants were observed in plants treated with *S. hermonthica* alone, dry cow manure mixed with powder of dried neem leaves, and fertilization with powder of dried neem leaves alone. The short length of plants treated with *S. hermonthica* may be explained because of the parasite's intense competition with the host for nutrients and moisture, while, the short length of plants fertilized with powder of dried neem leaves alone may be due to the presence of growth-inhibiting substances in the leaf powder, so, these plants grow more slowly and are hence shorter. The combination of dry cow manure and powder of dried neem leaves resulted in much shorter *S. bicolor* lengths, which may also be due to the high amount of growth-inhibiting substances in both fertilizers, which greatly shortened *S. bicolor* lengths.

The number of *Sorghum* leaves varied significantly (p = 5%) depending on the treatments, as shown in (Table 2). The treatment with dried cow manure alone produced the highest number of leaves (16 L/P), followed by the treatment with powder of dry neem leaves alone (14 L/P), while *Striga* - treated plants and, those treated with a combination of dry cow manure, powder of dry neem leaves, and powdered dry neem seeds produced the lowest number of leaves (8.67 and 9.33 L/P, respectively) (Table 2). The fact that the cow manure enhanced the elongation of nodes and number of leaves in the plant may be the reason why the treatment with dried cow manure alone outperformed the other treatments in terms of leaves number per plant, this result is in line with what was found by Hassan and Kharbit (2014). The highest number of leaves were observed in the fertilization treatments using dry cow manure alone and in fertilizing with powder made from dry neem leaves. This is because these fertilizers provide the corn plants with the nutrients they need and may also, inhibit the growth of *S. hermonthica*, which had a positive impact on the number of leaves and a negative impact on *Striga* growth. Nevertheless, the low number of leaves in the plant applied with dry neem seeds alone may be due to the presence of a substance that works to partially inhibit the cells of the growing region in the *Sorghum* plant since the beginning of the vegetative growth, this substance may cause a rapid division of the shoot cells, which in turn affects the number of plant leaves. For plants that are treated only with *Striga*, the reason why they have fewer leaves may be attributed to their infection with *S. hermonthica*, which competes with it for nutrients and moisture from the soil. This may also be because the parasite encourages the host plant to produce abscisic acid (ABA) and reduce cytokinin (CKs) and gibberellin (GAs) hormones, which, accordingly changes the hormone levels in the host plant.

The outcomes of Table (2), indicated that there were significant (p = 5%) variations in the leaf surface area of *Sorghum* in the investigated treatments. The treatments: dried cow manure alone and powder of dry neem leaves recorded the largest leaf surface area of the plants, with values of 656.70 and 476.70 dm^2, respectively. While, the treatment consisting of (dry cow manure + powder of dry neem leaves + powdered dry neem seeds) and the plants treated with the *S. hermonthica* recorded the smallest leaf surface area of the plants, which was assessed at 127.30 and 113.30 dm^2, respectively. Table (2), shows a significant increase in leaf surface area for plants treated with dry cow manure alone and with powder of dried neem leaves alone compared to other treatments. This difference is attributable to the quick nutrient return caused by the fertilization treatments mentioned before, which may speed up the division of the shoot's meristematic cells and increase the leaf surface area Al-Dulaimi (2012).

Table 2: Effect of a combination of powdered neem leaves, seeds, and dried cow manure on *Sorghum* (Abo Drisha) plant height (cm), number of leaves, and leaf surface area (dm^2).

Treatments	***Sorghum* plant height (cm)**	**Number of *Sorghum* leaves (L/P)**	**Leaf surface area of *Sorghum* (dm2)**
Control (without any treatment)	97.67^{ab}	11.67^{c}	305.6^{c}
S. hermonthica	58.33^{e}	09.33^{de}	113.3^{e}
Powder of dry cow manure (20 ton/ha)	107.33^{a}	16.00^{a}	656.7^{a}
Powder of dry neem leaves (20 ton/ha)	66.00^{de}	14.00^{b}	476.7^{b}
Powder of dry neem seeds (10 ton/ha)	80.67^{bcd}	10.33^{cde}	189.3^{cde}
Powder of dry cow manure + Powder of dry neem leaves	64.67^{de}	10.00^{cde}	281.6^{c}
Powder of dry cow manure + Powder of dry neem seeds	93.00^{ab}	11.00^{cd}	235.1^{cd}
Powder of dry neem leaves + Powder of dry neem seeds	88.33^{bc}	10.67^{cd}	215^{cde}
Powder of dry cow manure + Powder of dry neem leaves + Powder of dry neem seeds	74.33^{cde}	08.67^{e}	127.2^{de}
Mean	81.15	11.30	288.93
±SEM	11.80	08.06	21.62

Means followed by the same letter within the column do not differ significantly (p=5%) according to Duncan's Multiple Range Test (DMRT).

2. Effects of Dried Neem Leaves, Seeds, And Dried Cow Manure on The Number of Days (100% flowering) in *Sorghum* (Abo Drisha) Plant, The Weight of Kernel (g) and Its Perimeter (cm):

Table (3) demonstrated significant changes in the number of days per 100% flowering trait of *Sorghum* plants at (p = 5%). The treatment free of *S. hermonthica* recorded the highest estimate for this trait with a value of 103.33 days, and the treatment with powdered dry neem seeds alone followed by the treatment with a mixture of cow manure, a powder of dried neem leaves and dried neem seeds, were amounted to be 95.33 and 98.67 days, respectively. On the other hand, the treatment with (dry cow manure + powder of dry neem leaves), and the treatment with (dry cow manure + powder of dry neem seeds) recorded the lowest number of days for 100% flowering (83.00 and 83.33 days), respectively. The early flowering in the plants treated with dry cow manure alone, with the mixture of (cow manure + powder of dry neem seeds), and with the mixture of (cow manure + powdered dried neem seeds) may be attributed to the fertilizers' fermentation over time into organic substances that facilitated absorption by the roots and positively impacted early flowering in the *Sorghum* plant. The destruction of the *Striga* seeds may also be due to this organic fertilization. This research supports that of Hamza *et al.* (2016) who found that mixing *Striga* seeds with undiluted compost extract made the seeds completely inactive.

Significant differences at (p = 5%) in the weight of the kernel per plant are shown in **(**Table 3**)**. The highest kernel weights (97.00 and 108.33g) were reported, respectively in both treatments comprised dried cow manure alone and a mixture of dried cow manure, powder of dry neem leaves and powder of dry neem seeds. While, the treatments using powdered dry neem seeds alone and powdered dry neem leaves alone produced the lowest weights of the kernel (37.00 and 41.33g), respectively. The treatments with dry cow manure alone and with a combination of cow manure, powdered dry neem leaves and powdered dry neem seeds were better than the other treatments because they increased the chlorophyll pigment concentration in the leaves as a result of increasing the leaf thickness and thereby

promoted the efficiency of the photosynthesis process, which positively affected the crop's ability to produce more and resist the *S. hermonthica*.

Our findings determined that the various treatments used in this study had a substantial impact on the perimeter of the kernel per plant (Table 3). The maximum value for the kernel perimeter (24.33cm) was obtained in the treatment using a mixture of dry cow manure, powder of dried neem leaves and powder of dried neem seeds (Table 3). This is followed by the treatment with (dry cow manure + powder of dry neem leaves), and the treatment with dry cow manure alone, which resulted in 19.67 and 20.67 cm, respectively, but the three treatments using powdered dried neem leaves alone, powdered dried neem seeds alone, and a mixture of powdered dried neem leaves and seeds had a lower value for the kernel perimeter, that ranged between 11.67-12.83cm. The mixture of dry cow manure, powder of dry neem leaves and powder of dry neem seeds was superior to other treatments, because the dry cow manure, dry neem leaves and seeds contained significant amounts of bacteria (cow manure), which accelerated the decomposition process of plant and animal wastes and transformed them into organic materials that were well absorbed by the roots, and the plant benefited from them in its vegetative and root growth. It was positively reflected in increasing the kernel perimeter as stated by Farah (1981), who discovered that fertilizer (N.P.K.) causes a decrease in *Striga* infestation and an increase in the vegetative and grain production of the *Sorghum* crop. Organic fertilizer also improves the physical and chemical properties of the soil.

Table 3: Effect of a combination of powdered neem leaves, seeds, and dried cow manure on the number of days (100% flowering), the weight of the kernel (g) and its perimeter (cm) in *Sorghum* (Abo Drisha) plant.

Treatments	**Number of days (100% flowering)**	**Weight of the kernel (g)**	**Perimeter of the Kernel (cm)**
Control (without any treatment)	103.33^{a}	72.33^{bc}	18.67^{c}
S. hermonthica	00.00^{e}	00.00^{e}	00.00^{f}
Powder of dry cow manure (20 ton/ha)	85.33^{d}	97.00^{a}	20.67^{b}
Powder of dry neem leaves (20 ton/ha)	90.33^{c}	41.33^{d}	11.67^{e}
Powder of dry neem seeds (10 ton/ha)	95.33^{b}	37.00^{d}	12.33^{e}
Powder of dry cow manure + Powder of dry neem leaves	83.00^{d}	76.67^{b}	19.67^{bc}
Powder of dry cow manure + Powder of dry neem seeds	83.33^{d}	59.33^{c}	16.33^{d}
Powder of dry neem leaves + Powder of dry neem seeds	90.00^{c}	63.00^{bc}	12.83^{e}
Powder of dry cow manure + Powder of dry neem leaves + Powder of dry neem seeds	98.67^{b}	108.33^{a}	24.33^{a}
Mean	81.04	61.67	15.17
±SEM	02.59	14.39	07.24

Means followed by the same letter within the column do not differ significantly (p=5%) according to Duncan's Multiple Range Test (DMRT)..

3. Effects of Dried Neem Leaves, Seeds, And Dried Cow Manure on The Weight of 100 Grains (g), Number of Grains and Their Weight (g) Per the Kernel, And the Dry Weight of *Sorghum* (Abo Drisha) Plant (g):

The weight of 100 grains per *Sorghum* plant varies significantly (Table 4). The highest values of 2.70 and 2.76g were yielded in plants treated with (dry cow manure + dry neem seed powder) and (dry cow manure alone), respectively. This result may be owing to

that these treatments caused the plants to flower earlier and thus increasing the period of grain filling, which was positively reflected in increasing the weight of 100 grains. Despite this, the lowest weight of 1.70g was produced in plants treated with powder of dried neem seeds alone. According to Jaliya *et al*. (2008), increasing NPK fertilization rates led to an increase in grain productivity (tons/ha) and the weight of 100 grains per *Sorghum* plant. It also corresponds to the results of Al-Saadi and Qais (2000) and Amujoyegbe *et al*. (2007) who reported that increasing the addition of organic fertilizers led to an increase in the weight of 1000 grains in millet plants.

The treatment using dry cow manure alone had the largest number of grains in the kernel (2469.33 grains), followed by the treatment with (dry cow manure and powder of dry neem leaves), which was estimated to have 2326.67 grains. The lowest number of grains per kernel (1132.67 grains) was produced by the treatment using powder of dry neem seeds. The treatments, dried cow manure alone and dried cow manure with powder of dry neem leaves increased the quantity of grains by percentages of 15.32 and 8.66%, respectively, compared to the treatment without *S. hermonthica*. For the *Striga*-free treatment, it outperformed the other treatments in this characteristic by percentages ranging from 2.86 to 47.10%. The highest values for the number of grains were obtained from treatments of plants with dry cow manure alone and with a mixture of (dry cow manure + powder of dried neem leaves), which may be because all germination sites have reached the stage of flower formation and are fully fertilized. This outcome agreed with the findings of Sarhan *et al*. (2016).

The weight of grains in the kernel varied between 41 and 20.03g in the dry cow manure and in the powdered dry neem seeds treatments, respectively. The treatments using dry cow manure alone and dried cow manure combined with powder of dry neem leaves increased the weight of grains per kernel by 33.86 and 18.74%, respectively, in comparison to the treatment without *Striga*. The other treatments recorded a decline in this trait of 17.07 to 34.61% compared to the *Striga*-free treatment. The dry cow manure alone was the best treatment for this characteristic. This dry cow manure helped in providing high amounts of elements in the soil, which were reflected in increasing leaf surface area, leaves number, the number of stem nodes, length of the internodes, and grain production, thus in turn increased grain weight in the kernel. This result was in line with the conclusions of Uwah *et al*. (2011) and Jaliya *et al*. (2008), who found that increasing NPK fertilization rates caused a considerable increase in grain weight and grain productivity per (tons/ha) in *Sorghum*.

The highest values for the dry weight of *Sorghum* plant were 46 and 47g, which were provided by the treatments using (dry cow manure with powder of dry neem leaves) and (dry cow manure alone), respectively. The *Striga*-treated plants produced the lowest weight (20g) (Table 4). The treatments that involved dry cow manure alone and dry cow manure mixed with powder of dried neem leaves had a good effect on plant height, the number of leaves, and the leaf surface area of plants, so, the dry weight of the plant was influenced by these treatments at the end of the growing season. This conclusion was consistent with those made by Hamza (2013), who said that the addition of urea and compost fertilizer increased the dry plant weight significantly, and delayed the appearance of the *S. hermonthica* on the soil surface.

Table 4: Effect of a combination of powdered neem leaves, seeds, and dried cow manure on the weight of 100 grains (g), number of grains and their weight (g) per the kernel, and the dry weight of *Sorghum* (Abo Drisha) plant (g).

Treatments	Weight of 100 grains (g)	Number of grains per kernel	Weight of grains per kernel (g)	Dry weight of *Sorghum* (g)
Control (without any treatment)	02.43^{ab}	2141.33^{bc}	30.63^{c}	41.67^{a}
S. hermonthica	00.00^{d}	00.00^{j}	00.00^{f}	20.00^{c}
Powder of dry cow manure (20 ton/ha)	02.76^{a}	2469.33^{a}	41.00^{a}	47.00^{a}
Powder of dry neem leaves (20 ton/ha)	01.93^{bc}	1723.00^{d}	22.67^{e}	42.67^{a}
Powder of dry neem seeds (10 ton/ha)	01.70^{c}	1132.67^{f}	20.03^{e}	35.33^{b}
Powder of dry cow manure + Powder of dry neem leaves	02.70^{a}	2326.67^{ab}	36.37^{b}	46.00^{a}
Powder of dry cow manure + Powder of dry neem seeds	02.23^{abc}	2080.00^{c}	25.40^{d}	31.67^{b}
Powder of dry neem leaves + Powder of dry neem seeds	01.87^{bc}	1801.33^{d}	22.47^{e}	30.67^{b}
Powder of dry cow manure + Powder of dry neem leaves + Powder of dry neem seeds	01.80^{bc}	1368.67^{e}	22.67^{e}	43.67^{a}
Mean	01.94	1671.44	24.29	37.63
±SEM	18.28	06.44	05.68	08.72

Means followed by the same letter within the column do not differ significantly (p=5%) according to Duncan's Multiple Range Test (DMRT).

4. Effects of Dried Neem Leaves, Seeds, And Dried Cow Manure on The Number of *Striga* Parasites, Their Length (cm), Number of Their Branches, and Their Dry Weight (g):

A combined application of dried cow manure; powder of dried neem seeds and powder of dried neem leaves produced the lowest numbers of *S. hermonthica*, which were 5.33 *Striga* per experimental unit, while, the plant that was not treated with *Striga* scored significantly the highest number of *S. hermonthica* during the experiment, which came to 36 *Striga* (Table 5). The drop in parasite numbers was due to that the cow manure, dry neem leaves, and dry neem seeds contain a substance that serves to reduce and bind the *Striga* to the host roots, thus decreasing the number of *Striga*. Also, the rise in the number of parasites in plants treated with *Striga* alone may be caused by not fertilizing it, and this type of plant is considered one of the varieties that is sensitive to infection with *S. hermonthica*. The findings of Dzomeku and Amegbor (2013), who noticed that giving organic fertilizer and powdered dried neem seeds to the yellow corn plants caused the *Striga* plants to die two weeks after emergence, are different from those of this study.

The *S. hermonthica* achieved lengths of 54 and 41cm and branches of 10.67 and 7, respectively in plants treated with *Striga* and those treated with powdered dried neem leaves alone. The lowest lengths (27.33cm) and fewest branch number of *Striga* (3.33) in the experimental unit were reported in the treatments with dry cow manure, powdered dry neem leaves and powdered dry neem seeds. This is followed by the treatment with dry cow manure + powder of dry neem seeds which produced the branches number of *Striga* (3.67) (Table 5). This can be explained by the presence of a component in the mixture of cow manure, powder of dry neem leaves and seeds that impedes the vegetative growth of the *Striga* resulting in a reduction in the length and number of its branches. Additionally, the parasite's

length and branch number may have increased in plants treated with *Striga* due to lack of fertilization.

The *Striga*-free therapy recorded the greatest dry weight of the *Striga* parasite, reaching 30g, followed by the treatment with powder of dry neem leaves alone, with a value of 26.67g. Contrarily, the treatment using a combination of dry cow manure, powder of dry neem leaves and powder of dry neem seeds produced the lowest dry weight (12g). The significant decrease in the dry weight of *Striga* when treated with the mixture of cow manure + Dry neem seeds + dry neem leaves compared to the other treatments may be due to the reduction and weakening of the *Striga* caused by these treatments, which was negatively reflected in their dry weights, while, the plants free of the *Striga* recorded the highest estimate of the dry weight. This could be a result of not applying any of the treatments, which resulted in higher weights that were recorded in **(**Table 5**)**. These results are in tandem with that of Farah (1955) who mentioned that nitrogen fertilizers minimized the numbers of *Striga* parasites when cultivating local varieties of Wad Fahl and Al-Fatrita, in Sudan.

Table 5: Effect of a combination of powdered neem leaves, seeds, and dried cow manure on the number of *S. hermonthica*, their length (cm), number of their branches, and their dry weight (g).

Treatments	**Number of *Striga***	**Length of *Striga* (cm)**	**Number of *Striga* branches**	**Dry weight of *Striga* (g)**
Control (without any treatment)	00.00^{f}	00.00^{e}	00.00^{d}	00.00^{j}
S. hermonthica	36.00^{a}	54.00^{a}	10.67^{a}	30.00^{a}
Powder of dry cow manure (20 ton/ha)	11.67^{c}	38.67^{bc}	05.67^{bc}	24.00^{c}
Powder of dry neem leaves (20 ton/ha)	17.00^{b}	41.00^{b}	07.00^{b}	27.67^{ab}
Powder of dry neem seeds (10 ton/ha)	08.33^{cde}	35.33^{c}	04.33^{c}	20.00^{de}
Powder of dry cow manure + Powder of dry neem leaves	11.33^{cd}	40.00^{b}	05.67^{bc}	25.00^{bc}
Powder of dry cow manure + Powder of dry neem seeds	07.67^{de}	35.33^{c}	03.67^{bc}	19.33^{e}
Powder of dry neem leaves + Powder of dry neem seeds	10.33^{cd}	37.00^{bc}	04.67^{bc}	22.67^{cd}
Powder of dry cow manure + Powder of dry neem leaves + Powder of dry neem seeds	05.33^{e}	27.33^{d}	03.33^{c}	12.00^{f}
Mean	11.96	34.30	05.00	20.07
±SEM	16.56	06.78	25.82	09.01

Means followed by the same letter within the column do not differ significantly (p=5%) according to Duncan's Multiple Range Test (DMRT).

Conclusion

Based on our findings of the study, treating *Sorghum* grains with dry cow manure alone or mixing it with powdered dried neem leaves or seeds, increased the growth parameters and productivity of these grains compared to plants to which dry cow manure was not added. Additionally, treating plants with dry neem seed powder alone, mixing it with dried cow manure, or with dried neem leaves, led to a significant decrease in the spread rate of the *S. hermonthica*, their length and dry weight.

Recommendations

According to the results of the current investigation, we recommend the following:

1. Encouraging farmers to use dry cow manure as organic fertilizer in *S. bicolor* fields where *S. hermonthica* are present in order to reduce the infection of plants with the parasite.
2. Use a mixture of dry cow manure powder with dry neem leaves and dry neem seeds powders for *Sorghum* fields infected with *S. hermonthica* to acquire the least infection with the parasite and to increase crop yield.
3. Conduct laboratory tests using a mixture of dried cow manure with powder of dry neem leaves and seeds to study the impact of this mixture on the different stages of *S. hermonthica* growth and determine the substance that inhibits or reduces *Striga* growth.

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ARABIC SUMMARY

تأثير مسحوق أوراق وبذور النيم وروث الابقار الجاف على نمو وإنتاجية الذرة الرفيعة "*Sorghum bicolor* ,L. Moench" المزروعة في تربة موبوءة بطفيل البودا (*Striga hermonthica*) بمدينة كندل- تشاد

***حمزة الزبير عثمان[1]، الشيخ عوض الكريم ابراهيم [2]، بينو جيمبي[1]، قمر محمد قمر[1]**

[1]المعهد العالي لإعداد المعلمين بانجمينا، قسم علوم الحياة والأرض، ص. ب: 460 انجمينا، تشاد.

[2]قسم علوم المحاصيل، كلية الموارد الطبيعية والدراسات البيئية، جامعة كردفان، الأبيض السودان.

أجريت هذه الدراسة بمدينة كُندل- جمهورية تشاد - الواقعة في خط طول"35 ˈ58 ˚11 درجة شمالاً وخط عرض "00 ˈ09 ˚15 درجة شرقاً. خلال الموسم 2019م، شملت الدراسة على صنف واحد من الذرة الرفيعة (أب دريشة) ومعاملات مسحوق أوراق النيم الجافة ومسحوق بذور النيم الجافة وروث الابقار الجاف، تم تنفيذ التجربة في أكياس بلاستيكية باستخدام تصميم القطاعات العشوائية الكاملة (RCBD) بثلاثة مكررات. أوضحت نتائج التجربة أن المعاملة روث الأبقار الجاف منفرداً تفوقت معنوياً عند مستوى 5% لصفات النمو والإنتاجية للذرة الرفيعة والتي تتمثل في طول النبات، عدد الأوراق، مساحة السطح الورقي، وزن 100 حبة، عدد الحبوب في القندول ووزنها، والوزن الجاف للنبات والتي بلغت 107 سم و16 ورقة/ نبات و657 دسم^2 و 208 جرام و2469 حبة و41 جرام و47 جرام على التوالي مقارنة بالمعاملات الأخرى، وكما أظهرت النتائج أن المعاملة خليط روث الأبقار الجاف مع مسحوق أوراق النيم الجافة سجلت أقل تقدير معنوي لصفة التبكير لـ 100% إزهار والذي وصل 83 يوماً من تاريخ الزراعة مقارنة ببقية المعاملات الأخرى، بينما تفوقت المعاملة خليط روث الأبقار الجاف مع مسحوق أوراق النيم الجافة مع مسحوق بذور النيم الجافة بإحرازها أعلى تقديرات معنوياً لصفتي زون القندول ومحيطه 108 جرام و24 سم على التوالي، وكما أنها سجلت أقل تقدير معنوي لأعداد طفيل البودا وأطواله وأعداد الأفرع له والوزن الجاف الذي بلغ 5 نبة و27 سم و3 فروع و12 جرام على التوالي مقارنة بالمعاملات الاخرى. وخلصت الدراسة على أن استخدام خليط روث الابقار الجاف مع مسحوق الأوراق وبذور النيم الجافة هو الأكثر تثبيطاً لطفيل البودا، بينما روث الابقار الجاف منفرداً هو الأفضل تسميداً للذرة. عليه توصي الدراسة باستخدام خليط التسميد كمثبط لطفيل البودا والروث الجاف كمخصب عضوي للذرة.

الكلمات المفتاحية: أوراق وبذور النيم وروث الابقار المجففة، الذرة الرفيعة، الصنف ابو دريشة، طفيل البودا، مدينة كندل تشاد.