Research Article

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Effect of different levels of organic manure on *Striga hermonthica* (Del.) Benth. and sorghum growth.

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Green house study was conducted in Shambat area to investigate the effect of chicken manure row or compost at 12 and 24 g/5kg alone or mixed with nitrogen (95.2 $kgha^{-1}$) on *Striga hermonthica* growth and development on sorghum Abu Sabien. Chicken manure alone or in combination with nitrogen was effective in reducing and delaying *Striga* growth and early infestation in comparison with the control. At 10 WAS, compost chicken manure at 24g/5kg mixture with nitrogen displayed the most inhibitory to *Striga* emergence in comparison with the respective control. It reduced *Striga* infestation by 62%. Nitrogen alone displayed the most inhibitory to *Striga* growth as compared with control. It reduced *Striga* infestation by 83%. *Striga* free control or infested sorghum treated with compost at 24 g/5kg significantly increased the shoot dry weight as compared with the respective control. This study indicates that combination of chicken manure with nitrogen as urea is an effective weed management practice to control *Striga*.

Key words: Striga hermonthica, chicken manure, nitrogen, suppression

Sorghum (*Sorghum bicolor* (L.) Moench) an important staple food crop in Africa, South Asia and central America is the fifth major cereal crop in the world interms of tonnage after maize, wheat, rice and barley (FAO, 2004). The genus *Striga* (Orobanchaceae) is one of the most important biotic constraints affecting crop production. Yield losses in staple cereal crops damage by *Striga* from a few percentages up to complete crop failure depending on factors such as crop species, level of infestation rainfall pattern and soil degradation (Weber et al. 1995). Hemi-parasitic angiosperms characteristically occur in low-nutrient habitats (Parker and Riches 1993), and it has long been recognized that both the incidence and impact of these species can be reduced by the application of fertilizers (Eplee and Norris 1995; Parker and Riches 1993). Nitrogen plays a key role in this response. The role that nutrients other than nitrogen play in the response of parasitic plants to soil fertility are less well documented. It would seem possible that these too may play a role in the response of parasitic angiosperms to increasing fertility. Parasitic plants are therefore, highly likely to encounter elevated levels of this nutrient when fields are fertilized. Abu- Irmaileh1 and Abu-Rayyan (2004) Fermentation of poultry manure was more effective than cow and sheep manures. Fermenting manure in the planting row for six weeks prior to planting was effective in reducing *Orobanche ramosa,* on tomato plants. Fermentation of manure could offer a new environmentally safe procedure to manage *Orobanche,* using farm resources and could improve the sustainability of crop management. It would also be an effective asset in organic farming. Liebman et al. (2004 and 2001) showed that certain weed species such as common water-hemp are present, use of composted swine manure as a soil amendment may increase requirements

for weed suppression in corn production systems. The present work was undertaken to investigate the effect of chicken manure and nitrogen on *Striga* incidence and performance on sorghum plant in a green house.

MATERIALS AND METHODS

***Striga hermonthica* seeds collection:** *Striga hermonthica* seeds were collected in 2006 from infested sorghum plants at the Gezira station, Seeds were surface sterilized as described by Hsiao et al. (1981).

Soil preparation: In this experiment, soil mix made of river silt and sand (2:1 v/v) for *S. hermonthica* in polythene bag contains 5kg soil. Surface seeds sterilized sorghum var. Abu Sabien (7/bag) were planted and immediately irrigated. The experiment was conducted from early December 2009 to early March 2010 at College of Agricultural Studies, Sudan University of Science and Technology.

Effect of organic manure on *Striga* incidence: Two types of organic chicken manure compost and row were selected. In this experiment, fresh chicken manure row or compost were collected from Omdurman Islamic University. These chicken manures were applied to soil at the two rate 12 and 24g/5kg, respectively. Nitrogen at 1N/95.2g h^{-1} was applied to soil alone and in combination with chicken manures.

Sorghum greenhouse experiment: This study was conducted to investigate the effect of chicken manures (compost or row) and nitrogen alone or in combination of both on *S. hermonthica* incidence, growth and development in sorghum. 10 mg of sterilized *Striga* seeds were mixed with 5kg soil. Row chicken manure, each level, were mixed in the soil pots and immediately irrigated and left for 10 days (time required for composting), then sorghum and *Striga* seeds were inoculated in soil. Nitrogen as urea at 0N and 1N (95.2 kg ha-1) was applied immediately after sowing. Sorghum inoculates with or without compost chicken manures alone or in combination with nitrogen was placed in plastic pots. *Striga* infestation was assessed by the number of emerged shoots weekly starting from the three week after sorghum emergence. Sorghum height was recorded at five and nine week after sowing (WAS). Sorghum shoot and root dry weights were recorded at end of experiment. Means of four replications were analyzed for variance and significant differences were determined by LSD test at the 5% probability level (Gomez and Gomez. 1984). The pot was irrigated every two day. Experiments were arranged as randomized complete block design (RCBD) with four replications. *Striga* infested and uninfected controls were included in each experiment for comparison.

RESULTS

Effect of chicken manure on *Striga* incidence:

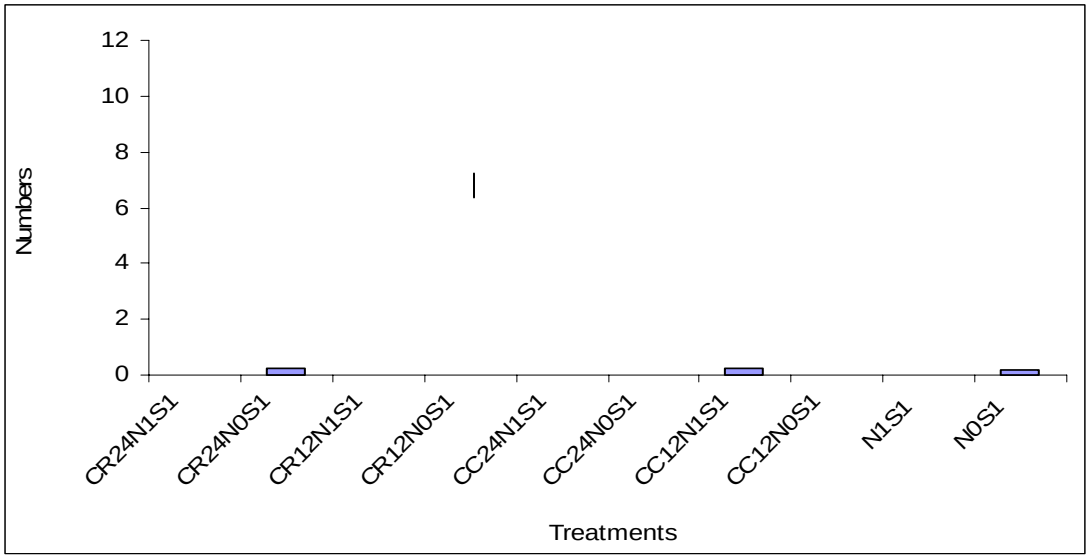
This experiment was designed to study the effects of organic manure alone or in combination with nitrogen on *Striga* incidence in sorghum Abu Sabien. At five and six week after sawing (WAS), *Striga* emergence was only observed on row chicken manure at 24g/5kg, compost chicken manure at 12/5kg mixed with nitrogen and the un-inoculated un-fertilized control sorghum and no *Striga* emergence was occurred on other treatments (Fig. 1 and 2).

At seven WAS, *Striga* was observed in all treatments except on row chicken manure at 12 and 24/5kg incorporation with nitrogen and compost at 24/5kg alone or mixed with nitrogen and compost at 12/5kg. Sorghum unfertilized uninoclated chicken manure control displayed the highest *Striga* emergence (Fig. 3).

At eight WAS, *Striga* emergence increased, substantially and was highest on the unfertilized un-inoculated chicken manure control (4 *Striga*/bag). *Striga* emergence was observed only on most of treatments except on row chicken manure at 12/5kg incorporated with nitrogen, compost at 24/5kg mixed with or without nitrogen and compost at 12/5kg applied a lone. Result indicated that all treatments reduced *Striga* emergence as compared with control (Fig. 4). It reduced *Striga* infestation by 75 - 100%

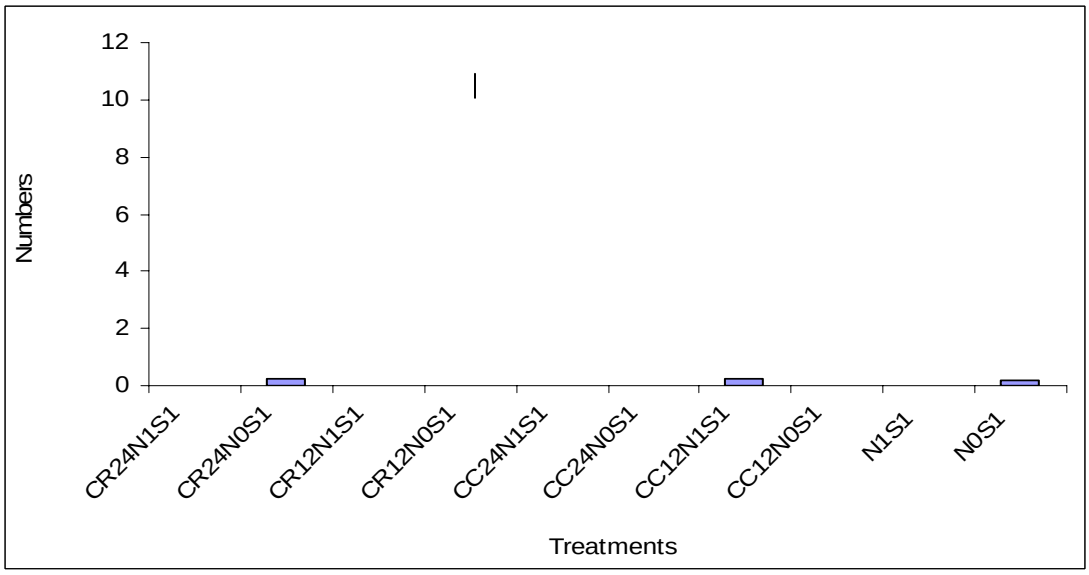
At nine WAS, *Striga* emergence increased substantially and was highest on the unfertilized un-inoculated chicken manure control (7 *Striga*/bag). *Striga* incidence followed the same trends as 8 WAS (Fig. 5). *Striga* emergence was not occurred on row chicken manure at 12/5kg incorporated with

Figure 1: Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 5WAS.



C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation, Vertical bar indicated LSD.

Fig. 2. Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 6WAS.



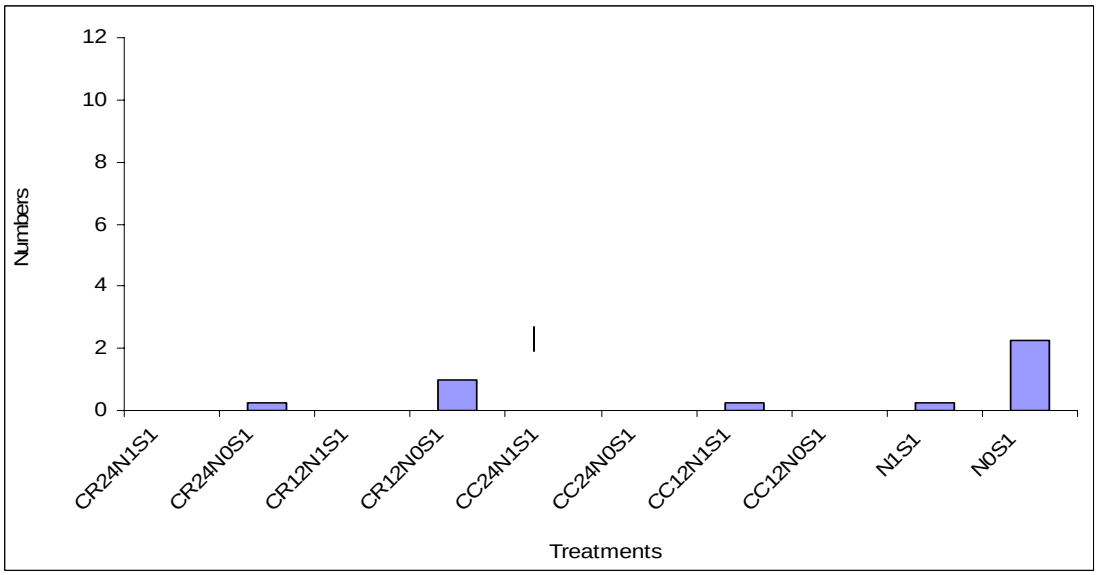
C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation Vertical bar indicated LSD.

nitrogen, compost at 24/5kg mixed with nitrogen and compost alone at 12/5kg. It reduced *Striga* infestation by 58 - 100 %.

At ten WAS, result indicated that *Striga* emergence was occurred in all treatments. *Striga* number on the unfertilized uninoculated control showed a considered increase (10 *Striga*/bag) (Fig. 6). Results indicated that all treatments reduced *Striga* incidence significantly as compared to the control. In among all treatments compost at 24g/5kg mixed with nitrogen sustained the highest reduction of *Striga* emergence as compared with the control. It reduced *Striga* infestation by 62 %.

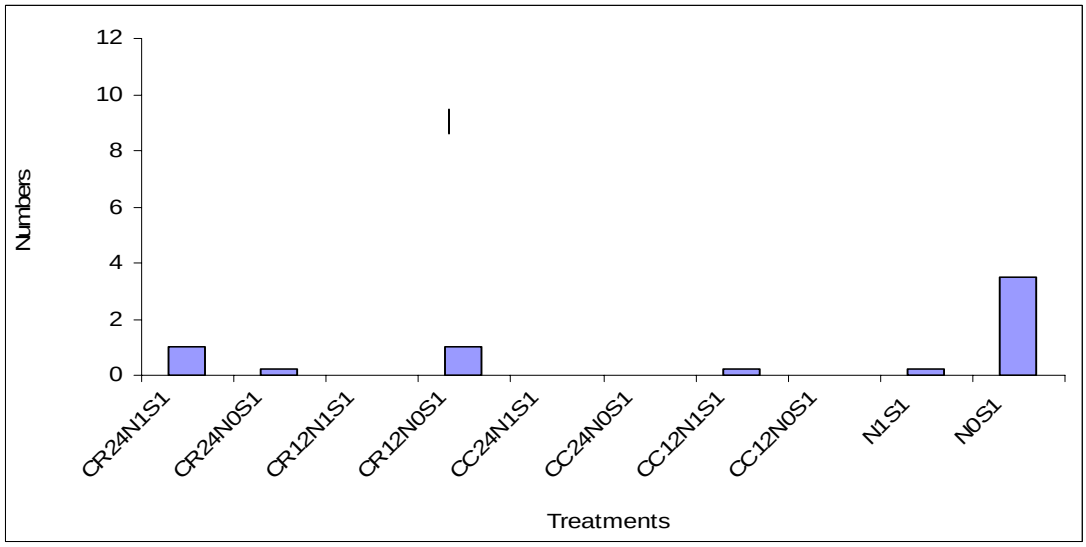
At 12 WAS, sorghum free shoot dry weight displayed the highest weight as compared with sorghum infested, irrespective to treatments (Fig. 7). Sorghum free treated with chicken manure at 12g/5kg in combination with nitrogen displayed the highest weight as

Figure 3: Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 7WAS.



C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation. Vertical bar indicated LSD.

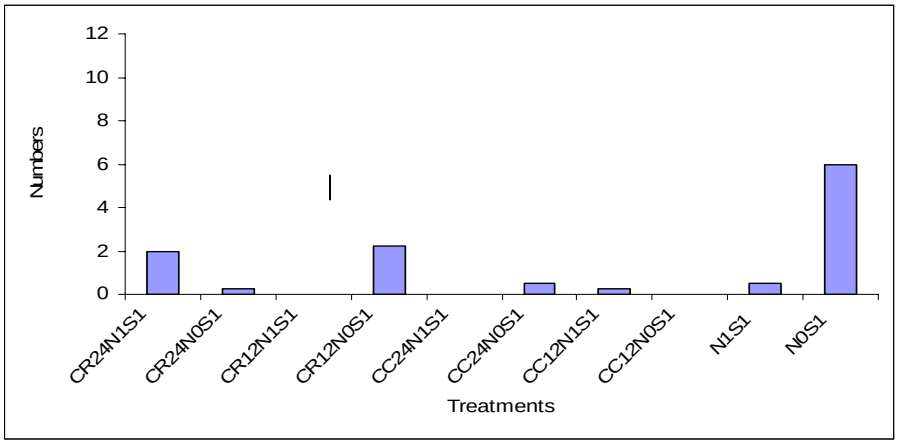
Figure 4: Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 8 WAS.



C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation. Vertical bar indicated LSD.

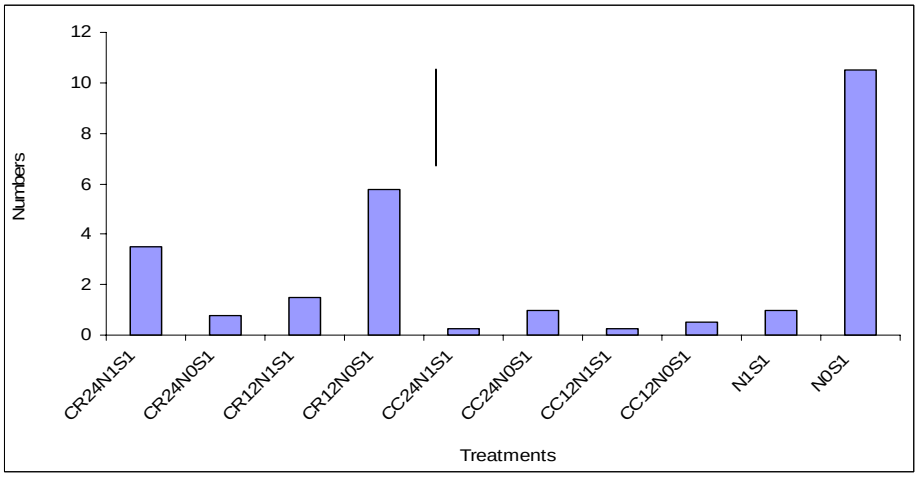
compared with respective control (Fig. 7). With respect to sorghum infested with *Striga* result showed that all treatments increased sorghum shoot dry weight except compost chicken manure at 12 g/5kg. However, sorghum treated with compost chicken manure at 24 g/5kg displayed the highest shoot weight as compared to respective control. It increased sorghum shoot weight by 45 %.With respect to sorghum root dry weight results showed that sorghum infested with *Striga* displayed the highest root dry weight as compared with sorghum free (Fig. 8). Sorghum infested with *Striga*, treated with chicken manure at 24g/5kg in presence or absence of nitrogen displayed the highest root dry weight as compared with respective control (Fig. 8). However, sorghum inoculated with compost at 12g/5kg in absence of nitrogen displayed the lowest sorghum root weight as compared with the respective control.

Figure 5: Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 9 WAS.



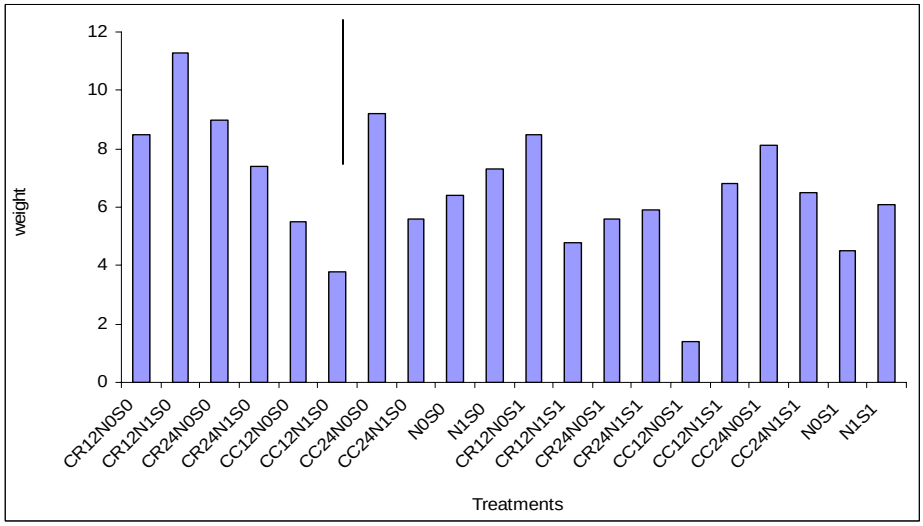
C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation, Vertical bar indicated LSD.

Figure 6: Effect of Chicken manure and Nitrogen on *Striga* incidence on sorghum at 10 WAS.



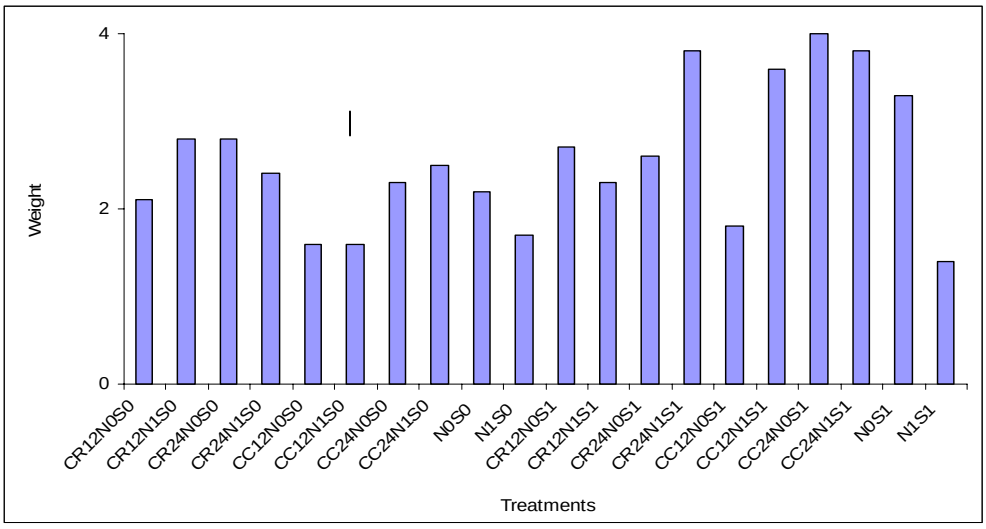
C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S = *Stiga* infestation, Vertical bar indicated LSD.

Figure 7: Effect of Chicken manure and Nitrogen on sorghum shoot dry weight at 12 WAS.



C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S1 = *Stiga* infestation, S0= *Striga* free sorghum Vertical bar indicated LSD.

Figure 8: Effect of Chicken manure and Nitrogen on sorghum root dry weight at 12 WAS.



C = chicken manure, R = Row chicken manure at 12 and 24g/5kg, C = compost chicken manure at of 12 and 24g/5kg, N = nitrogen as urea, S1 = *Stiga* infestation, S0= *Striga* free sorghum Vertical bar indicated LSD.

DISCUSSION

Poultry manure increased the presence of P, K and Mg in the soil beside the solubility of Ca, Mg and NO as a result of the continuous lowering of pH by manure application and to the increase of electrical conductivity. In addition, organic matter may affect plant growth as a source of growth promoters, auxins, vitamins, amino acids which act on the vegetative growth, yield and quality of the plant product (Melo and De- Oliveira, 1999). The results revealed that chicken manure reduced and delayed *Striga* emergence on sorghum. Combinations of chicken manure with nitrogen were often more suppressive to *Striga* growth. All treatments reduced *Striga* emergence above ground that developed on sorghum compared to the control. Amendment with nitrogen at 95.2 kg^{-1} was significantly impact on *Striga* infestation early in the season this was consistent with the results of Conn and Lazaovits (1999) who reported that chicken manure increased the soil pH, and that increase was accompanied by an increase in the levels of ammonia in the soil. Ammonia is known to be inhibiting the seed germination of *Orobanche crenata* (Vanhezewijk and Verkleij, 1996). Chicken manure compost or row at 12-24g/5kg alone or the combination with nitrogen at 95.2gka^{-1} significantly reduced *Striga* shoot number compared with the control. The reduction of *Striga* infestation and growth from the chicken manure is difficult to *explain* because it can affect various processes in soil. Many studies have shown that heavy metals, gases, fatty acids, microorganism, moisture, earthworms, soil microflora, fertility, soil pH, nutrients and salts are changed in soil during the decomposition of organic and inorganic compounds, and effect the seed germination and growth of many plants (Westwood and Fey, 1999; Babiker, 2007). Bibi, (1996) reported that chicken manure is widely used in Lebanon as organic fertilizer also it was selective in reducing *Orobanche ramosa* growth and infestation in potatoes. Therefore, the detrimental effect of chicken manure on *Striga* growth and development may be caused by unknown biological and chemical reactions that occurred during fermentation (Penalosa et al.1994). Reduction of *Striga* by organic residues depended on their rate of decomposition and N mineralization, which in turn was determined by quality in terms of C: N and lignin+polyphenol to N ratios. The observed reduction and delay in *Striga* emergence caused by chicken manure may be attributed to reduced germination, reduced haustorium initiation and attachment. This study indicates that combination of chicken manure with nitrogen as urea is an effective weed management practice to control *Striga*.

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