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The role of Conservation Agriculture in management of Fall Army Worm *Spodoptera frugiperda* in Southern Tanzania

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ABSTRACT

Fall Army Worm (*Spodoptera frujiperda*), also written as FAW, is an insect native to tropical and subtropical regions of the Americas, but since 2017, it has been cited in east Africa. It has significant economic importance to farmers since it has potential to destroy about 100% of maize crop. Farmers are looking for effective ways to manage the pest and reduce the crop damage. A field trial to study the ecosystem services enhanced by Conservation Agriculture was set up with maize crop which was attached by FAW. This paper documents the observations made in the process of managing the pest in conservation and conventional agriculture plots. The study observed severe attach on maize where there was little or no soil cover and on late planted maize.

Keywords: Conservation tillage, Conventional tillage, Economically significant invasive pest, Maize farming, Fall army worm.

INTRODUCTION

FAW is an insect native to tropical and subtropical regions of the Americas. The economically significant invasive crop pest was first detected in Central and Western Africa in early 2016 (Goergen et al., 2016) and has quickly spread across virtually all sub-Saharan Africa. It was first observed in Tanzania in February 2017 and by February 2018 it had spread to most parts of country (FAO, 2018). The destructive pest attacks economically important crops such as maize, wheat, millet, sorghum, sugarcane and rice at all stages. The moth can fly up to 100 km per night and the female moth can lay up to a total of 1 000 eggs in her lifetime. In its larva stage, the insect causes severe damage to crops that can lead to 100 percent crop loss. According to an evidence note published by the Centre for Agriculture and Biosciences International (CABI) (Abrahams et al., 2017; Day et al., 2017), if proper control measures are not implemented, the pest could cause extensive maize yield losses, estimated between $3.6 and $6.2 billion per year across the 12 major African maize producing countries namely Nigeria, South Africa, Tanzania, Ethiopia, Egypt, Malawi, Kenya, Zambia,Uganda, Ghana, Mali, Angola as listed by the world atlas.

The principles of Conservation Agriculture; minimizing soil disturbance, establishing a crop cover and crop rotation; are of interest in management and control of FAW. A field trial experiment was set with the aim to study ecosystem services that are enhanced by Conservation Agriculture. One month after planting maize (*Zea mays*), the crop was attacked by Fall Army Worm (FAW), *Spodoptera frugiperda*. This paper is based on observations following the attack by FAW and its aggressive management in that cropping season.

Materials and Methods

A field trial to study the ecosystem services enhanced by Conservation Agriculture was set up at Sokoine University of Agriculture, Morogoro, Tanzania at S 060 50' 12.9" - S 060 50' 18.6" and E 0370 38' 37.9" – E 0370 38' 36.3" lying 500-600m above sea level. The Randomized Complete Block Design experiment on plots of 30 m x 10 m was replicated thrice with six levels of tillage treatments namely; Animal Ripping, Hand hoe Basins, Tractor Ripping (these three are conservation tillage methods), Animal Plough, Tractor Plough, and Hand hoe Ridges (which are conventional tillage methods). Conservation tillage treatments were sprayed with broad spectrum systemic herbicide, Glyphosate, to control weeds before planting, and with selective 2,4-Dichlorophenoxyacetic acid herbicide to control weeds after the maize crop was established at 150 ml per knapsack which is 16 litres for both. Conventional tillage treatments were manually weeded using hand hoes. All the plots received 50 kg per acre of Yaramira Cereal fertilizer, and hybrid maize seeds (C.P.201) planted. The maize crop was managed using insecticides consisting chlorpyrifos 50% and cypermethrin 5% which was sprayed one day after the first sighting of *Spodoptera frugiperda* and repeated seven days later. The maize crops that had been attacked and whose whorl was affected were all counted using total count method per row in all plots, three days after the repeat spraying. Counting in all rows of all plots in all blocks was repeated about a month later when the crop was tasseling. A comparison between the various counts of attacked plants in the various tillage treatments was carried out using spreadsheet statistical application.

Results and Discussion

Overall the total number of FAW observed reduced with the management of the pest. Conventional tillage plots were attacked early and more (Figure 2). The maize that appeared healthier in the same plot and row were more attacked than the ones that appeared less healthy. In relatively poor performing plots, patches that had tall normal healthy maize are mostly the parts that had been attacked by FAW. Due to heavy rains during the cropping season, some plots had excessive moisture leading to either oxygen in-availability or nutrients leaching and therefore presented symptoms of poor nutrition in maize, including purpling and yellowing of leaves and stem. This block was the least attacked by FAW with 10% and 12% of total number of maize attacked in two consecutive counts (May and June) respectively (Figure 3). Block two had 23% and 28% while Block 1 had 67% and 60% of the total number of maize that was attacked by FAW.

FAW can be a difficult insect pest to control in field maize. According to (Bessin, 2004) late planted fields and later maturing hybrids are more likely to become infested. Plots that had more gaps filled, therefore had a lot of later planted maize recorded an increase in number of FAW between the first and the second count (Figure 1). While fall armyworm can damage maize plants in nearly all stages of development, Bessin (2004) observed that it will concentrate on later plantings that have not yet silked. This study observed that the plots that had much late planted maize had an increase in FAW attack in the second count.

FAW was first seen in plots whose maize was growing much better than others; the crop was healthy and tallest where FAW was first observed. The largest attack was observed here although it later reduced by 7.4% in the second count. This plots also had the least number of late planted maize 26.3% compared to 36% in plots in block 2 and 37.7% in plots in block 3. Block three was least attacked although it recorded 2% increase in FAW numbers.

The conservation tillage plots; Animal Ripping, Tractor Ripping and Hand Basins in all blocks had less number of FAW observed (Figure 1). Analysis of variance showed a significant difference between the number of FAW counted in first count in Conventional tillage plots and conservation tillage plots (p value = 0.021). Hand ridges which had healthiest looking maize at the beginning recorded about 53% of all attack observed in that count. These are also the plots whose weeds had been well managed by weeding and had bare ground. The plots also recorded the highest decrease (41%) between the first and second FAW count and was the first to record 100% tasseling. Animal ripping treatment plot in block two had healthy maize but also had lots of weeds even after spraying. It was the least attacked with 0.15% at the beginning. Adjacent animal plough plot had healthy maize and well weeded and recorded a relatively higher attack of about 17%

FAW is an economically significant pest in Africa which can only be effectively controlled while the larvae are small. Early detection when egg masses are present on 5% of the plants or when 25% of the plants show damage symptoms and live larvae are still present (Bessin, 2004). Since temperatures are worm throughout the year in Africa, *Spodoptera frugiperda* goes through the entire life cycle from egg to adult moth in 34 - 76 days (FAO, 2017). Its eggs laid in batches of 50-200 hatch in 2 to 3 days, the larval stage lasts 14 - 22 days, pupal stage lasts 8 - 30days and the adult lives for an average of 10days and maximum of 21 days. The larval stage lasting between two to three weeks is the most destructive to crops. Proper timing of insecticide application is critical because controlling larger larvae, typically after they are hidden under the frass plug, is much more difficult. Farmers should pay close attention to late planted fields.

Although there was no significant difference in the number of maize planted late per block as shown in Figure 4, block three had unique challenges of water retention which affected the performance of maize. Particularly the maize that was planted late was challenged more. At the same time, the block did not respond well to weeds control compared to the other blocks despite receiving the same treatment. The number of FAW counted the second round was significantly different from the other blocks with p value of 0.005. Block three had only 12% of the total number of Maize attacked by FAW. It is important to note the overall poor performance and poor health of the maize as well as existence of more weeds in that block. This observation requires

further investigation to establish whether there is a relationship between the overall health of the maize and the existence of the weeds with the attack by FAW.

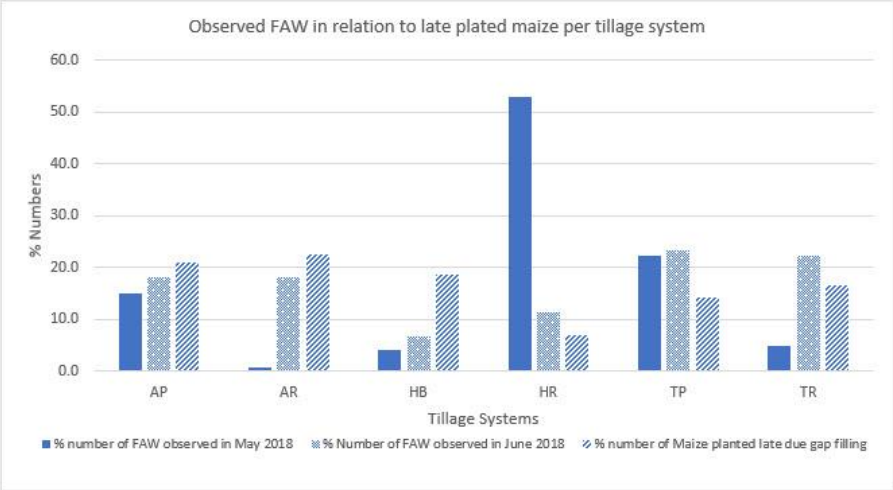

Figure 1. Number of FAW and late planted maize in different tillage systems

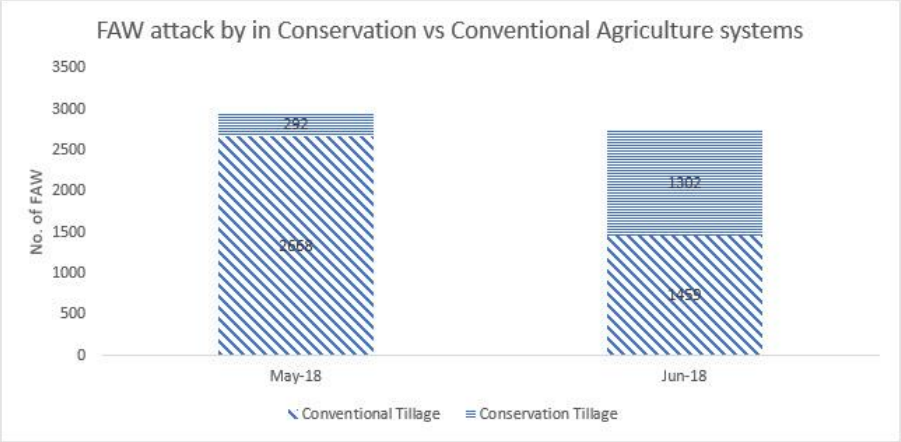

Figure 2. Number of FAW observed in different tillage systems

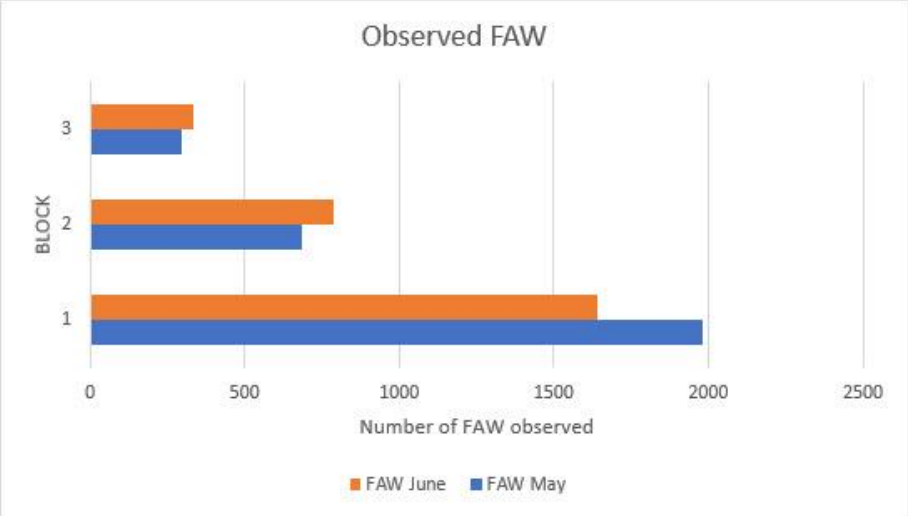

Figure 3. Number of FAW per block in May and June

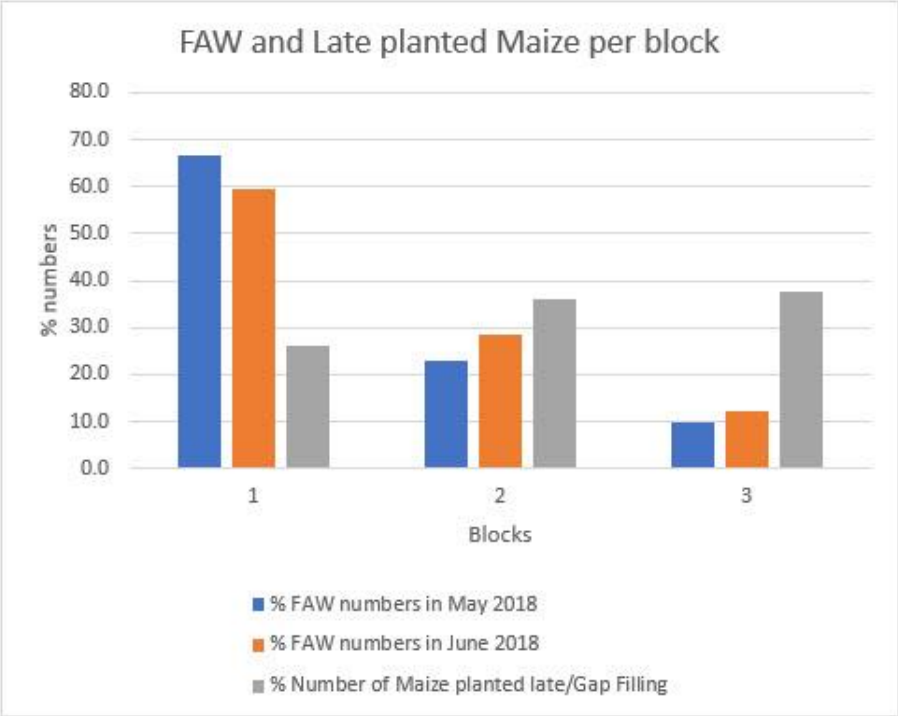

Figure 4. Number of FAW observed and Maize planted late per Block

Figure 5. maize plant damaged by FAW (Source: Faith Muniale)

Figure 6. The Larvae of Spodoptera frujiperda (Source: Faith Muniale)

Conclusions/Way forward

Basing on the observations in this study, despite the fact that FAW observation and data collection was not planned but an opportunity that presented itself due to the unexpected attack by the pest, we would make a few conclusions; there is a better chance for healthy maize to recover from FAW attack if controlled early, maize planted late may experience severe attack than maize planted earlier in the same season, and lastly there is possibility that bare field where the maize crop does not have weeds or any form of ground cover are severely attacked by FAW.

There is need to collect more data and assess the trends of FAW attack in the conservation and conventional tillage systems. It is also necessary to study trends of FAW attack in maize fields with crop cover especially of a crop that FAW does not attack.

REFERENCES

Abrahams, P., Beale, T., Cock, M., Corniani, N., Day, R., Godwin, J., Murphy, S., Richards, G., Vos, J., 2017. Fall Armyworm Status: Impacts and Control Options in Africa: Preliminary Evidence Note (April 2017). CABI Httpwww Invasive-Species OrgUploadsInvasiveSpeciesFAW-Inception-Rep. Pdf.

Bessin, R., 2004. Fall Armyworm in Corn. Univ. Ky. Coll. Agric. Cooperative Extension Service.

Day, R., Abrahams, P., Bateman, M., Beale, T., Clottey, V., Cock, M., Colmenarez, Y., Corniani, N., Early, R., Godwin, J., 2017. Fall Armyworm: Impacts and Implications for Africa. Outlooks Pest Manag. 28, 196–201.

FAO, 2017. FAO Briefing note - Fall Army Worm Lifecycle

FAO, 2018. FAO Briefing Note on FAW - Country status.

Goergen, G., Kumar, P.L., Sankung, S.B., Togola, A., Tamò, M., 2016. First report of outbreaks of the fall armyworm Spodoptera frugiperda (JE Smith)(Lepidoptera, Noctuidae), a new alien invasive pest in West and Central Africa. PloS One 11, e0165632.