စိုက်ပျိုးရေး၊ မွေးမြူရေးနှင့် ဆည်မြောင်းဝန်ကြီးဌာန
စိုက်ပျိုးရေးဦးစီးဌာန

Community-based mass releases of *Trichogramma ostriniae* and *T. chilonis* against Fall Armyworm on maize in Southern Shan State

တောင်သူလူထုပူးပေါင်းပါဝင်မှုအခြေပြုကာ ဥကပ်ပါးနဂျီ *Trichogramma ostriniae* နှင့် *T. chilonis* တို့ကို လွှတ်၍ ရှမ်းပြည်နယ်တောင်ပိုင်း ပြောင်းသီးနှံဖောင်မြောင်တောင် ဖျက်ပိုးအား ကာကွယ်နှိမ်နင်းခြင်းကို လေ့လာခြင်း

Yee Yee Myint (PhD)

Staff Officer

Plant Protection Division (PPD)

Feb 27th – 29th, 2024

Contents

Introduction

❖ Maize Production

- Agriculture- contributed 23.7% of GDP and 35.1% of total export earning.
- Maize- the 2nd largest planting crop, 601,249 ha, 2.8 million MT.
- An economically export crop- reached volume 2.6 million MT to China, Thailand.
- Maize contributes export earning 536 million $ annually.

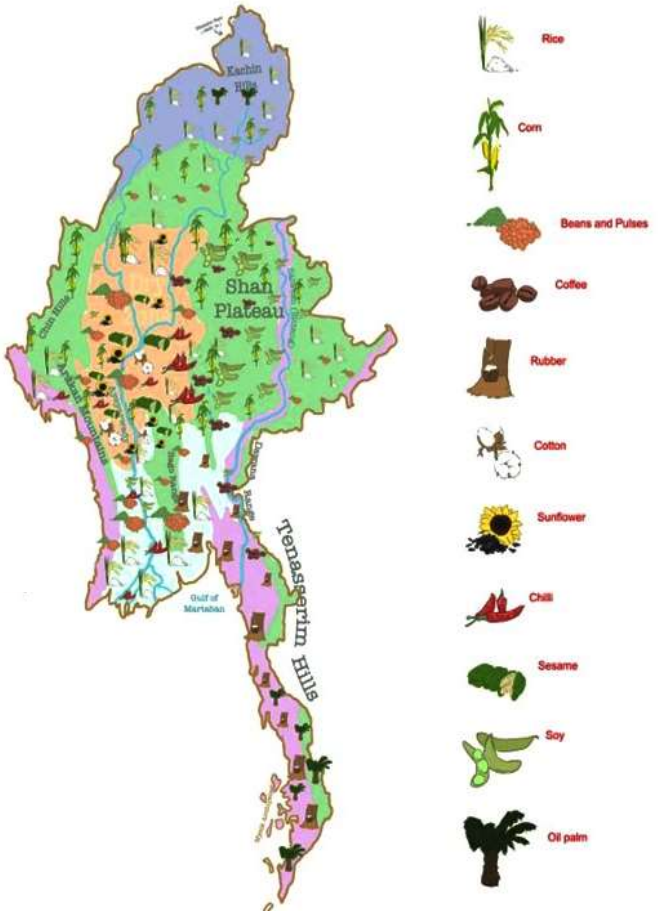


Fig 1. Crop Production Regions of Myanmar.

Source: Frontier Myanmar, Agriculture in Brief, 2021

Introduction

Maize Production

Shan State – major maize production area where plants in monsoon and winter seasons, contributed in 56% of total production.

Ayarwaddy – sweet corn area where grows as a cash crop after rice**.**

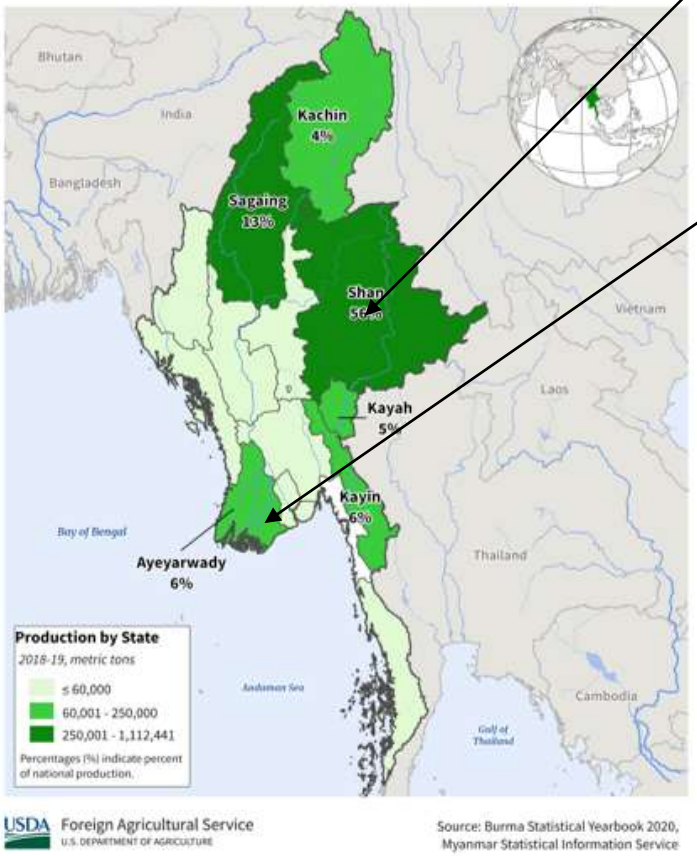


Fig 2. Regionalized maize production

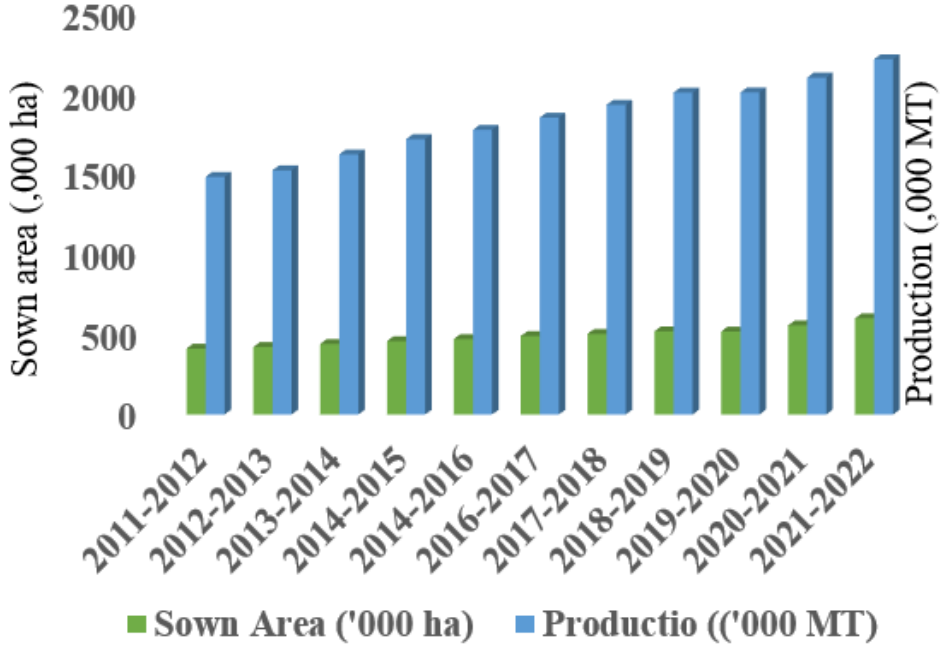


Fig 3. Yearly maize production

Source: FAO, 2021; Myanmar Agricultural Sector in Brief (2021)

Problem Statement

Effect of climate change on maize production and migration of pests

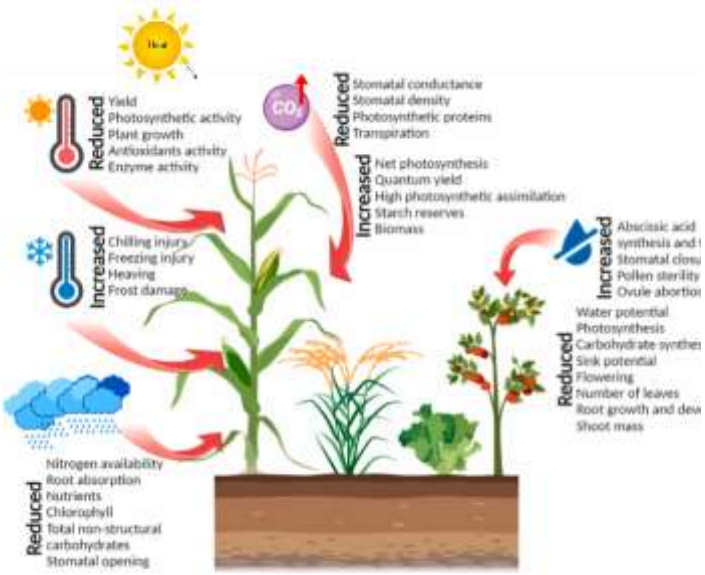


Fig 4. Impact of climate change on pests

Fig 5. Global distribution of FAW

Fig 6. Distribution of FAW

❖ Invasion of Fall Armyworm (FAW)

- First occurred- central Myanmar & Shan State in 2018.
- Reported – 37% of total growing areas infested in 2019.
- Lack of scientific report on yield loss by FAW infestation.

★ Arrived in 2018

★ Dispersed in 2019

Source: Yee *et al*., 2019;CABI 2019; FAO 2020; Kassie *et al*. 2020, Regional PPD report

Problem Statement

Fall Armyworm, *Spodoptera frugiperda* (JE Smith) Lepidoptera: Noctuidae

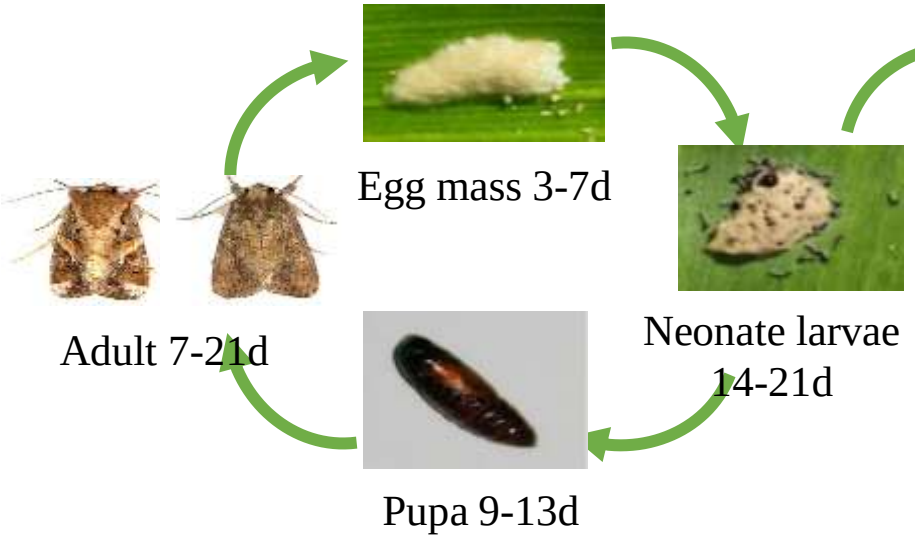


Fig 7. Life cycle of FAW

Fig 8. Damage symptom of FAW

- Females can produce multiple generations (10-12) in a year.
- Adults can disperse quickly across large geographics areas (100km/night).
- No control is taken yield loss ranging from 11.5% to 73% under severe infestation.

Source: Hiriska et al., 1990; Kassie *et al.*,2020; Kenis *et al.*, 2022

Problem Statement

❑ Pesticides used in FAW management

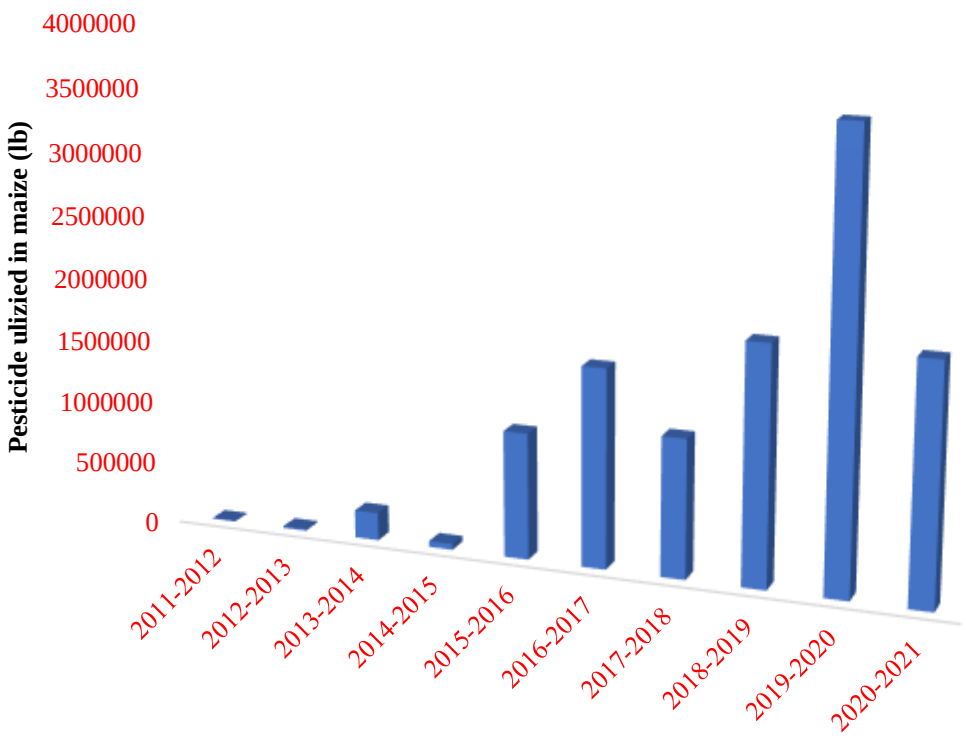


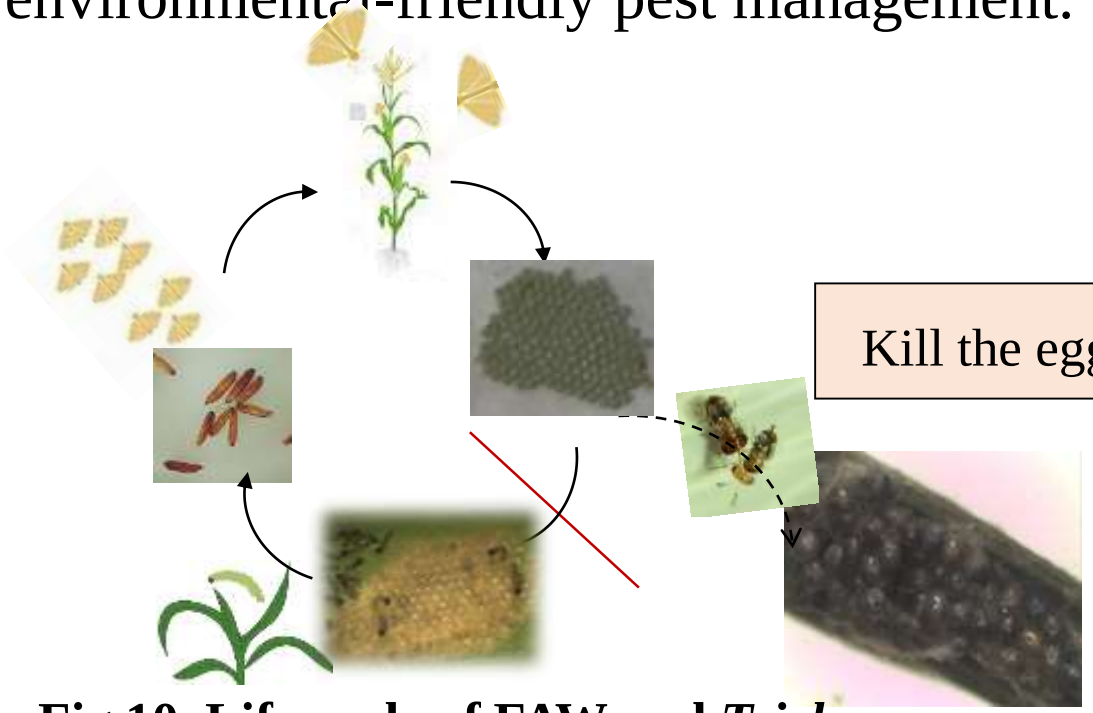
Fig 9. Volume of yearly pesticide used in maize

- Chemical pesticide application cannot achieve effective control in long run because of the internal feeding behavior of larvae.
- The same pesticide application with high frequencies increases the risk of pesticide resistance development and high production cost.
- Therefore biological control using egg parasitoids is alternative way to reduce the larval damage and risks of pesticide application .

Source: Agriculture at a glance 2021; Regional PPD report; Jin *et al*., 2021; Agboyi *et al.*, 2021

Objectives

- To reduce plant damaged by FAW larvae,
- To minimize the yield loss by FAW infestation,
- To promote the local biological control agents, and
- To fill the important gap a better understanding of the ecologically and environmental-friendly pest management.



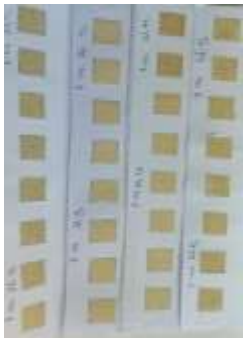
Kill the eggs before the larval damaged to crops

Fig 10. Life cycle of FAW and *Trichogramma* parasitize on FAW egg mass

Materials and Methods

❖ *Trichogramma* rearing and preparing egg cards

Rice moth eggs



Egg cards

Exposing egg cards in a parasitism cage

Parasitized egg cards

Releasing egg cards in field

Parasitized egg card packs for release

Parasitized egg cards

Materials and Methods

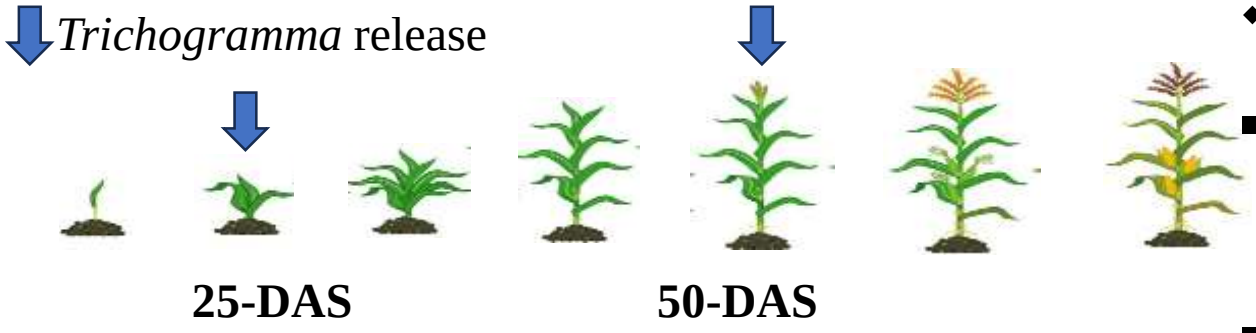


Fig 11. *Trichogramma* release demonstration

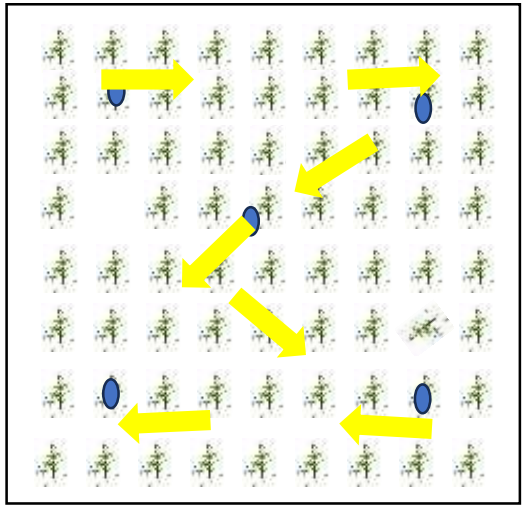


Fig 12. Field demonstration with 5 sub-plots

Fig 13. Mass release *Trichogramma* in maize field

Myint et al., 2023, Tang et al., 2017

❖ Field Demonstration

- Sample ten consecutive plants in a sub-plot (5plots/ac).
- Release *Trichogramma* egg cards 40 cards/ac (100,000/ha). Apart 10 m in each.
- Collect egg masses after 5days release (2nd release) to record egg parasitism.
- Regard non-release plot as a control.
- Demonstrate in June-Oct, 2023.

Materials and Methods

- Record 10 cobs damaged in a sub-plot at harvest (5 sub-plots/ac- total 50 cobs/ac).
- Regard non-release plot as a control & Record total yield/ac.
- Replicated 5 times (5ac) & Field Trials- 2 sites (Taunggyi & Yatsawk)
- Egg parasitism(%)= No. of parasitized eggs x 100

  Total collected egg mass
- Damaged cobs (%)= No. of cobs damage by larvae x 100

  Total no. of cobs (50)
- Data analyzed (One-way ANOVA) by SPSS v. 25.

Damaged Cobs

Healthy egg mass

Egg mass with neonate larvae

Parasitized egg mass

Materials and Methods

❖Conducting Training and Agroecosystem Analysis







Materials and Methods

Taunggyi and Yatsawk
Southern Shan State

2 crop seasons/ year
Monsoon and winter maize

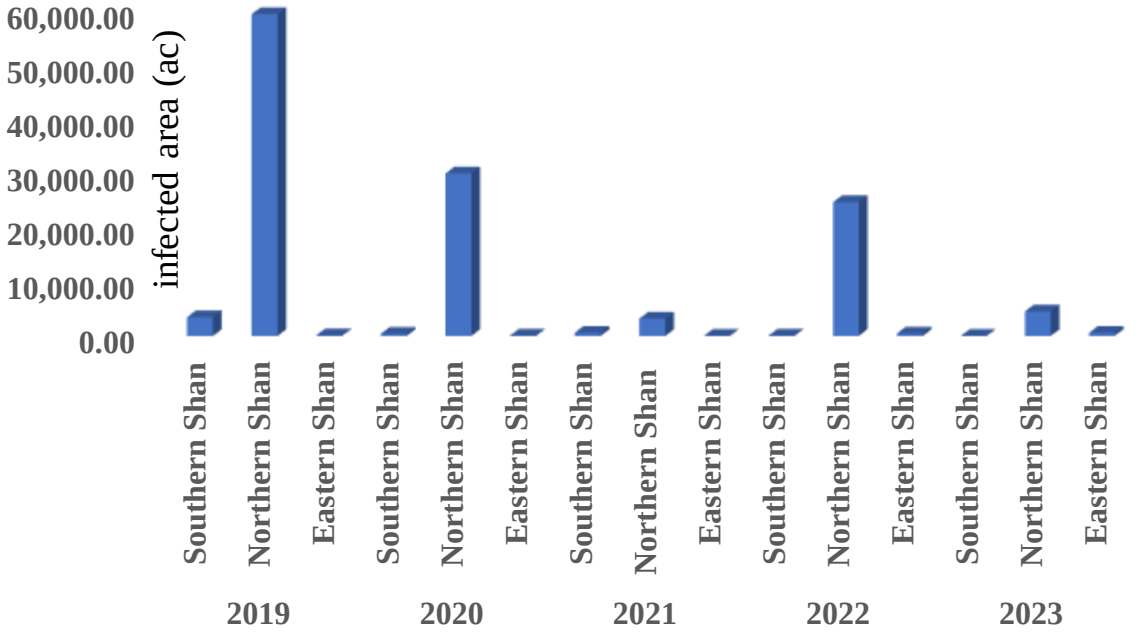


Fig 14. Yearly FAW infestation areas in Shan State

● Studied area

Results and Discussion

Table 1. Egg parasitism of *Trichogramma* in Southern Shan State in 2023.

Township	Cropping pattern	Release		Control	
		No. of egg mass	No. of parasitized egg mass	No. of egg mass	No. of parasitized egg mass
Taunggyi	maize-soybean/vegetables	13.4	13.4	15.6	0
Yatsawk	maize-vegetables	11.6	11.6	15.8	0

100% parasitism was observed in *Trichogramma* released plots. The field parasitism rates were very variable but sometimes surprisingly high under environmental conditions (Agboyi *et al*., 2020).

Results and Discussion

Cobs damaged with FAW larvae was substantially reduced by 42%-55.6% in *Trichogramma* release plots.

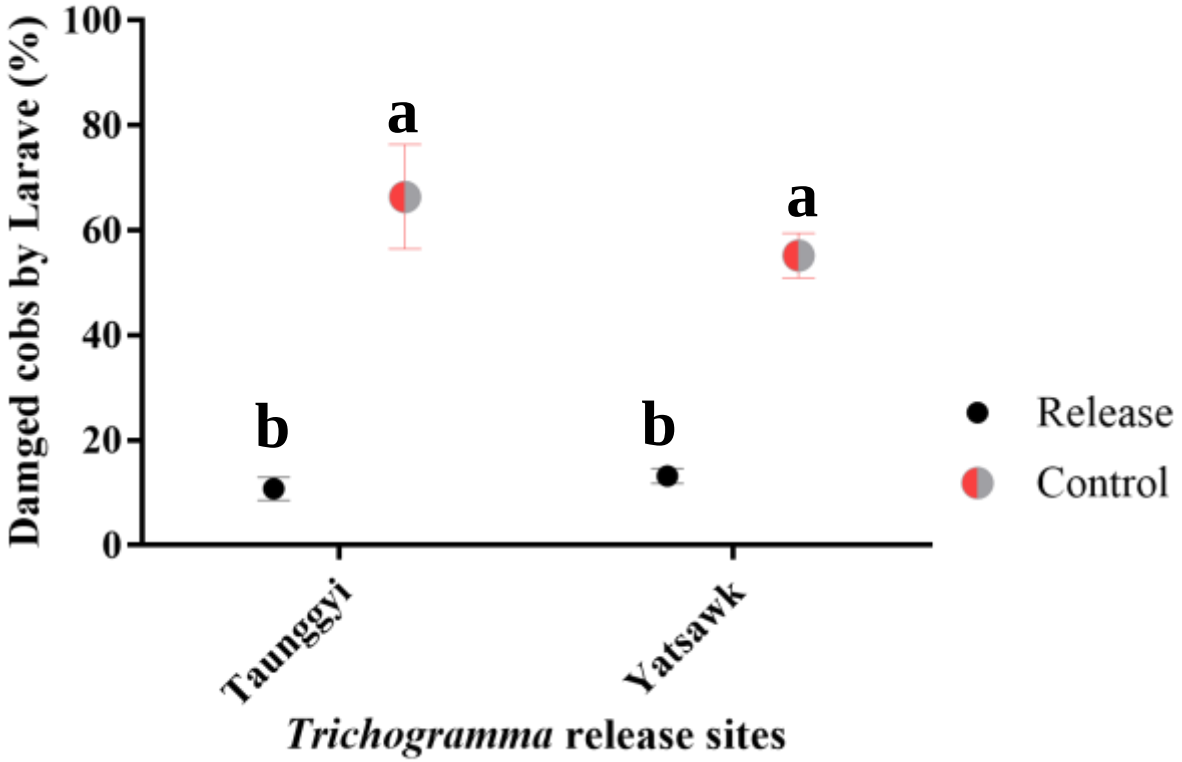
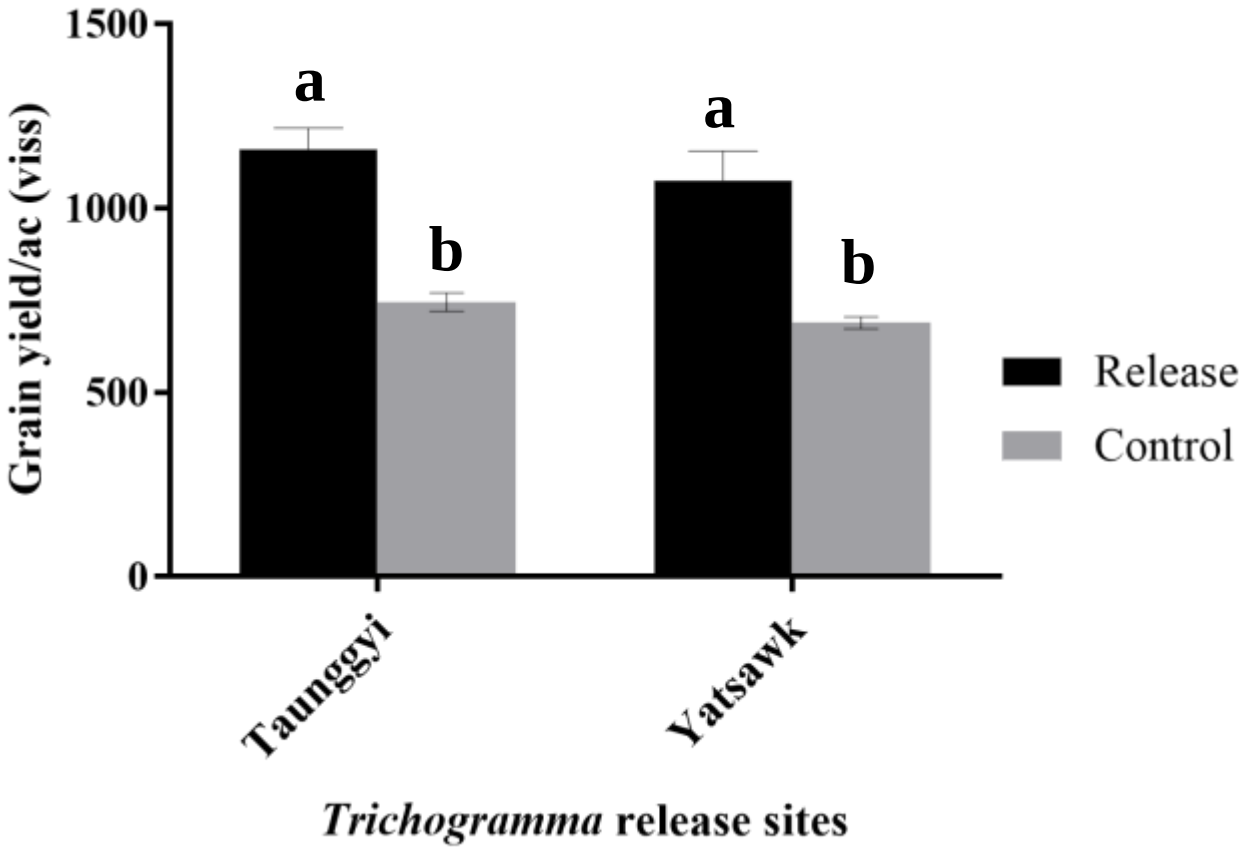


Fig 15. Mean (%) ±SE value of cobs infested by FAW larvae.
Means were separated by Tukey HSD test, same small letter indicated means were not significantly different at $p < 0.05$.

Our results support the findings in other *Trichogramma* spp. (Agboyi *et al.*, 2021; Jin *et al.*, 2021) where *Trichogramma* release reduced the plant damage rate ranged from 36.1% to 59.7%.

Results and Discussion



Plots treated with *Trichogramma* release comparatively reduced yield loss 45%-55.6% over the non-released plots.

Fig 16. Mean ±SE value of grain weight/ac (viss).

Means were separated by Tukey HSD test, same small letter indicates means were not significantly different at $p < 0.05$.

Results and Discussion

Natural abundance of natural enemies complex on FAW in release plots


Larval parasite


Larval parasite


Predatory bug


Fungal pathogen


Larval –pupal parasite


Larval parasite


Predatory earwigs


Egg parasitoid


Larval –pupal parasite

Our findings are in agreement with the field release showing increase in natural enemies community (Agboyi *et al*., 2020).

Conclusion and Recommendation

- The release of *Trichogramma* had a positive effect on management of FAW, reducing larval damage in cobs, yield loss and increase natural enemies communities.
- This field trails indicated that releasing time was synchronize (timely release) to the abundance of FAW egg masses.
- Local biological control agents (*Trichogramma* spp.) can successfully control the invasive pest, FAW.
- Therefore, the initiative in community-based biological control of FAW facilitate the sustainable management of invasive pest with non-target effect.
- Further field evaluation will be necessary to explore other potential egg parasitoids and to estimate cost and benefit ratio (CB) from *Trichogramma* release.

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Thank for your kind attention!