INVASIVE PESTS AND CASI. A MANUAL FOR EXTENSION

Agriculture Production systems based in conservation agriculture (CASI) and others are being threaten by a massive introduction and colonization of exotic pests (FAO). Climate change in the planet, globalization and the moderns transport systems and human mobility are in part related with this outbrake of exotic pests. This pests are responsible for the degradation of agriculture systems, affecting somehow public health and the social and economic environment.

According with the African Development Bank (AfDB), more than 160 million Africans live in food insecurity and malnutrition. Around 32 millions of children from 0 to 5 years old are beyond the weigh, in this approximately 10 million in severe situation. Beside that the agriculture employs 50 to 70% of the labour in Africa, but only produces 25% of the gross domestic product. This is not only associated with the low use of technology in agriculture but is mainly because of the impact of biological invasions in the agriculture systems.

Mozambique is also in the list of this sad African reality in agriculture. Just to clarify, since 1980, more than 20 exotic species of invasive pests were introduced with big consequences in agriculture. More recently the following pests appear: fruit fly *Bactrocera dorsalis* (Diptera: Tephritidae) (2007), Banana Fusarium Wilt (FOC TR4) (2013), "Banana top bunchy virus" BBTV (2015), tomato leafminer *Tuta abosoluta* (Lepidoptera: Gelechiidae) (2016) and Fall Armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) (2017) (Vala et al., 2018; Cogala, 2017).

Fall Armyworm (FAW) is the main concern for the maize farmers that work with conservation agriculture (CABI, 2017). This pest from Central America (Mexico, Guatemala) and South America (Brazil, Peru and Argentina), was introduced in 2016 trough Western Africa (Goergen et al., 2016; Cock et al., 2017; du Plesis et al., 2018). Today is reported in 28 African countries (ACAPS, 2017). Can cause losses of 100% in maize systems if not controlled. The pest have around 100 hosts but maize is the main crop. In Brazil, where this pest is a problem for more than 40 year the control can cost $600 millions with losses of $400 millions. The pest is severe in maize with high genetic plasticity, what make the control very hard because can develop resistance very fast, specially to pesticides. Because the maize is an important food and income security crop, used by smallholder farmers without financial resources the African seed system and food security may be at risk. At some level the damage of this pest may not be

reverted. According with the AfDB the control of fall armyworm will cost, to the 10 main maize producers in the African economy, around $2.2 to 5.5 billion per year in the next five years, putting this important maize pest in the emergency situation, public health and even environmental problem.

Mozambique is also in the risk, as the information from the Provincial Agriculture and Food Security Services (DPASA) says the impact of the introduction of this pest in 2017/18 causes losses of: Sofala 21.1%; Nampula 7.5%; Cabo Delgado 16%; Manica 20.0%; Gaza 26.1%; Zambezia 46.3%; Niassa 56% and Maputo 65.2% (DSV-MASA, 2017).

Another example is Zambia, where the fall armyworm was first noticed in December, 2016. It has since been reported in all the ten (10) provinces (Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, Northwestern, Southern and Western Provinces) of the country, affecting over 279,843 farmers and damaging a total of 222,586 hectares (DMMU, 2017). Both the rice and the maize strains are known to have invaded the country. Infestation of as high as 90% has been recorded in most parts of the country. Due to the high damage caused by the pest, over 87,152.07 hectares required replanting. Efforts to control the pest in all the three countries have been mostly dependent on synthetic insecticides, but the results achieved have not been satisfactory.

The fall armyworm is very versatile, polyphagous, voracious, highly prolific, strong at flying and does not normally undergo diapause such that when it gets into an area, it easily becomes an established and very serious problem if not properly managed (De Almeida Sarmento et al., 2002; Capinera, 2014). Since efforts to manage the pest in Malawi, Mozambique and Zambia in the just-ended rainy season have not been satisfactory, fear is there that the pest may be on its way to become an established and more serious threat to maize production and food security in the three countries. For this reason, it is important that these countries coordinate and step up their research and management efforts against this pest. It is with this background that this project proposal has been developed.

DSV-MASA (2017) In response to this a National Taskforce was created to discuss and develop strategies to face this new pest. This taskforce involve government institutions, research, academy, NGOs and input suppliers. So far this are the national response actions for FAW in Mozambique:

1. Meeting with different stakeholders (PPT, IIAM, Extension, Academia, input suppliers, cooperation agents – WG) for socialize the problem and elaborate the next stapes to management the pest;
2. Conduct surveillance in all provinces in the country and confirm the presence;
3. Notified the IPPC, about the pest;
4. Elaborated a list of pesticide registered in the country that are used to control *S. exempta* while the companies are carry out the process of registration of other efficient pesticides used in the region;
5. Elaborated the NAP to management and control the pest and share the document with MASA Agriculture Council, FAO, World Bank, USAID, APPSA for financial resource mobilization;
6. Awareness material produced and distributed (leaflets on pest identification and management) for different stakeholders;
7. Conduct training program for PP technicians, extensionists, inspectors, farmers and media personal on pest identification and control methods;
8. Pest surveys have been carried out to evaluate the impact in all provinces of the country;
9. Received from IRLCO and FAO, 279 traps, 678 pheromones and 450 vapones to support the monitoring of the FAW;
10. APPSA project to enhance the research capacity on FAW ongoing
11. Trials ongoing on FAW control in different areas inside the country
12. FAO provide tablets and mobile app to monitor and identify (pilot) FAW in Mozambique
13. Impact assessment undertaken now in north and south of the country

It is important to recognize that in production systems like conservation agriculture and intensification systems the prevention actions and rapid response to emergency pest problems must: i) understand the factors that influence the occurrence and the impacts; ii) provide management options and the impacts of the control actions; iii) enhance regulatory and institutional policies with monitory and surveillance systems; iv) have available resources for rapid interventions.

Conservation agriculture as an sustainable agriculture intensification practice and environment manipulation is showing good results in the control of fall armyworm and other pests. Research and training of researchers, extension officers and farmers is

required to generate innovations, dominate principles, looking for productions of safe and quality food, making sure farmers get the fair income, and at the same time protect the consumers and the environment. In summary the environmental manipulation, the decision taking process based in the knowledge that combine all control methods including crop management, varieties, biologic and chemical control are the base.

Looking at the conservation agriculture inserted in the context of fall armyworm control in Mozambique the challenge the country faces to improve the capacity of prevention, rapid response are in 4 ways: i) evaluation of risk and benefits associated with pest management; ii) development of integrated pest management options based in the knowledge of the factors that affect the pests; iii) establish dissemination systems and mechanisms to integrated pest management practices by farmers; iv) establish policies, coordination mechanisms, regulaments and local capacity.

With all this is important to have policy brief

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Attachment

TABLE 1. Year, Name and gender/specie of the main exotic pests and diseases introduzed in Mozambique since 198,

Name	**Gender/specie**	**Year confirmed to CABI**
Large grain borer	*Prostephanus truncatus*	1999

Peanuts leafminer	*Aproearema modicella*	1999
Sugar stem borer	*Chilo sacchariphagus*	1999
Fruit fly	*Bactrocera dorsalis*	2007
Coconut white fly	*Aleurotrachelus atratus*	2010
Spiral white fly	*Aleurodicus dispersus*	2010
Fruit fly	*Zeugodacus cucurbitae*	2013
Papaya mealybug	*Paracoccus marginatus*	2013
Cotton mealybug	*Phenacoccus solenopsis*	2013
Tomato leafminer	*Tuta absoluta*	2016
Fall Armyworm	*Sopodoptera frugiperda*	2017
Panama disease	*Fusarium* sp	2013
BBTV	*Virus*	2015