MANAGEMENT OF CROP PESTS INVASION IN KENYA.

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Abstract:

1. INTRODUCTION

Pests and diseases of crops are as old as agriculture itself and their catastrophic effects are recorded in the bible. In early times the epidemics were attributed to the wrath of the gods. It was not until the middle of the 19th century that pests were recognized as causes of crop damage and stimulated attempts to discover methods of controlling them. Pests have been known to cause such heavy damage to crops that they have often caused famine. One of the best known example of a catastrophic disease epidemic is the outbreak of potato blight fungus (Phytophthora infestans) which occurred in 1845 and 1846 in Western Europe and caused widespread famine in a number of those countries. Many other diseases have occurred in an epidemic manner that they have caused serious

economic consequences. Insect pests have also been known to cause catastrophes. In 1863 the American Grape aphid, Phylloxera vastatrix was just observed in France and England and threatened the existence of the vineyards and the remedy was nothing short of uprooting every vine and replanting with *resistant* vine stocks from the Eastern United States of America under a very heavy cost. In Africa pest outbreak have been one of the major causes of the famine. Migrant pests such as locusts (Red locust, *Nomadacris septemfasciata* Serville; African migratory locust, Locusta *migratoria migratorioides* R & F); Brown locust, Locusta pardalina Walker; Desert locust, *Schistocerca qregaria* Forskal), armyworm, *Spodoptera exempta* Wik., grain eating birds (Red billed weaver, Quelea quelea and black headed weaver) and field rodents periodically invade African countries and cause highly devastating damage. Introduced pests such as Larger Grain Borer, Prostephanus truncatus Horn, cypress aphid, Cinara cypressi Buckton, Fall armyworm and American leafminer, *Liriomyza trifolii* have also caused havoc and their control has been very difficult.

2. MAJOR DISASTER PESTS AND THEIR DAMAGE

Locusts eat nearly every plant part of many field crops and wild plants. Heavy losses occur in the field because of the nature of their feeding habits and their gregarious nature. The history of locusts plague is recurrent in Africa and is as recent as 1984-1985 in Ethiopia. The invasion areas of the desert locust in Africa lie mainly north of the equator but there are no well-designed outbreak areas. However, swarms of desert locusts can migrate to Kenya, Uganda and Tanzania.

The African armyworm causes serious damage to cereal crops and grasses during outbreak years. They lead to crop failure when damage is severe

and therefore indirectly cause starvation and famine for man and animals. In years of high infestation their damage rivals those of locusts in severity. African armyworm occurs throughout Africa south of the Sahara and can be particularly damaging in Eastern, Central and Southern Africa.

The Red billed Quelea is the most serious bird pest in Africa. It is the main plague of grain growing farmers throughout Africa. They attack Sorghum, bullrush millet, finger millet, Italian millet, rice, wheat, barley, Oats, triticale in cultivated fields before harvest throughout most of Africa. A loss of 15.2% wheat grain due to Quelea birds have been observed in Kenya (FAO, 1981).

A number of introduced pests are potentially disastrous in Kenya. The Larger Grain borer, Prostephanus truncatus (Horn) was reported for the first time in Africa in 1981, assumed to have been introduced with grain imports into Tanzania during the 1970's (Golob and Hodges, 1982). Larger Grain borer was first reported in Kenya in 1983 in Taita Taveta area. Recently, however, the beetle was reported to be spreading to other areas close to the focal point. In early 1977 a leaf miner pest, Liriomyza trifolii (Burgess) was introduced into Kenya through unquarantined Chrysanthemum cuttings from Florida, U.S.A (De Lima, 1979). These cuttings were commercially multiplied in Msongaleni estate near Kibwezi where serious outbreak of L. trifolii occurred in mid 1977. Although some chemical control measures were instituted the pest became progressively more difficult to control and it spread to many parts of the country. The multimillion Chrysanthemum project wound up primarily due to the ravages of L. trifolii. It is now evident that L. trifolii has established itself in the country as one of the most important pests on diverse horticultural

crops (Kabira, 1985). The first report of the cypress aphid, Cinara Cypressi Burkton in Africa was in Malawi in 1986 and since then it has been recorded in Southern highlands of Tanzania, Burundi and Uganda. Cypress aphid has been reported in Kenya in 1990 (Odera, 1990). Cypress trees under severe attack develop severe die back and finally die. A major disaster is expected in Kenya since 44% of industrial plantations is Cypressus sp which is highly vulnerable to attack by the cypress aphid.

3. MANAGEMENT PROCEDURES OF PEST INVASION.

There are various procedures to prevent or manage pest invasions which could all be integrated to prevent a disaster

1.Plant Quarantine and inspection.

Most introduced pests are responsible for most of the disasters to major food and economic crops. Most countries impose restrictions on the importation of plant materials in order to protect their crops from foreign pests and diseases. The country must thus largely depend on her plant import regulations, the responsibility of her citizens and the cooperation of the visitors, in whatever capacity they come, in order to minimize the risks. It is important to realize that the introduction of anyone of these hundreds of known pests could result in serious losses and diversions of funds into costly research and control programmes. In Kenya plant importation regulations falls into three broad categories:- (i) Imports which are made under a permit by the Ministry of Agriculture or Kenya Agricultural Research Institute (KARI), (ii) imports which must pass through plant quarantine Stations and (iii) importations which are

prohibited under any circumstances. Enforcement of plant import controls can highly minimize pest introductions.

2.Survey, Monitoring and forecasting pest populations.

Migrant pests and exotic pests are often associated with heavy damage of crops. Migrant pest are non-residents of the ecosystem. They periodically invade the ecosystem and occupy it for short periods only but their damage could be highly devastating. Introduced pests build up in an ecosystem and they could continuously be present in the ecosystem. It is necessary to strengthen survey, monitoring and forecasting of these pests so as to improve planning of control strategy to prevent disastrous losses of crops.

Survey, monitoring and forecasting of migrant pests is done by both national and international organizations. Bulletins of locust situation in various countries are exchanged to alert everybody of international locust situation. FAO has an emergency centre for locust Operations under Plant Production and Protection Division. Desert Locust Control Organization of Eastern Africa (DLCO)(EA) is a joint effort of seven countries, namely Djibouti, Ethiopia, Kenya, Uganda, Somalia, Sudan, Tanzania to control desert locust in the region and offer its services in the coordination and reinforcement of national action against the desert locust in the region. DLCO(EA) also assists in the disaster pests like Quelea quelea and African armyworm. In Kenya there is an Inter-Ministerial National Locust Monitoring Task Force Committee constituted in 1988 which prepares itself for locust management in terms of personnel, equipment and inputs. On-going field operations of aerial and ground survey are normally done on routine basis. At the most general

level, donors and countries need to know what is to be expected in the medium term; for example, that we face a major plague which is likely to last many years. At the country and regional level, we need to know whether or not a major infestation is to be expected in the coming season in order that pesticides and equipment may be procured, aircraft contracts arranged and pesticides and fuels distributed to regional bases. Forecasting at the national level is normally a part of the national locust survey and control activity. The aim of information and forecasting at the local level is to provide assessment to aid planning and deployment both for survey and control. The assessment will need to take into account of threats from elsewhere; that information should be provided in the main by the international forecasting service. An additional function at the international level is to provide a basis for action by the international community. The designation of areas to be surveyed during research should be the job of the local forecasting unit. Surveys are concerned with identifying areas where breeding is occurring, or has occurred, and estimating the scale of the infestation. Systematic sampling, concentrating sampling in potentially favourable habitats should be done. In practice during upsurges and plagues, surveys are replaced by search. The organizations responsible for locust work have been able to suppress the infestation on time. However, preparedness of international and national locust control bodies is very essential and should be alert for any outbreak.

Since 1969 there has been an East African armyworm forecasting service which collects information on biology, ecology and biogeography of S. exempta in order to predict the armyworm months outbreaks. They

predict when and where the next breeding might occur in 7-14 days in advance, to enable control operation to be successively undertaken by the farmers and Crop Protection Branch of the Ministry of Agriculture when larvae are still young. Light, suction, pheromone sticky traps and other trapping devices have since 1962 been used in East Africa as essential tools in the study of the population movements of *S. exempta.* Similarly, outbreaks of larvae associated with major moth breeding in suitable habitats have also been reported, documented on standard record sheets, analyzed and mapped routinely since 1963/64. The onset duration and progress of infestation of larvae over East Africa has been recorded. A regular biogeographical pattern is being exploited for predicting onset of initial moth invasions and subsequent infestation across East Africa. Over the last 20 years Kenya has had outbreak of larvae in 18 years.

Surveys of Quelea roosting sites are normally carried out so as to effectively control the birds. The survey work is normally done by staff of crop Protection Branch of the Ministry of Agriculture. DLCo(EA) also assists the government on survey and control operations against Quelea during outbreak years. The monitoring of the field rodents are also done on a routine basis by the Crop Protection Branch of the Ministry of Agriculture.

Monitoring of Larger Grain Borer is undertaken by visual inspection and by use of pheromone traps. Continuous monitoring is carried out by KARI team and crop Protection Branch of Ministry of Agriculture and any sightings of the beetles reported to the relevant authorities concerned with control programme. Surveys in the infested areas are continuously

carried out to determine effectiveness of the control strategies. The outbreak of cypress aphid should be monitored and surveyed thoroughly so as to formulate effective control strategies otherwise the pest could become an economic disaster.

4. CONTROL OF MIGRANT AND EXOTIC PESTS.

Where invasion of migratory and exotic pests are involved the Kenya government takes full responsibility for their control. Field operation of aerial and ground control of locusts are done by DLCO(EA). The National Locust Monitoring Task Force Committee has the responsibility of acquiring equipment and technical assistance from various Ministries to control any outbreaks of locusts. The preventative strategy of locust control, defined as the elimination of hoppers and adults before encroachment into crop areas, calls for the use of persistent insecticides for barrier spraying and for baiting. The strategic control is practiced in well-defined but remote desert and semi-arid areas. If barrier spraying and baiting fail to contain the hoppers, then adults fly in search of fresh feeding areas, often grassland and agricultural land. Once flying, swarms are typically controlled from the air with ULV formulation of organophosphorous compounds. In marginal and cropped areas, baiting, dusting or spraying by hand, by vehicle and by aircraft with numerous compounds is possible. Normally a pesticide Bank is created by the Crop Protection Branch of the Ministry of Agriculture as soon as the locust outbreak is predicted.

The migratory nature of the armyworm moths, together with the short larval period, half of which is inconspicuous, makes effective control of armyworm a difficult undertaking. In Kenya once a positive forecast is given, insecticides and spraying equipment are organized for immediate dispatch to the affected areas. While quite a number of methods could be used to control outbreaks of larvae the only effective one at the moment is by use of insecticides. It is the responsibility of the Kenya government to provide insecticides to the farmers when an outbreak occurs. For example, in 1988 the Crop Protection Branch distributed 6,700 litres of various recommended chemicals to affected districts in Coast, Central, Eastern and Rift Valley Provinces which approximated 25,000 ha (Anon, 1988). In 1989 a total of 5,322 Ha of both cropped and pasture land were reported infested with armyworms and 7,900 litres of sumicidin, 2,500 litres of cypermethin ULV, 120 mini ULVAs and 30 pairs of overalls and gloves were distributed to be used during control operations (Anon, 1989).

Lethal control by aerial spraying of fenthion (queletox) is the established control technique for quelea (Bruggers et al, 1989). Successfully aerial spraying causes a massive reduction in the local quelea population and the cessation of significant damage or the prevention of an outbreak of damage to cereal crops in the area affected by that population. Aerial spraying and firebombing were the two methods in the control operation in the country in 1988 (Anon, 1988). A total of seven breeding colonies and 18 roosting sites were destroyed in the Rift Valley and Nyanza Provinces using a total of 399 litres of queletox avicide in the control operations. In 1989 the quelea breeding area in Magadi in Kajiado District had a total of 265 Ha

colonies/roosts with an estimated population of 11 million birds (Anon, 1989). In this breeding area, 7 sites were aerially sprayed using 377 litres of queletox while 13 sites were firebombed using 9,200 litres of fuel and gelignite.

Larger Grain Borer is most readily controlled by synthetic pyrethroid insecticides. One of the recommendation for farmers is that they shell their maize before storage. In Kenya spray applications of pirimiphos-methyl have been used comprehensively for the Larger Grain Borer control. These applications were undertaken in an area where the outbreak of Larger Grain Borer was restricted to a few hundred farmers. There is a field control campaign to reduce on-farm storage losses and contain the beetle within Larger Grain Borer-infested areas. The agricultural field staff in the LGB-infested areas has been trained to recognize and take necessary measures to control LGB. All the farmers in the LGB infested areas have been made aware of the importance of the pest and of the measures they should take to combat it. The government ensures that farmers are able to obtain the necessary insecticides when they are required. In 1988, 10,000 Kg of super Actellic were purchased and distributed to the infested areas of Taita-Taveta District and Loitoktok Division of Kajiado District for dusting 18,969 bags (90 kg/bag) (Anon, 1988). 3,716 farmers' storage structures were also sprayed. In 1989 3,500 kg of super Actellic was used to treat about 53,183 bags of maize and also a total of 2,602 stores were sprayed using 400 kg of permethrin 25% W.P. The ministry of Agriculture has embarked on a containment and eradication programme where the movement of produce from infested area is controlled and inspected in order to contain the beetle. Eradication Programmes have been going on in

the affected areas. Intensive control campaigns are being done and their effects on the LGB populations are closely monitored during the remaining and subsequent storage seasons. In collaboration with the local administrative and political organizations the people in the areas are mobilized to participate in the programme. The area is quarantined. All farmers in the quarantined areas are required to shell their maize and treat it with insecticides. The programme to contain the beetle depends almost entirely on preventing infested produce from being moved to uninfested areas. How effective these restrictions are will determine whether the pest spreads to the high potential area of maize production in the country.

The control strategy of cypress aphid include silvicultural, insecticidal, biological and legislation. Silvicultural method involves replacement of the susceptible cypress species with more resistant species to the cypress aphid. However, it is long term strategy for control of the cypress aphids which may prevent the disaster. Insecticidal method is only likely to provide temporary solution to the control of this pest, and aerial application over large cypress plantation is not likely to be economically feasible. Prevention of entry through the legislation includes prohibiting entry of the seedlings and fresh products of the suspectible species from infested areas. Since the pest is widespread in the country, legislation prohibiting movement of the plant material into the country or from one area of the country to the other will have minimum effect. It is also difficult to enforce movement of the plant materials within the country. Biological methods provide the only feasible strategy for the control of the cypress aphid. However, it is a long term control strategy since a lot of information will have to be collected before release of parasites and also their

effectiveness may take some time long after serious economic damage has been done. However, entomologists are in a dilemma of how to reduce the epidemic status of the pest.

CONCLUSIONS

There are sufficient strategic plans to control any outbreak of both migrant and introduced pests in Kenya. However, quarantine and plant importation regulations should be emphasized to prevent any further introductions of exotic pests. The implementation of quarantine regulations for plants would require less money than combating pests which have already been introduced. There is need for sufficient funds for surveillance of migrant and introduced pests so as to be able to predict and prepare ourselves to control them with minimum effort and cost. The movement of plant materials should be regulated regionally as it was during the East African Community. The regional organization should be responsible of making regulations governing the import of plant materials into the region to minimize the risks of introduced pests. We are well served by DLCO (EA) to control migrant pests. DLCO (EA) should also be strengthened and given full mandate and enough finance to combat any other pest plague that may occur in Eastern Africa. The organization should take the mandate to control Larger Grain Borer and other serious introduced pests. However, the funding of such regional organization should be given top priority by the countries involved. A joint effort by the Eastern African countries in control of such pests would be much worthwhile than a country's individual efforts in terms of logistics, finance, manpower and equipment required to combat outbreaks. that transverse from one country to another. However, each country effort should not be overlooked in the

continuous monitoring and survey so as to safeguard herself from any pest introduction.

RECOMMENDATIONS

1. The plant quarantine and inspection of the Ministry of Agriculture should be strengthened and coordinated so as to safeguard the country from any introduced pest.
2. A national committee on migrant and exotic pests should be formed to coordinate all outbreak of crop pests.
3. DLCO (EA) should be strengthened and its scope of countries and mandate widened to include introduced pests in the member countries.
4. Research on migrant and exotic pests at the national level should be strengthened
5. Information bulletins in simplified language should be availed to the general public during an outbreak of migrant or exotic pests.

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