SUSTAINING FOOD PRODUCTION IN NIGERIA USING ENVIRONMENTALLY FRIENDLY PEST AND DISEASE CONTROL MEASURES

BY

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ABSTRACT

One major road block on the path of attaining self sufficiency in food production in Nigeria is the scourge of pests and diseases. The use of chemical pesticides, herbicides and fungicides to control pest infestations often give dramatic results, but the attendant environmental consequences are grave. Hence, this paper advocates for a shift in pest control postures of the Nigerian farmers from total dependence on the use of agro-chemicals towards environmentally friendly pest management techniques that could keep pest populations below the damage threshold.

INTRODUCTION

Sustainable agriculture involves the successful management of resources for agriculture to satisfy human needs, while maintaining or enhancing the quality of the environment and conserving natural resources (FAO, 1989).

Food occupies the centre stage of all variables needed to sustain life. The life of organisms would be a complete misery if the quantity and quality of food desired is not attained. Through the process of selection, adaptation and breeding, man has been able to identify several plant stocks with qualitative characters such as early maturity, high yielding and disease resistance, all in a bid to enhance food production. It is regretable that the task of self sufficiency in food production is yet to be attained in Nigeria. This is evident from the large scale importation of different types of foodstuff including rice, one of the country's stapple foods. This task or ambition has however, been supremely achieved in United Kingdom (80%) and Europe (30%), but with major damaging environmental impacts (Green, 1993). Human endeavours into maximising food production has almost always been checkmated by the ravages of pest organisms both on the farm and during storage. With increase in human population and corresponding demand for increase in the availability of food it is necessary to utilise pest control measures that would not compromise the serenity and viability of the environment.

ROLE OF PEST ON FOOD PRODUCTION

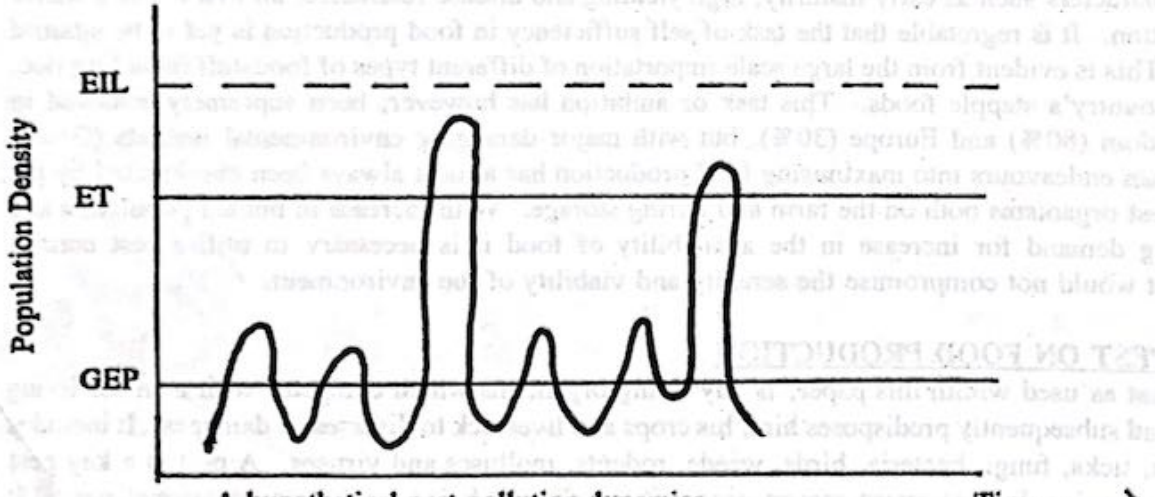
A pest as used within this paper, is any living organisms which competes with man for living space, food and subsequently predisposes him, his crops and livestock to diseases or damages. It includes insects, mites, ticks, fungi, bacteria, birds, weeds, rodents, molluscs and viruses. A pest is a key pest when it causes major damage every season except it is controlled; it is called an occasional pest if it causes damage at irregular intervals. Some pests cause crop losses by defoliating the leaves, damaging the fruits and seeds, shoots, secretion of toxic substance into plants during feeding or egg laying, as well as through the secretion of exudates e.g. honey dew, which is a sticky substance secreted by aphids which encourage the growth of mildew.

It is important to note that an organism may not be a pest in its natural habitat but becomes one when it comes into conflict with man (Matthews, 1984). This inevitable conflict in the continued human exploitation of the earth's natural resources has always brought obvious consequences with it. The functional roles of pest and diseases (components of biotic stress) on cultivated crops wield a menacingly destructive influence on yield. Low yield in grain legumes attributable to biotic stress have been highlighted. For instance soyabean diseases reduce yield by 10-30% (Akem, 1996); Cowpea Yellow Mosaic Comovirus by 60-100% (Thottappily and Rossel, 1996); Insect pest reduce yield in upland rice by 30% and in lowland rice by 100% (Umeh, Joshi and Ukwungwu, 1995); maize borers give about 10-100% loss in Africa (Bosque-perez, 1995).

Over the years the destructive effects of pests on man, his crops, livestock and other belongings has led to increased demand to reduce or completely eradicate them so as to meet the increasing demand for food and fibres (Youdeowei and Service, 1983). Green, (1993), writing on the attainment of food sufficiency in Europe and the U.K., postulated that environmental protection is a difficult concept to people like farmers and foresters who appreciate the countryside as a functional way and see ecological changes as desirable result of man's mastery over nature. To these people there is merit in whatever kind of landscape results, so long as the end-season harvest justified the means, he asserted. This assertion is by no means oppossed to the tenets of environmental protection which aims primarily at the conservative exploitation of natural resources. It is therefore imperative that sustainable food production in Nigeria should seek to incorporate and internalise the use of pest and disease control measures that are environmentally friendly, which as defined by IITA, (1992), is the choice of control methods that do not harm people or the natural resources upon which their livelihood depends.

DYNAMICS OF PEST POPULATION

Pest problems are population problems. In order to effectively control pest attack it is important to have a thorough knowledge of the population dynamics. It is vital to note that pest organisms are always available in the habitat irrespective of control measures applied. According to Matthews, (1984), the average population density of a pest over a period of time, unaffected by temporary interventions is called the General Equilibrium Position (GEP). The GEP describes the characteristics abundance of the pest relative to other organisms. The population of the pest will always oscillate around this equilibrium depending on the effect of density-dependent mortality factors such as parasites, predators, and diseases. The Economic Injury Level (EIL) or Damage Threshold (DT) is the population density that produces incremental damage equal to the cost of preventing damage, that is, the minimum pest density which will cause economic damage. The Economic Threshold (ET) is the pest density at which it becomes necessary to take decision to apply control measures so as to prevent the infestation from rising to the damage threshold. The dynamics of pest population varies from one pest species to another. This is because some insects have a higher characteristics abundance. For example when locust invades a farmland it causes tremendous damage. In this case the GEP would be higher than the D. T. which will be below.



A hypothetical pest pollution dynamics

CONCEPTUAL EVALUATION OF PLANT PROTECTION STRATEGIES

Due to the danger in unpredictability of weather and other factors which help to check pest numbers, farmers find it difficult to rely completely on natural pest control factors. Matthews, (1984), observed that sometimes farmers apply prophylactic doses of pesticides to avoid major applications later, in a bid to play safe. He stressed that such prophylactic applications may however, be economically unwise and ecologically unacceptable.

The crave to drastically eradicate pest led to the discovery and use of various insecticides such as organochlorines, organophosphates, carbamates, pyrethroids and others (Jackai, 1995). They are nerve poisons and toxic to all animals. The toxicity may be chronic in which case the effect of small, non-lethal doses received over a long time results in cancer as well as damages to the liver, kidney or brain. It may be acute in which case the poisonous effect of a single dose immediately results in nauseas, nervous breakdowns and eventual death.

The use of insecticides have been discovered to endanger the environment, especially the longer - lasting insecticides. Jackai, (1995), postulated that soil microbes are mostly affected by insecticides. nematicides, molluscicides and fungicides. They even affect animals which are not pests. For instance the populations of mites and earthworms are drastically reduced by excessive organophosphorus compounds. Insecticides reach and contaminate water bodies via erosion and runoff from agricultural farmlands, direct application, spray drift, aerial spraying, discharge from sewage and factories, (Youdeowei and service, 1983; Wild, 1993; Ndahi, 1997; Ukpene, 1997). Dajoz, (1977), also observed that there is bioconcentration of pesticides through aquatic food chains and this affects aquatic invertebrates such as plankton which may not get killed, but fishes may die feeding on them.

Insecticides also destabilize the equilibrium position of the population of most organisms. This is because parasites and predators are often more susceptible to insecticides than the insect pest (Jackai, 1995). Furthermore, some insects develop tolerance when continuously exposed to a particular insecticides. This is done through selective destruction of susceptible insect pest species leaving those with resistant genes which then rapidly multiply to produce a population that tolerates the insecticides even if increased doses are applied.

APPROACHES TOWARDS ENVIRONMENTALLY SAFE PLANT PROTECTION

There are different approaches towards environmentally safe plant protection. However, four of these approaches are considered in this paper as major. They include:-

i. CULTURAL CONTROL:

The cultural method of pest control is the manipulation of the agro-ecosystem to prevent or reduce pest population. Farm sanitary practices aimed at reducing pest infestation by removing breeding and hibernating sites of the pest should be intensified. As sanitary procedures may differ depending on the type of pest, farmers should be conversant with the habit of the pest. Crop residues harbour pest organisms. For example, maize residues may harbour species of *Fusarium, Pythium,* while cotton residues may harbour the pink bollworm, Pectinophora gossypiella. These primary sources of innoculum should be burnt at the end of the cropping season to prevent re-infection of new plants. However, consequence of destroying such crop residues on wind erosion, surface run-off and moisture loss should be evaluated. Furthermore, weeds and grasses in adjourning fields and farm boundaries which constitute reservoir for pest organisms should be cleared.

Ripe and unripe fruits and seeds which fall on the ground should be collected and disposed off to avoid breeding of fungi and bacteria as well as providing food for rodents. Also crop rotation should be encouraged among farmers. Planting a crop species such as maize successively on the same field could predispose it to infection by stalk rots caused by Pythium sp or Macrorima sp of fungi. Similarly, cowpea and tomato harbour root knot nematodes therefore should not be planted next to each other in any cropping programme.

Fertiliser usage is intended to increase crop yield. Adequate availability of Potassium fertiliser enables cassava to withstand biotic stress and still able to produce economic yield despite the pest load (Okeke, 1990). However, over-fertilisation with nitrogen increases vegetative growth and consequently increases the severity of jassids and whitefly attack on cotton (Youdeowei and Service, 1983).

Trap crops can also be used to protect cultivated crops of interest. For example rice planted twenty days earlier attract pest on rice field which are then destroyed before planting the major crops. Also, maize plants have been successfully used to protect melon when used as a trap crop. Similarly, cissus plants are used as trap crops for a cotton pest in Uganda. The problem with using trap crops however, is that the pests may eventually develop strong preference for the most economic crop. Other desirable pest control cultural practices include adequate crop spacing, correct timing of planting periods, interplanting of crops, prompt harvesting of mature fruits and seeds or grains and properly drying them before storage.

ii HOST PLANT RESISTANCE:

Plant resistance is an inherited characteristic of a host plant which lessens the effect of parasitism

by providing a compensatory ability by the crop attacked to heal quickly of the wounds inflicted by the pest. Nigerian farmers should be encouraged to use improved germplasms adapted for host resistance to pest or diseases. For instance some pubescent varieties of cotton with hairy leaves show resistance to jassids, while some other varieties produce gossypol (poisonous chemicals) which prevent insect attack. The IITA in Nigeria has equally developed a germplasm of cassava which is resistant to cassava bacteria blight disease (IITA, 1992), which farmers could make use of for planting. In order to sustain host plant resistance to infestations, Wolfe, (1981), suggested that several varieties of crops with varying varieties be cultivated because the rapid spread of a disease could be catastrophic if only one variety is cultivated and there is a breakdown in resistance. Host plant resistance is currently the most effective method of control of cowpea diseases (Thottapilly and Rossel, 1996).

iii **BIOLOGICAL CONTROL**

Pest organisms are attacked by a variety of natural enemies. Biological control, otherwise called biocontrol involves the use of the natural enemies in the form of pathogens, parasitoids and predators such as bacteria, viruses, fungi, mites, mollusc and nematodes in natural control to keep pests in check. Biocontrol has a very wide application in the protection of many tropical crops. For instance, according to Okeke, (1990), when the cassava belt of Nigeria (6^0 - 12^0N and 2^0 -15^0E) was ravaged in 1973 by the cassava mealybug, *Phenacoccus manihoti*, it took the importation of a natural enemy of the pest, *Epidinocarsis lopezi*, from South America in 1981 and its subsequent release by IITA to bring the scourge of the pest to a manageable level (Neuenschwander and Hammond, 1990). Also, isolates of *Paecilomyces lilacinus* is highly effective against the rootknot nematode and the potato cyst nematode. The isolate is now commercially mass produced and marketed as BIOCON. A significant yield increase in potato; okra, pineapple and tomato through the use of *P. lilacinus* was observed by Davide, (1990). Bio-control is highly profitable to agriculture because in terms of direct cost it is competitive with conventional pest management, and it is also considered superior from the ecological point of view (Klay, 1990). However, one setback for bio-control is that pathogens and parasitoids of a particular pest may not readily be commercially available. Some are very limited and have to be mass reared before release. Predators and parasites may find it difficult to adapt to habitats alien to them.

iv. **INTEGRATED PEST MANAGEMENT (IPM)**

This is a part of a major holistic approach to environmentally sound and sustainable agriculture. It was introduced around 1960 in response to the overuse of agrochemical insecticides for pest control in the industrialised world, as well as a growing dependence on its usage in developing countries. IPM does not aim at eliminating the use of agrochemical insecticides, but at combining them with other methods such as host resistance, habitat management and biocontrol to minimise insecticide usage to levels that are ecologically less harmful or disruptive. IITA (1992), reports that since the introduction of IPM there has been a dramatic reduction in the rate of pesticide application per hectare. However, the extent to which IPM can be successfully applied in Nigeria is limited because of the complex technology and intensive knowledge it involves. Also, the small scale resource poor Nigerian farmers lack the human and financial resources to educate themselves on the appropriate use of the method.

CONCLUSION

The control of pest and diseases is strategic to all crop production programmes. However, caution should be exercised on the method of control to be chosen. Chemical control is readily available, easy to use and gives encouraging results within a short time after application. But because of its attendant consequences such as creation of new pests, killing of non-pest organisms of ecological importance, accumulation of residues in food chains as well as rapid resurgence of pests, its usage should be limited only to when there is an emergency or sudden explosion in pest population. Although cultural control does not completely eradicate pest infestations, it is capable of maintaining pest numbers below the damage threshold. Coupled with host plant resistance and biocontrol which have no obvious environmental consequences, the cultural pest control method have the potential of sustaining food production in Nigeria without exposing the environment to aberrations that would endanger the earth's

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