

**THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF AGRICULTURE**



Government City-Mtumba
P. O BOX 2182
40487 DODOMA
Email: ps@kilimo.go.tz

**BUILDING A BETTER TOMORROW: YOUTH INITIATIVES FOR
AGRIBUSINESS (BBT-YIA)**

INTEGRATED PEST MANAGEMENT PLAN

22nd JULY 2024

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ACRONYMS

ASDP	Agricultural Sector Development Program
AYC	African Youth Charter
AfDB	African Development Bank
BBT-YIA	Building a Better Tomorrow: Youth Initiatives for Agribusiness Program
CAADP	Comprehensive African Agriculture Development Program
E&S	Environmental and Social Safeguard Officer
GDP	Gross Domestic Product
GoT	Government of Tanzania
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Plan
LGAs	Local Government Authorities
NEMC	National Environment Management Council
MoA	Ministry of Agriculture
PCU	Project Coordination Unit
NEPAD	New Partnership for Africa's Development
NGOs	Non-Governmental Organizations
NSCM	National Steering Committee Meeting
NTAC	National Technical Advisory Committee
RSs	Regional Secretariats
TPHPA	Tanzania Plant Health and Pesticide Authority
TCDC	Tanzania Cooperative Development Commission
USD	United States Dollar
SGR	Standard Gauge Railway
SAPZ	Special Agro-industrial Processing Zone

EXECUTIVE SUMMARY

This Pest Management Plan (PMP) addresses the Building a Better Tomorrow (BBT) Programme aiming to promote Tanzanian youth engagement in agribusiness for sustainable and improved livelihoods. The specific objective of the programme is to create business opportunities and decent employment for young women and men along priority agricultural value chains. In response to low engagement of youth in the agriculture sector, there has been a growing political commitment across African countries including Tanzania to engage the youth in agriculture and agribusiness. The implementation of the BBT Programme involves training of youth for agribusiness entrepreneurship skills and intensive commercial agriculture in the block farming system.

The BBT project I merge with The African Development Bank's Feed Africa Strategy (2016-2025) aims to “transform the African agriculture into a competitive and inclusive agribusiness sector that creates wealth, improves lives, and secures the environment”. The project will support the Government in the attainment of the Agenda 10/30 that envisages to achieve a 10% growth rate of the agriculture sector and increase the youth employment by 1.5 million by 2030 through supporting youth and women in agriculture, rebranding the sector image, and encouraging private sector investments.

The production of crops under the BBT block farms may lead to usage of agricultural chemical like pesticides, herbicides and insecticides for controlling pests and diseases, especially when growing crops of high value like horticultures. Application of these chemicals and fertilizers are among the major achievements of modern agricultural to increase productivity and may pose risks to environmental. As a result of increased use of industrial fertilizers and pesticides due to agricultural intensification in the area, human health, soil and water pollution may rise especially if recommended application rates are not followed and safe use, handling and storage of agrochemicals is not observed.

This Pest Management Plan (PMP) has been prepared in order to address the best management practices to avoid environmental degradation and to comply with the Bank on Pest Management practices, and also to abide with laws of the Government of the United Republic of Tanzania (GoT) on pesticides managements. The management practices of pests and diseases for selected crops in block farms (Chinangali, Ndogowe and Chunya) were discussed in details. These include cereal crops such as maize and sorghum, oil crops such as sunflower, horticulture crops such as onion, sweet pepper, tomatoes and pulses crops such as soybeans. The major pest problems of those crops and associated pest management are discussed in details. Pests and diseases cause significant impacts on crop losses of 10–30%, depending on the genetic constituents of the crop, its health, and the environment. Generally, national estimates of annual crop losses due to pests amount to 270 billion TZS per year.

The BBT– project I will be carried out under the following components; component I will involve youth empowerment in agribusiness, component II will involve development of climate resilient block farming and livestock Fattening Agribusinesses, Component III will involve financing youth agribusinesses and private sector engagement, Component IV will involve project coordination and management. The BBT project will focus on implementing activities on an integrated approach to improve value chains through increased productivity of selected crops in block farms and forging sustainable market linkages. The project will be implemented in two regions namely Dodoma and Mbeya.

The pest management approaches in the country involves use of selection of tolerant varieties, timely harvest, dehusking and shelling, Proper drying, Sorting and cleaning of the produce, Cleaning and repair of the storage facilities, use of rodent guards in areas with rat problems, use improved granaries and use of chemicals like insecticides, herbicides and pesticides. In BBT block farms will involve application of those methods and the use of chemicals will follow recommended dosage to avoid environmental degradation. The practical experience of integrated pest management in the country involves a variety of techniques that include biological control, the use of resistant varieties, habitat management, modification of cultural practices and, when needed, judicious and timely use of chemical controls.

The use of pesticide in the country involves a mixture of substances or a living organism which includes insecticides, herbicides, fungicides, rodenticides, nematicides, avicides, molluscicides and antimicrobials intended for preventing, destroying, repelling, mitigating, used or intended to be used, either alone or together with other material or substance intended for preventing, destroying, repelling or mitigating. The application of pesticide is only intended to minimize the probability of spread of the pest in or out of the delimited area or a non-target area. The Tanzania Plant Health and Pesticides Authority (TPHPA) oversee all matter related to pesticides and plant health in the country which include supervision, monitoring, registration of pesticides and use of pesticides. The authority uses the extension officers to disseminate different knowledge to farmers which are available throughout the country. The handling of obsolete pesticides or pesticides empty containers are regulated by TPHPA in consultation with the National Environment Management Council. The list of all registered pesticides in the country are provided.

The GoT have taken deliberate measures for promotion of IPM in all crop production systems whereby in 2013, the Ministry of Agriculture introduced the National Agriculture Policy and National Environmental Policy, (2021). The establishment of Environmental Management Act of 2004 lead to formation of sector environmental management Units at each Ministry, with the responsibility of ensuring compliance on environmental matters was taken into board. The Ministry of Agriculture have enhanced performance of plant health services in the country by established the Tanzania Plant Health and Pesticides Authority

(TPHPA), under the Plant Health Act, 2020 No. 04 of 2020 followed with the plant health regulations, 2023. TPHPA has been established to comply with requirements of International Plant Protection Convention (IPPC) on sanitary and phytosanitary measures. The establishment of the Authority intended to smooth coordination, proper utilization of resources and remove duplication of roles in order to enhance efficiency and effectiveness in service delivery.

The IPMP also provides guidelines for pest management in accordance to the IPM approach. It augments the biological, chemical and cultural control aspects of the management of pests and diseases. An outline of the specific pest management measures to be incorporated (including a "positive list" for procurement, rules for safe handling of pesticides, and promotion of IPM); and an implementable work plan outlining those specific measures (e.g. budget, timeline, institutional roles and responsibilities) are given in this IPMP. The preparation of this IPM also involved consultations with regional and district officials in the targeted areas to review the project plans and pest management challenges.

A comprehensive approach to Integrated Pest Management (IPM) project implementation involves a range of relevant activities aimed at building the capacity of direct actors. Firstly, training workshops should be organized to cover theoretical aspects of IPM, focusing on pest identification, monitoring, and the application of biological control methods. Practical sessions and field demonstrations can enhance participants' hands-on skills. The BBT project will take responsibility for implementation of a separate but coordinated work plans and budgets under the BBT.

Budget

S/N	Item	Units	Unit cost		Total		Source of financing
			Local	US\$	Local	US\$	
1	Sensitizing the end beneficiaries		10,000,000.0	10,000.0	10,000,000.0	10,000.0	AfDB /GoT
2	Supporting the extension services in charge of phytosanitary		5,000,000.0	50,000.0	5,000,000.0	50,000.0	AfDB /GoT
3	Monitoring and evaluation			15,000.0		15,000.0	AfDB /GoT
	Total				15,000,000.0	75,000.00	

1.0 INTRODUCTION

1. The Building a Better Tomorrow (BBT) Programme aims at improving job creation, food and nutrition security for the youth in Tanzania. The specific objective of the programme is to create business opportunities and decent employment for young women and men along priority agricultural value chains. In response to low engagement of youth in the agriculture sector, there has been a growing political commitment across African countries including Tanzania to engage the youth in agriculture and agribusiness. These commitments are reflected in several initiatives such as the adoption of the African Youth Charter (AYC) by the African Union in 2006, the declaration of the Youth Decade Plan of Action (2009 to 2018), the establishment of the Youth Desk in the New Partnership for Africa's Development (NEPAD) (NEPAD, 2016), and the Comprehensive African Agriculture Development Program (CAADP) (CAADP, 2016). Pursuant to these initiatives, many African governments and development partners have developed strategies and implemented various interventions to facilitate youth engagement in agriculture and agribusiness. These include skills development, facilitating access to resources, and use of technologies in agribusiness. For instance, training on financial literacy help the youth manage money, entrepreneurship skills, and the Enable Youth Programme supported by the African Development Bank (AfDB) have been benefitting the youth in understanding the market and developing own business plans (Moore, 2015). Such interventions are assumed to increase innovativeness among the youth and giving them incentives to engage in agribusiness activities (*Betcherman and Khan, 2015*). However, the level of investment in targeting rural youth in agribusiness remains low compared to the high attention given to the youth agenda at the international, regional, and national levels (*Proctor and Lucchesi*)

2. The African Development Bank's Feed Africa Strategy (2016-2025) aims to **“transform the African agriculture into a competitive and inclusive agribusiness sector that creates wealth, improves lives, and secures the environment”**. Following the Dakar 2 Feed Africa Summit, the AfDB renewed its commitment to accelerate and scale-up interventions for increased agricultural production and productivity, post-harvest value addition, and investments in soft and hard infrastructure for market access and inclusiveness, to turn the continent into a continent that is able to feed itself, and a net exporter of agricultural commodities. Tanzania's Country Food and Agriculture Delivery Compact Programme focuses on increasing food production and productivity of four strategic value chains: wheat, edible oils (sunflower and soybeans), horticulture (fruits and vegetables), and livestock (beef and dairy). By financing the Building a Better Tomorrow Project phase I (BBT I), the Bank is delivering on its commitments to mobilize financing for the implementation of the Country's Food and Agriculture Delivery Compact presented at the Dakar 2 Summit. A key priority of the Country Compact is to empower young people to participate in agriculture and food systems by addressing the challenges that limit their participation, thereby enabling the youth to obtain decent jobs,

sustainable livelihoods, and food and nutrition security through engagement in agriculture and agribusiness.

3. The proposed project will support the Government in the attainment of the Agenda 10/30 that envisages to achieve a 10% growth rate of the agriculture sector and increase the youth employment by 1.5 million by 2030 through supporting youth and women in agriculture, rebranding the sector image, and encouraging private sector investments. The project will benefit from synergies with other AfDB financed projects planned or implemented in and around the target regions in Tanzania. These include Tanzania Agricultural Development Bank (TADB): Equity enhancement project aimed at boosting TADB capital base thus providing affordable financing to entrepreneurs engaged in agribusiness including the BBT program - youth enterprises. The proposed project will also benefit from Tanzania-Burundi-DRC Standard Gauge Railway (SGR) Phase II Project which will catalyse economic growth through lower transport costs and enhanced competitiveness while attracting private sector participation in the sector. Moreover, the project is linked to the Special Agro-industrial Processing Zone (SAPZ) project that will help to enhance value addition and agro processing catalysing private sector investments in the sector to help in job creation.

4. The BBT project specifically intends to: i) inspire the youth through implementation of a behaviour changing communication strategy that would rebrand agriculture and make it more appealing to the youth; ii) empower the youth through training, mentoring, and coaching, and other interventions that would impart necessary skills for employment or management of their own agribusinesses; iii) engage the youth in profitable and sustainable management of agribusinesses; iv) enable youth-led enterprises by improving policy, legal and regulatory environments and facilitating the development of BDS for the youth in agribusinesses; and, v) coordinate effectively activities of NGOs supporting the youth for synergy as well as efficiency and effective outcomes.

5. The activities that will be funded under the BBT block farms may lead to the increased use of agricultural pesticides, especially when growing vegetables of high value. This Integrated Pest Management Plan (IPMP) has been prepared in order to ensure that BBT is managed in compliance with the Bank on Pest Management, and with the related safeguard requirements of the Government of the United Republic of Tanzania (GoT) while observing the international safeguards requirements and best practices. The IPMP includes proposals for effective and sustainable integrated pest management relating to crop production and marketing systems extending beyond the lifetime of the Project.

6. The principles of modern farming which will be adopted for BBT Block farms in Dodoma and Mbeya Block farms will include, improved methods of land cultivation; use of certified and approved seeds and fertilizer; control of crop diseases and pests, adherence

to modern crop husbandry (spacing, weeding, etc.); use of modern crop harvesting technology and safe storage of harvested produce. Herbicides, or chemical weed killers, and mineral fertilizers are among the major achievements of modern agricultural production. As a result of increased use of industrial fertilizers and pesticides due to agricultural intensification in the area, human health, soil and water pollution may rise especially if recommended application rates are not followed and safe use, handling and storage of agrochemicals is not observed. Prolonged agricultural use of these products may result in the presence of their compounds in the soil and water, and they can degrade the soil and the environment in general.

7. However; according to the Environmental and Social Impact Assessment reports for Ndogowe and Chinangali II Block farms (2023), agriculture in the project area is practiced with very minimum to none application of agrochemicals. Few farmers use pesticides, though Government Officers through TPHPA occasionally apply pesticides for the control of migratory and outbreak pests such as armyworm and birds. Herbicide use is becoming more common, though still amongst a small minority of the target population. The Project may encourage greater experimentation with the use of herbicides as an option for weed and pest control in the project areas.

8. The BBT project is not expected to promote greater use of insecticide. Nonetheless, it is deemed important to provide all participating farmers with strong advisory assistance relating to the safe use of both insecticide and herbicide. Pest scouting will be encouraged to allow control of migratory and outbreak pests at an earlier stage, thus reducing the need for pesticide application.

9. This IPMP briefly summarizes current knowledge of the incidence of crop pests in the cropping and marketing systems of the BBT Regions especially Dodoma and Mbeya Regions which have high percentage of block farms to be supported by BBT Project. The IPM Plan reviews relevant national policies and regulatory systems, and recent experience in the application of Integrated Pest Management techniques. These are followed by an outline of the budget for integrated pest management to be applied in BBT. The key pest problems encountered in the targeted BBT crop production systems are indicated in Table 2-9 under specific crop type.

2.0 APPROACH

10. The Integrated Pest Management Plan (IPMP) is designed to utilize the diverse pests control measures while minimizing their potential adverse impacts on human and environmental health through promotion of Integrated Pest Management.

11. The Bank's Safeguards Policy stipulates that "in assisting borrowers to manage pests that affect either agriculture or public health, the Bank supports a strategy that promotes the use of biological or environmental control methods, and reduces reliance on synthetic

chemical pesticides”. Further, “in appraising a project that will involve pest management, the Bank assesses the capacity of the country’s regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. As necessary, the Bank and the borrower incorporate in the project components a work plan to strengthen this capacity”.

12. In line with this the IPMP highlights the anticipated pests and pest management problems in the areas targeted by the Project, reviews national policies and regulations for dealing with these pests, reviews the country’s pest management practices including its experiences with IPM and outlines a work plan and budget for applying IPM to improve the effectiveness and safety of pest management under the proposed Project and defines a monitoring and evaluation plan for the implementation of the IPMP.

13. The preparation of this IPMP involved literature reviews, consultations with relevant government departments, and consultations with farm communities. The literature review included the following documents:

- i) BBT Project Appraisal Report;
- ii) BBT Program Document;
- iii) Environmental Management Act (2004);
- iv) Environmental Impact Assessment and Audit Regulations, 2005 of 2005;
- v) Environmental Management (Soil Quality Standards) Regulations, 2007;
- vi) Agricultural Sector Development Program (ASDP) Integrated Pest Management Plan (IPMP) of 2009;
- vii) Southern Agricultural Growth Corridor of Tanzania (SAGCOT) Investment Project, Integrated Pest Management Plan (IPMP) Of 2014;
- viii) Tanzania Safeguard Policies on Pest Management; and
- ix) AfDB Safeguard Policies on Pest Management.

14. The preparation of this IPM also involved consultations with regional and district officials in the targeted areas to review the project plans and pest management challenges. An inventory of common pest problems in the project sites, and the practices commonly used by farmers to control these pests was undertaken, discussed and compared with adoption data available in the literature.

3.0 DESCRIPTION OF THE PROJECT

15 The proposed BBT project will focus on implementing activities on an integrated approach to improve value chains through increased productivity of targeted crops and forging sustainable market linkages. The BBT Project will be implemented in three regions of Dodoma and Mbeya. Below are prioritized value chains crops in each of the selected region.

Table 1: BBT Project implementation sites

Sn.	Region	Site	Priority Value Chains
1.	Dodoma	Ndogowe and Chinangali	Horticulture (onion, sweet pepper, and tomatoes), maize, sorghum, sunflower, and soybeans.
		Kongwa	Livestock fattening and fodder production
2.	Mbeya	Mapogoro	Horticulture (onion, sweet pepper, and tomatoes), maize, wheat, sunflower and soybeans,

3.1 Project Components

Component I: Youth Empowerment in Agribusiness (USD 47.13 million)

16 The aim of this component is to create an enabling environment for building and accelerating entrepreneurship in agribusiness for youth unemployed/ underemployed and activities will be carried out under the following two sub-components:

Sub-component 1.1 - Agribusiness Incubation and Acceleration Activities: a) Develop and implement an outreach, knowledge management and dissemination strategy using youth-friendly ICT (social media, networking, etc.) to promote program and opportunities in modern and climate smart agriculture, with a particular attention to attract female candidates. b) Develop/review criteria for youth selection and screening methods to identify youth based on aptitude and interest in agribusiness entrepreneurship, and c) Conducting incubation and acceleration training programs, expected to train and empower over 11,000 youths.

Sub-component 1.2 - Upgrading of Youth Agribusiness Incubation Centres (YABICs): Activities will include conducting needs assessment studies of incubation centres, rehabilitating, and equipping of 13 YABICs, and building YABIC host institutions capacity in incubation management.

Component II: Development of Climate Resilient Block Farming and Livestock Fattening Agribusinesses (USD 153.97 million)

17 Under this component, the BBT I will develop Block Farms in Dodoma and Mbeya regions that will be allocated to youth, anchor investors, and local communities. The arrangement is a private-public partnership commercial farming between anchor investors and publicly financed youth incubation program to engage young people in contract farming. More details on establishment Block Farms and land allocations process are presented in Annex 2-2 (technical annexes). Activities under component II will be carried out under the following two sub-components:

Sub-component 2.1 - Land and Irrigation Infrastructure Development: Interventions under this subcomponent will complement Government and private sector investments and

include activities such as procurement of land development machinery, construction of access roads (60 km), land clearing, in-farm road networks (700 km), establishment of climate smart irrigation systems (48,000 acres), youth housing and other farm infrastructures.

Sub-component 2.2 - Improving Production and Productivity through climate smart technologies and postharvest value addition: activities include: introduction of a package of climate smart technologies (including certified seeds, fertilizers, mechanization, good agronomic practices, and modern livestock husbandry practices) to increase productivity, production, and resilience for commercial production of target value chains.

Sub-component 2.3 - Block Farm Management Structure: The structure serves to a) oversee the management of block farms and delivery of services to the youth farmer cooperatives including training and agricultural inputs (certified seeds, fertilizers, mechanization, good agronomic practices, and modern livestock husbandry practices); b) provide post incubation follow up and monitoring of youth; and c) play a central role in linking up youth to other stakeholders in the block (off takers, service providers, and financial institutions).

Component III: Financing Youth Agribusinesses and Private Sector Engagement (USD 4.22 million)

18 Under this component, the project will implement activities to ensure the timely and cost-effective access to financing for the youth-led businesses and active engagement of the private sector, thereby ensuring the overall success of the BBT initiative. Activities under this component will include the following sub-components:

Sub-component 3.1 - Setting up a Risk-Sharing Instrument: USD 4 million will be allocated to provide partial credit guarantees for loans from commercial banks that have expressed interest in financing BBT businesses as well as additional financing from other commercial banks. The risk-sharing instrument will be managed by TADB and will have an initial focus of unlocking financing in the Ndogowe Block (pilot site) for the project, thereby establishing its proof of concept and paving way for further financing from financial institutions.

Sub-component 3.2 - Capacity building of BBT I Beneficiaries for Investment Readiness: This sub-component will focus on providing the BBT I beneficiaries with capacity building and training to enhance their investment readiness and business management skills through addressing capacity gaps in financial management and management systems strengthening to enable the businesses to able to meet the requirements of banks and other sources of finance.

Sub-component 3.3 - Anchor Investor/Off taker Engagement: This sub-component will focus on engagement and off taker agreement arrangements with the private sector anchor investors who will provide youth produces with access to market. Last year, Government launched anchor investor recruitment and private sector companies were encouraged to

submit an expression of interest. About 56 private sector companies expressed their interest in the BBT Program, 33 were shortlisted, and 3 were selected as anchor investors/Off takers for the pilot phase (Dodoma sites). The anchor investor recruitment and selection process are presented in Annex 2-2 (technical annexes)

Component IV: Project Coordination and Management (USD 4.95 million)

19 The Ministry of Agriculture will host the PIT to coordinate the project activities. These include the day-to-day management of project activities based on an adequate results measurement framework; coordination and supervision of project activities; mid-term, studies, and final project reviews; and project procurement, disbursement, financial management, audit, and reporting; baseline study.

4.0 PEST PROBLEMS AND IPM IN BBT PROJECT AREAS

20. Plant pest and disease management issues cost Tanzania millions of dollars annually and frequently lead to crop yield losses through damages like wilting, scabs, rust, rot, and molds covering. Insect pests spread diseases in plants in addition to damaging crops. Aphids and leafhoppers, for instance, frequently transmit several plant diseases when feeding. Fall armyworms, tomato leaf miner are so damaging to maize and tomato respectively. Weak plants in nutrient-deficient soils (an abiotic state) are occasionally more vulnerable to pest and disease attacks. In these situations, applying pesticide against these pests is costly and not friendly to human and environmental health. In fact, pesticides usage may cause undesirable side effects like toxicity to humans, poisoning and residue issues, killing of natural enemies and other non-target organisms, making target organisms resistant, and degrading and polluting the environment. Furthermore, pesticides are costly, and using them properly needs knowledge and experience. The transmission of technology from research to extension to farmers frequently fails for a variety of reasons. Often, the technology is insufficient and not customized to the unique requirements of the area. This indicates that using pesticides only is not sustainable, that's why integrated pest management is required.

21. Integrated pest management is an ecosystem-based strategy that focuses on the long-term prevention of crop pests and diseases through a variety of techniques that include biological control, the use of resistant varieties, habitat management, modification of cultural practices and, when needed and as a last resort judicious and timely use of chemical controls. In practice, integrated pest management (IPM) serves as a framework for decision-making to address localized and immediate pest infestations in the most cost-effective way feasible. Overall, this is a science- and field-driven strategy, crop and site specific to managing pests and diseases that seeks to lessen the effects of pesticide use in BBT for the

good of the economy and environment. For example, the use of Mass trapping and rotational spray against *Tuta absoluta* in tomato growing regions of Tanzania.

22. An IPM utilizes more than one control tactics in a compatible, sustainable and economically feasible way to reduce the status of pests to tolerable levels while maintaining a balanced and healthy ecosystem, crops and humans. IPM is an acceptable cardinal approach which emphasises on key points such as; ecologically-based ability to regulate populations, relies on pest management as opposed to pest eradication and on multiple tactics as opposed to the “Silver bullet” approach (Chemical pesticides is used as a last resort). A pest is any organism which is noxious, destructive or troublesome to human and his belongings such as crops, livestock, structures, or the surrounding environment. These pests include, insects, weeds, pathogens, birds, rodents and nematodes. The choice of IPM package against these pests differ with crop types, locations, crop growth stages and other ago-ecological conditions.

23. The health of a plant is influenced by its environment. This environment includes abiotic factors (i.e. sun, rain, wind and soil nutrients) and biotic factors (i.e. pests, diseases and weeds). All these factors can play a role in the balance which exists between pests and their natural environment. If we understand the whole system of interactions, we can use this knowledge to reduce the negative impact of pests and diseases. Decision making in Integrated Pest Management requires a thorough analysis of the agro-ecosystem. Implementers of IPM packages will have to learn how to observe the crop. IPM embodies crop protection approach that is centered on local farmer needs that are sustainable, appropriate, environmentally sound and economically viable. The IPM approach advocates the use of all available, appropriate prevention and control strategies. Pesticides used only as a last option when making plant protection decisions based on damage and economic thresholds. Thus, gentle and selective pesticides are employed to reduce adverse effects on humans, natural enemies, and other non-target creatures. The IPM theory is based on not completely eliminating all noxious species, but rather on managing them at levels below damage and conserving the ecosystem to encourage the presence of natural enemies.

The technology can widely be used since it has to be implemented by farmers in collaboration with extension officers. IPM approach is location and crop specific, most sub-projects under the BBT project may need a specific pest management plans for addressing the concerns onboard.

5.0 FUNDAMENTALS OF IPM

24 The fundamentals of IPM includes;

- Awareness of the ecological interrelationships that exist within agricultural system; crop, plant, pest species as well as the factors that influence their development.
- Understanding of economic aspects in a production system; infestation: loss ratio, market potential, and product value.
- Awareness of farmers' socio-cultural decision-making behavior; traditional preferences and risk behavior.
- Farmers' participation in the assessment of plant protection challenges and the development of solutions; and the development of a legislative and agricultural policy framework suitable to a long-term IPM strategy and plant protection.
- Reducing pest levels below those that can cause economic damage
- Some of government intervention such as pesticides subsidies should be implemented in the manner that do not interfere with IPM approaches and implementation strategies.

6.0 KEY CHARACTERISTICS OF AN IPM APPROACH

25 Key characteristics of an IPM approach

- Use all available and appropriate measures of prevention and control, but pesticides will be used only as a last resort, preferably selective ones, or used selectively to avoid negative effects on natural enemies and other non-target organisms.
- Encourage the presence of natural enemies by conserving the ecosystem.
- There will be no absolute eradication of all pests, but they will be kept at a manageable population density.
- Farmers work closely with researchers and extension agents to create technology.
- Farmers decide and carry out their own decisions.

6.1 IPM PRINCIPLES

26 Prevention: Involves pest control measures that encompass good agricultural practices such as: Good land preparation, timely planting, phytosanitation, crop rotation, mixed cropping, quarantine measures and resistant varieties.

27 Monitoring: This involves regular checking to identify pest signs, symptoms and crop damages for immediate rational decision making

28 Intervention: This involves the use of biological control agents, physical methods, botanical, sterile insect techniques, mass trapping, mating disruption, growth regulators, genetic engineering and pesticides as a last resort.

7.0 EXISTING AND ANTICIPATED PEST PROBLEMS IN BBT PROJECT AREAS

7.1 Tomato

29 Tomato (*Solanum lycopersicum L.*) production ranks first among vegetables in Tanzania with a total annual production of 129,578 tons, representing 51% of the total vegetable production (Mwasha, 2000; de Putter *et al.*, 2007). It is almost grown in all the regions of Tanzania. The major pest and diseases in Ndogowe and Chinangali block farms includes Early blight, Late blight, Bacterial wilt, Fusarium wilt, Verticillium wilt, Damping off, Bacterial canker, Tomato mosaic virus, Leaf miners, White fly, Red spider mite, American ballworm, nematodes and various weeds.

Table 2: Major tomato pest problems and the current management practice (Ndogowe, Chinangali and Chunya)

Pests/Diseases	Current management approaches
<p>Early blight (<i>Alternaria solani</i>)</p>	<ul style="list-style-type: none"> • Remove infected plants starting from nursery • Weed out Solanacea plants • Use botanicals and other natural pesticides • Observe recommended time of planting • Regular crop scouting to detect early attack • Use resistant varieties such as; Tengeru 2010, Meru and Kiboko • Treating of soil with Trichoderma isolates such as T10 • Apply recommended fungicide molecules such as Mancozeb 800g/Kg, metalaxy, Carbendazim, Azoxystrobin 80g/L, Tebuconazole 160 g/L and Chlorothalonil 500g/L.
<p>Late blight, (<i>Phytophthora infestans</i>)</p>	<ul style="list-style-type: none"> • Regular crop scouting to detect early attack • Field sanitation after harvest by removal infected plant parts • Crop rotation • Avoid moist microclimate at shady places • Use wide spacing (wet season) • Timely planting • Plant at correct spacing • Shade management • Decrease humidity through pruning, desuckering, staking and weeding • Use resistant varieties such as; Meru and Kiboko • Avoiding the humid season and • Mulching to avoid rain splash causing infections • Traditionally use a mixture of mexican marigold, nettle and <i>Plectranthus barbatus</i> • Apply recommended fungicide molecules such as Mancozeb 800g/Kg, Metalaxy, Carbendazim, Azoxystrobin 80g/L, Tebuconazole 160 g/L and Chlorothalonil 500g/L.

<p>Bacterial wilt, (<i>Ralstonia solanacearum</i>)</p>	<ul style="list-style-type: none"> • Practice good crop rotation • Practice deep ploughing/post harvesting cultivation exposing soil to sun • Add organic matter to the soil (cow dung, mulch and green manure) • Removal of affected crops and weed-hosts, destroy or bury outside the field • Avoid transferring infested soil including soil on roots of plants • Bio-fumigation: Treat soil by incorporating cruciferous plant residues (mustard, broccoli, cabbage, radish, cauliflower, etc) into the soil • Do not irrigate with contaminated water from infected areas • Choose seedbed in clean uninfected areas.
<p>Fusarium wilt, (<i>Fusarium oxysporum</i>)</p>	<ul style="list-style-type: none"> • Use resistant varieties (like Tengeru 97) for both fusarim wilt races 1 and 2 • Practice good crop rotation • Sanitation and crop hygiene • Deep ploughing • Avoid transferring infected soil including soil from plant roots • Do not irrigate with contaminated water from infested areas • Add organic matter to the soil (cow dung, mulch, green manure) • Apply recommended fungicide molecules such as Mancozeb 800g/Kg, metalaxy, Carbendazim, Azoxystrobin 80g/L, Tebuconazole 160 g/L and Chlorothalonil 500g/L.
<p>Verticillium wilt, (<i>Verticillium spp</i>)</p>	<ul style="list-style-type: none"> • Keep the planting area weed-free • Maintain plant vigor with appropriate fertilization and irrigation. • Prune off affected parts of diseased plants and destroy them. • Disinfect pruning tools after use on an infected plant. • Maintaining the pH of the soil from 6.5 – 7.0 • A heavy mulch layer will keep the soil temperature low which can slow fungus growth. • Rotate your crops with different families. • Use disease free seedlings
<p>Damping off, (<i>Pythium or Rhizoctonia spp</i>)</p>	<ul style="list-style-type: none"> • Use of soilless pathogen-free growth medium to avoid damping off. • Avoid placing nursery in a shaded and humid place.

	<ul style="list-style-type: none"> • Use a well-draining nursery sites away from tomato fields. • Elevate seed beds to improve drainage. • Use disease-free seedlings. • Ensure good aeration through spacing and staking • Do not over water. • Disinfect seedling pots and trays with bleach (=NaOCl) before storage. • Uproot diseased seedlings and burry deeply. • Use recommended fungicides such as, Mancozeb 800g/Kg, Metalaxy, Carbendazim, Azoxystrobin 80g/L, Tebuconazole160 g/L and Chlorothalonil 500g/L.
Bacterial canker, (<i>Clavibacter michiganense</i>)	<ul style="list-style-type: none"> • Use healthy seeds, • Ensure field hygiene and sanitation • Deep plough to bury infected crop residue. • Crop rotation away from solanaceous crops. • Spray copper oxychloride, cupric oxide and copper hydroxide
Tomato yellow leaf curl (TYLC)	<ul style="list-style-type: none"> • Use disease free planting materials • Timely planting • Scouting and removal of affected plants • Intercrop with onion to reduce aphids (vectors) • Intercrop with eggplants as traps to draw whiteflies (vectors) away • Use repellent botanicals, such as Tephrosia and Mexican marigold • Good management of irrigation water • Remove and destroy crop residues after the final harvest • Avoid planting <i>Lantana camara</i> near tomatoes • Encourage beneficial insects • Spray recommended insecticides against disease vectors (such as imidacproprid, cypermethrin, profenofos and chlorophenapy)
Tomato mosaic virus, (ToMV)	<ul style="list-style-type: none"> • Use seed from healthy plants.

	<ul style="list-style-type: none"> • Dry heating seed at 70°C for 4 days or at 82-85°C for 24 hr will help to eliminate surface-borne virus. • ToMV on the seed coat can be eliminated by soaking seed for 15 min in 100 g/l of tri-sodium phosphate solution (TSP). • Crop rotation with non- solanaceae. • Disinfect tools, stakes, and equipment before moving from diseased areas to healthy areas. • Work in diseased areas last • Wash clothing that comes into contact with ToMV-infected plants with hot water and a detergent. • Remove diseased plants from the field. • Use resistant varieties eg. Tengeru 97.
<p>Tomato Leaf miners (<i>Tuta absoluta</i>)</p>	<ul style="list-style-type: none"> • Removal of wild solanaceous host plants in the vicinity • Eliminate remnants of the crop immediately after the last harvest. • Exclusive netting and screen houses (hole size of 0.4 x 0.7 mm) and double doors. • Use clean seedlings. • Crop rotation with non-solanaceous crops (preferably Cruciferous crops and leguminous crops) • Mass trapping: Pheromone lure (Tua-optimal or Tutrack) • Mating disruption • Recruiting or importation of biological natural enemies; <i>Trichogramma pertiosum</i>, <i>Trichogramma achaeae</i>, <i>Macrolophus pygmaeus</i>, <i>Nesidiocoris tenuis</i> and <i>Nabis pseudoferus</i>. • Use recommended insecticides such as Flubendiamide 480g/L, Abamectin 20g/l+ Acetamiprid 100g/l, emamectin benzoate + indoxcarb (Rotational spray).
<p>White fly (<i>Bemisia tabaci</i>)</p>	<ul style="list-style-type: none"> • Isolate newly arrived plants so as to prevent the spread of any potential infestation • Maintain good sanitation destroying all crop residues • Control weeds in non-crop areas in head rows and fallow fields. • Allow the maximum time between harvest and subsequent planting of host crops. • At the end of the season, dispose off any remaining plants appropriately. • Adopting crop rotation prevent carry-over to future crops

<p>Red spider mite (<i>Tetranychus urticae</i>)</p>	<ul style="list-style-type: none"> • Rogue infested plants • Avoid dusty condition during extreme dry season • Encourage moist microclimate by frequent irrigation • Hedge planting to reduce dust, invasion by mites blown by wind • Encourage natural enemies by mulching and hedging • Use neem as alternative sprays • Observe recommended time of planting • Proper application of irrigation • Plant tolerant/resistant varieties e.g. ARP 367-2 or Rossol • Sanitation or crop hygiene • Use healthy planting material • Frequent weeding • Inspect the crop regularly for new infestations • Use neem oil with cow urine • Apply a recommended miticide if necessary.
<p>American ballworm (<i>Helicoverpe armigera</i>)</p>	<ul style="list-style-type: none"> • Use a trap crop (e.g. African marigold) planted every 8th rows. • Hands pick small caterpillars before they enter fruit. • Remove and destroy infected fruit and infested plants after harvest, these may be composted to destroy the pest. • Plough soil after harvesting to expose pupae to sunlight and natural enemies. • Avoid closer spacing and excessive use of nitrogen fertilizer • The mechanical removal and destruction of larvae during the outbreak is more successful than the insecticidal management when the control failure occur • Plant tomatoes away from cotton or maize crops. • Closed season, discourage mono-cropping and advocating crop rotation with non-host crops • Conserve natural enemies such us bugs, lacewings, and ladybird beetles. • Use recommended insecticides such as profenophos and cypermenthrin.
<p>Root knot nematodes (<i>Meloidogyne spp</i>)</p>	<ul style="list-style-type: none"> • Optimal crop rotation and fallow • Deep ploughing

	<ul style="list-style-type: none"> • Avoid contaminated water • Plant tolerant/resistant varieties • Sterilize the seedbed before sowing • Avoid planting a new crop on infected areas • Incorporate neem cake or powder into the soil, • Fields should be ploughed deep and then followed by a dry fallow. • Uproot entire plants from the field after harvest and destroy crop debris. • Use resistant tomato varieties (e.g. 'Caracas', 'Kentom', 'Meru', 'Piersol', 'Roma VFN', 'Tengeru 97', 'Zest F1', 'Star 9001', 'Star 9003') • Use bio-fumigation where possible (e.g. Brassica juncea var. integrifolia or Brassica juncea var. juncea) should be used as intercrop on infested fields. • Use nematicides such as carbofuran.
<p>Various broad leaves, grass weeds Nut/Sedges.</p>	<ul style="list-style-type: none"> • Mulching to suppress weed growth • Timely weeding • Ploughing for destruction of annual and perennial weeds • Timely sowing of crop to minimize crop weed competition • Proper spacing to facilitate inter weeding operation • Apply recommended herbicides appropriately.

7.2 Onions

30 Onion (*Allium Cepa L.*) is the most significant vegetable in Tanzania. The country ranked ninth among African onion producing countries, producing approximately 56,000 tonnes of onion per year. From the southern highlands to the central plateau to the northern highlands, the crop is grown virtually everywhere in the country. Although exports to other markets are small, production is mostly for local consumption and the domestic market. The major pest and diseases of onions in Ndogowe and Chinangali block farms include, Onion thrips, Downy mildew, Purple blotch and Storage rots caused by *Bortyitis*, *Erwinia*, *Mucor* and *Fusarium* spp.

Table 3: Major pest problems of onions and the current management practice (Ndogowe, Chinangali and Chunya)

Pests/Diseases	Current management approaches
Onion thrips (<i>Thrips tabaci</i>)	<ul style="list-style-type: none"> • Field sanitation • Scouting regularly • Separate seed bed and field to reduce danger of carrying over thrips from one site to the other • Crop rotation • Mixed cropping of carrots and onions • Timely planting • Transplant clean seedlings • Mulching reduces thrips infestation • Plough deep after the harvest to bury the pupae • Irrigation/adequate watering • Enhance beneficial organisms such as predatory mites, bugs, and fungal pathogens like <i>Metarhizium</i>) • Use botanical extract like Neem oil, Tephrosia and tobacco. • Use recommended insecticides such as abamectin and emamectin benzoate
Downy mildew (<i>Peronospora destructor</i>)	<ul style="list-style-type: none"> • Grow resistant varieties (eg. red creole) • Crop rotation for at least five years • Sanitation: remove crop remains after harvest, do no leave volunteer plants in the field. • Wide spacing and good drainage to decrease humidity in the plant stand • Apply mulch to avoid rain splash • Inspect the crop regularly
Purple blotch (<i>Alternaria porri</i>)	<ul style="list-style-type: none"> • Sanitation: remove crop remains after harvest, • Crop rotation • Mulching to avoid rain splash • Plant at recommended spacing

	<ul style="list-style-type: none"> • Inspect the crop regularly • Apply recommended fungicide such as Mancozeb 800g/Kg, Metalaxy, Carbendazim, Azoxystrobin 80g/L, Tebuconazole 160 g/L and Chlorothalonil 500g/L
Storage rots (Bortytis, Erwinia, Mucor, Fusarium)	<ul style="list-style-type: none"> • Use of netted bamboo baskets • Avoid heaps exceeding 30cm depth and use racks of 1m high • Ventilated stores • Minimize damage during handling • Drying of onions before storage • Remove tops • Avoid thick neck/split onions

7.3 Sweet Pepper

31 Sweet peppers (*Capsicum annuum*) (Solanaceae) fruits is used as a food ingredient in soups and stews as spices. Pests such as Thrips, whiteflies, mites, and aphids are the most critical in sweet peppers. Effective management of this pest to improve the crop yields and quality is very important. Integrated pest management strategies become more advisable to control pests of sweet pepper. The major insect pests and diseases of sweet pepper in Ndogowe and Chinangali block farms are; Thrips, Cutworms, Whiteflies, Aphids, Tomato hornworm and various annual and perennial weeds,

Table 4: Major pest problems of Sweet pepper and the current management practice (Ndogowe, Chinangali and Chunya)

Pests/Diseases	Current management approaches
Cutworms	<ul style="list-style-type: none"> • Fields scouting weekly after transplanting for larvae, leaf-feeding or clipped stems. • Use recommended insecticide if plant injury warrants.
Thrips	<ul style="list-style-type: none"> • UV-absorbing plastics which disrupt host-finding behavior. • Use of Parasitoid such as <i>Orius spp.</i> • Use of entomopathogens such as <i>Beauveria bassiana</i> • Use of resistant cultivars. • Use recommended insecticides such as, spinosad
Whiteflies	<ul style="list-style-type: none"> • Isolate newly arrived plants to prevent the spread of infestation • Field sanitation (removing the host crops, weeds, and destroy crop residues. • Allow the maximum time between harvest and subsequent planting of host crops. • At the end of the season, dispose off any remaining plants. • UV-absorbing plastics which disrupt host-finding behavior.
Aphids	<ul style="list-style-type: none"> • Field scouting weekly.

	<ul style="list-style-type: none"> ● Conserve naturally occurring parasites and predators, ● Use recommended insecticide only if aphid numbers exceed 10/leaf. ● Use of Parasitoid such as hoverflies, <i>A. colemani</i> and <i>A. aphidimyza</i>. ● Intercropping pepper with maize or eggplant. ● Use of resistant cultivars.
Tomato hornworm	<ul style="list-style-type: none"> ● Field scouting weekly. ● Use selective insecticides that conserve beneficial organisms
Weeds (annuals, grasses and broad leaves)	<ul style="list-style-type: none"> ● Fields scouting for weed identification. ● Herbicide use is supplemented by at least one cultivation or hand weeding, ● Weeds in fields alleys and roadways are prevented from going to seeds. ● Outbreaks of new or problem weed species are controlled, using chemical or non-chemical means, to prevent spreading or seed production.

7.4 Maize

32 Maize (*Zea mays*) is the major staple food crop and it is grown in all the agro-ecological zones of Tanzania. It can be grown over a wide range of altitude ranging from 0-2400m above sea level (a.s.l). Maize requires an optimum rainfall of 1800 mm. According to Basic Data Agriculture Sector 1996/97-2002/2003 (MAFS 2004), it is estimated that 1,564,000 ha and 2,810,490 ha were put under maize cultivation in 1995/6-2002/03 respectively with overall production of 1,831,200 and 3,415,600 tons. The major insect pests of maize at Ndogowe and Chinangali are: African maize stalkborer (*Bossuela fusca*), pink stalkborer (*Sesamia calamistis*), spotted stalkborer (*chilo partellus*), American bollworm (*Helicoverpa armigera*), cutworms (*Agrotis ipsilion*), and maize leafhopper (*Cecadulina mbila*). The major diseases of maize are: leaf rusts (*Puccinia sorghi* and *P. polysora*), leaf blights (*Helminghtosporium turcicum* and *H. maydis*), maize streak disease (*maize streak virus*) and grey leaf spot (*Cerospora zaea-maydis*).

Table 5: Major maize pest problems and the current management practice (Ndogowe, Chinangali and Chunya)

Pests/Diseases	Current management approaches
Stalk borers (<i>Busseola fusca</i>)	<ul style="list-style-type: none"> ● Stalks are buried or burned to eliminate disposing larvae ● Early sowing reduces infestation ● Intercropping with pulses ● Neem (arobani) powder (4-5 gm i.e. pinch of 3 fingers) per funnel ● Neem seed cake (4gm/hole) during planting

	<ul style="list-style-type: none"> ● Use the extract of <i>Neuratanenia mitis</i>, a botanical pesticide
African armyworm (<i>Spodoptera exempta</i>)	<ul style="list-style-type: none"> ● Field scouting using pheromone traps. ● Timely apply recommended insecticide or botanical extract.
Seedling weevils (<i>Tanymecus spp.</i> & <i>Mesokeuvus spp</i>)	<ul style="list-style-type: none"> ● Timely planting to escape damage ● Field scouting. ● Apply lambda cyhalothrin if necessary
Storage pests (Larger grain borer (LGB) Maize weevils and Grain moths)	<ul style="list-style-type: none"> ● Selection of tolerant varieties ● Timely harvest ● De-husking and shelling ● Proper drying ● Sorting and cleaning of the produce ● Cleaning & repair of the storage facilities ● Use rodent guards in areas with rat problems ● Use improved granaries ● Use appropriate natural grain protectants where applicable with recommended dosage. ● Keep the grain in air tight containers/bags and store safely. ● Carry out regular inspection of the store and produce. ● Timely detection of any damage to the grain and/or storage structure is essential to minimise potential loss or damage. ● Promote biological control of LGB using <i>Teretriosoma nigrescens</i> (Tn) to minimize infestation.
Grey leaf spots (GLS)	<ul style="list-style-type: none"> ● Crop rotation ● Plant recommended resistant varieties e.g. H6302, UH6010, TMV-2 ● Timely planting ● Removal of infected plant debris by deep ploughing.
Maize streak virus	<ul style="list-style-type: none"> ● Timely planting ● Plant recommended resistant varieties e.g. TMV-1 in Kilima ST and Katumani ST and Staha ● Removal of infected plants
Northern leaf blight	<ul style="list-style-type: none"> ● Crop rotation ● Deep plough of the crop residues ● Plant recommended resistant varieties e.g. H6302, UH6010, TMV-2, H614. ● Removal of infected plants
Various	<ul style="list-style-type: none"> ● Hand pulling and hoe weeding

	<ul style="list-style-type: none"> ● Intercropping ● Improvement of soil fertility ● Tillage ● Proper land preparation ● Timely weeding (at 2 and 5-6 weeks after planting) ● Apply recommended herbicides
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7.5 Sorghum

33 Sorghum (*Sorghum bicolor* (L.) is an important subsistence and a drought resistant crop in Tanzania. In Ndogowe and Chinanga block farms the crop is affected by a wide range of insect pests and diseases including; Shootfly, Stalk borers, African armyworm, Cutworms, Large grain borers, grain weevils, grain moths, Grain moulds, Grey leaf spot, Rust, Anthracnose, Leaf blight, Ladder leaf spot, Sooty stripe, Zonate leaf spot, Witchweed, *Quelea quelea* spp, Warthog and Hippopotamus.

Table 6: Sorghum major pests and the current management practice (Ndogowe, Chinangali and Chunya)

Pests/Diseases	Current management approaches
Shootfly (<i>Atherigoma soccata</i>)	<ul style="list-style-type: none"> ● Timely planting. ● Plant recommended varieties ● Destroy infected crop residues by burying ● Apply recommended insecticides if necessary e.g. endosulfan or fenitrothion
Stalk borers (<i>Busseola fusca</i> & <i>Chilo partellus</i>)	<ul style="list-style-type: none"> ● Stalks are buried or burned to eliminate diapausing larvae ● Early sowing reduces infestation ● Intercropping with pulses ● Neem (arobani) powder (4-5 gm i.e. pinch of 3 fingers) per funnel ● Neem seed cake (4 gm/hole) during planting ● Use the extract of <i>Neuratanenia mitis</i>, a botanical pesticide
African armyworm (<i>Spodoptera exempta</i>) and Cutworms (<i>agrotis ipsilon</i>)	<ul style="list-style-type: none"> ● Plough a month before sowing. ● Encourage rapid seedling growth ● Timely weeding ● Use treated seeds ● Treat the seed bed with wood ash ● Field scouting using pheromones ● Timely apply recommended insecticide or botanicals
Storage pests (LGB, weevils and grain moths)	<ul style="list-style-type: none"> ● Use of botanicals, e.g. Neem or pili-pili ● Bio-control (use of natural enemies) ● Use recommended insecticides if necessary.

	<ul style="list-style-type: none"> ● Use airtight storage bags or granaries
Grain moulds	<ul style="list-style-type: none"> ● Plant recommended tolerant/resistant varieties e.g. IS 9470, IS23599, IS24995, cv. Framida and cv.Serena ● Timely planting ● Field sanitation ● Crop rotation
Grey leaf spot (<i>Cercospora sorghi</i>)	<ul style="list-style-type: none"> ● Timely planting ● Field sanitation ● Crop rotation ● Use clean planting material
Anthraxnose (<i>Colletotrichum graminicola</i>)	<ul style="list-style-type: none"> ● Plant recommended tolerant varieties e.g. Tegemeo, Serena, Framida and Segalane ● Timely planting ● Field sanitation
Rust (<i>Puccinia purpurea</i>)	<ul style="list-style-type: none"> ● Use disease free seeds ● Use recommended spacing ● Plough in crops immediately after harvesting ● Timely planting ● Field sanitation ● Crop rotation
Leaf blight (<i>Exserohilum turcicum</i>)	<ul style="list-style-type: none"> ● Plant recommended tolerant varieties e.g. Tegemeo and Serena ● Timely planting ● Field sanitation
Ladder leaf spot (<i>Cercospora fusimaculans</i>), Zonate leaf spot (<i>Gleocercospora sorghi</i>) and Sooty stripe (<i>Ramulispora sorghi</i>)	<ul style="list-style-type: none"> ● Timely planting ● Field sanitation ● Crop rotation ● Use clean planting material
Witchweed (<i>Striga asiatica</i>)	<ul style="list-style-type: none"> ● Hand pulling ● Inter-cropping ● Use resistant/tolerant varieties ● Improvement of soil fertility ● Tillage ● Proper land preparation ● Timely weeding (at 2 and 5-6 weeks after planting) ● Apply recommended herbicides
Quelea quelea spp Warthog Hippopotamus	<ul style="list-style-type: none"> ● Scaring ● Bird trapping

	<ul style="list-style-type: none"> ● Farmers to scout potential breeding sites and destroy nests ● Monitoring and organised aerial spraying using ● Fenthion 60%ULV at the rate of 2.0l/ha for spot spraying, targeting roosting sites
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7.6 Sunflower

34 Sunflower (*Helianthus annuus L.*) is an annual plant, native from temperate north America, which is one of the four most important oil seeds in the world. Due to its high drought tolerance and adaptation to a great variety of soils, the sunflower is suitable for cultivation in many regions of the world. Because of sunflower oil's high quality and the resulting high demand, the cultivation of sunflower is spreading to countries in Asia and Africa. In Tanzania, sunflower corresponds to 36% of national oilseed production, accounting for production of 350,000 tons of seeds in 2008, resulting in about 90,000 tons of edible oil (RDLC, 2008). For 2013, according to the FAO (Food and Agriculture Organization of the United Nations), sunflower seed production reached close to 1 million tons, with the potential to increase in the future (United Republic of Tanzania, 2016). In Ndogowe and Chinangali block farms, Sunflower is affected by many insect pests and diseases including; mealybug and powdery mildew, cutworms and sunflower mosaic virus.

Table 7: Sunflower major pests and the current management practice (Ndogowe, Chinangali and Chunya)

Pests	Name	Current management approaches
Insects	Mealybug (<i>Planococcus ficus</i>)	<ul style="list-style-type: none"> ● Scouting using sex pheromone. ● Mating disruption with higher concentration of sex pheromone. ● Controlling ants will expose the mealybug under the attack of parasitoids and predators. ● Apply recommended insecticides if necessary.
Insects	Leafhoppers	<ul style="list-style-type: none"> ● Scouting; scouting about ten days after flowering, If more than 10 leaves of the 100 show damage, apply an appropriate control. ● Mating disruption through electromagnetic shaker emitting vibrational signals. ● Use green lacewing (predatory). ● Use diatomaceous earth with pyrethrins ● Use systemic insecticides (e.g., imidacloprid). ● Control broadleaf weeds and grasses to reduce populations of the pest.
Insects	Cutworms	<ul style="list-style-type: none"> ● Timely planting

		<ul style="list-style-type: none"> ● Scouting just from emergence (defoliated plants or cut plants), ● Foliar insecticide can be used at the action threshold of 25 to 30% of scouted plants are cut. ● Apply insecticides late in the day or in the early evening to ensure adequate coverage ● Apply biopesticides such as, <i>Bacillus thuringiensis</i>
Diseases	Powdery mildew (Erysiphe necator)	<ul style="list-style-type: none"> ● Proper spacing to promote air circulation ● Field sanitation ● Scouting: Inspect for colonies which mostly on the upper leaf surface. ● Use preventative fungicides (eg. Hexaconazole)
	Sunflower Mosaic Virus	<ul style="list-style-type: none"> ● Use virus-free seed, ● Minimizing insect vectors (aphids and thrips) through insecticide sprays or cultural methods, ● Removing infected plants

7.8 Soybean

34. Soybean (*Glycine max*), is the unique grain legume known for its dual purpose use as pulse and oilseed containing 38-44% protein and 18-22% oil. Soybean also finds place as the key component in a diverse range of industrial products like solvents, adhesives, inks, lubricants and insulating foams etc. soybean plays an important role as a rich source of protein. In Ndogowe and Chinangali block farms soybean is attacked by numerous plant insect pests and diseases, these includes; Bacteria, fungi, nematodes, phytoplasmas, viruses, aphids, whiteflies and pod borer

Table 8: Soybean major pests and the current management practice (Ndogowe, Chinangali and Chunya)

Pests	name	Current management approaches
Diseases	Soybeans rust	<ul style="list-style-type: none"> ● Use of resistant varieties ● Timely planting. ● Elimination of volunteer plants ● Field sanitation ● Use of recommended fungicides
	Beans anthracnose	<ul style="list-style-type: none"> ● Scouting at two weeks from pod fill to harvest maturity. ● Plant high-quality, disease-free seed or certified seed ● Practice crop rotation ● Use of recommended fungicides
	Brown spot	<ul style="list-style-type: none"> ● Rotate soybeans with other crops ● Plough in infested residue. ● Use recommended foliar fungicides.
	Bacterial blight	<ul style="list-style-type: none"> ● Plant high-quality, disease-free seed.

		<ul style="list-style-type: none"> ● Do not cultivate crops when wet. ● Rotate crops ● Plough in infested residues
Insects	Pod Borer: (<i>Helicoverpa armigera</i>)	<ul style="list-style-type: none"> ● Deep ploughing ● Install pheromone traps at a distance of 50 m @ 5 traps/ha for each insect pest. ● Erect bird perches @ 50/ha. • Clip terminal shoots on 100 days of crop growth ● Setting up of light traps (1 light trap/5 acre) to kill moth population ● Dusting with Chlorpyrifos 1.5 % DP or fenvalerate 0.4% or quinalphos 1.5% @ 25 to 30 kg/ha
	Aphids (<i>Aphids fabae</i>)	<ul style="list-style-type: none"> ● Use insecticide seed treatments for early control ● Use resistance varieties. ● Timely planting ● Scout, for the presence of aphids if exceed economic threshold. ● Use appropriate insecticides .
	Whiteflies (<i>Bemisia tabaci</i>)	<ul style="list-style-type: none"> ● Cow urine and botanical extracts ● Ash has a thick-coating on leaves to disrupt the molecular signals for insects from locating their host. ● Marigold and chili extract are effective against whiteflies ● Use of recommended insecticides such as cypermentrin+imidacloprid.

8.0 POTENTIAL IMPACTS OF PEST AND PESTICIDE

35 Pests and diseases cause significant impacts on crop losses of 10–30%, depending on the genetic constituents of the crop, its health, and the environment. Generally, national estimates of annual crop losses due to pests amount to 270 billion TZS per year. However, negligence in endemic areas can result in complete crop failures. In view of the inefficacy of chemical pesticides and the human and environmental problems thereof, integrated pest management (IPM) has been accepted as a cardinal principle of plant protection. IPM, being an eco-friendly approach that is socially acceptable and economically viable, has to be advocated where chemical pesticides are usually considered the last resort.

36 The increased use of industrial pesticides due to agricultural intensification may result into human health problems, soil and water pollution if recommended application rates are not followed and if safe use, handling and storage of agrochemicals is not observed. Prolonged agricultural use of these products may result in the presence of their compounds in soil and water, and they can degrade the soil and the surrounding environment. In general, all chemicals and pesticides are toxic in nature. For instance, in the environment pesticides may affect non-target species, such as plants, animals and humans, may pollute various

components of water, air and soil ecosystem and may as well impact many other species, including pollinators such as bees, as well as birds which are consequently losing their food sources. Additionally, Toxicity of pesticide may cause cancer, affect nervous system, skin or eyes irritation, and affect body hormone or endocrine system.

37 Food products may include residues from several pesticides if a mixture of pesticides is used. Multiple pesticides in food can also result from other causes such planting in fields that have already been treated, inadvertent spray drift, and the transfer of post-harvest pesticide residues. A major problem for food safety risk assessment arises when food containing various pesticide residues is ingested because it creates complicated patterns of combined exposure that may have additive, antagonistic, or even synergistic effects.

38. Consequently, it is critical to take into account the possibility of complex interactions between pesticides and their impacts on the health of people, animals, and the environment. These pesticides may make it more likely for food to have many pesticide residues, which may build up inside the body and provide cumulative health hazards. To tackle this issue, TPHPA regulations have been put in place to guarantee that cumulative effects are included in pesticide risk assessments. In order to assess pesticide risks, TPHPA undertakes regular toxicological human blood testing using ACHe kits to pesticide applicators in plantations, vegetables and flower farms so that those whose levels of acetyl cholinesterase are below normal are advised to stop or change their daily activities. Furthermore, pesticide residues on soil, water and commodities like plants and animal products are assessed using the CG-MS machine at the authority so that appropriate measures can be undertaken immediately.

9.0 POLICIES AND STRATEGIES

9.1 National Agriculture Policy (2013)

39. The National Agriculture Policy is a result of macro, regional and global economic changes that have bearing on the development of the agricultural sector. At the national level there have been major changes in the National Policy Framework resulting from the implementation of the Tanzania Development Vision (TDV – 2025), the Poverty Reduction Strategy Paper (PRSP), National Strategy for Growth and Reduction of Poverty (NSGRP I & NSGRP II), Long-term Perspective Plan and Five-Year Development Plan.

The NAP 2013 therefore, aims at addressing challenges that continue to hinder the development of the agricultural sector; these include low productivity; over dependence on rain-fed agriculture; inadequate agriculture support services; poor infrastructure; weak agro-industries; low quality of agricultural produce; inadequate participation of the country's private sector in agriculture; environmental degradation and crop pests and diseases. A more conducive policy environment than the current one is required for effective participation of all actors in the sector in order to tap existing capabilities and potentialities so as to revitalize

the development of the sector. There shall, therefore, be a policy shift towards increased investment in agriculture and greater involvement of the private sector in the production and provision of support services to the farming community.

9.2 National Environmental Policy, 2021

40. Environment and natural resources are valuable national assets that have to be sustainably managed for the present and future generations. They offer a range of benefits and opportunities for local and national levels for socio-economic growth such as improved livelihoods and provision of environmental goods and services. Despite being the foundation on which sustainable development is anchored, the national analysis of the state of the environment identified six (6) environmental challenges that needed urgent actions to address the deterioration of the environment in the country. These challenges are: land degradation; lack of accessible good quality water for rural and urban inhabitants; loss of wildlife habitats and biodiversity; deterioration of aquatic systems; deforestation; and environmental pollution.

41 In order to ensure environmental conservation and sustainable use of natural resources, the first National Environmental Policy (1997) was adopted to address the identified environmental challenges and foster sustainable socio-economic development in the country. Since the adoption of the first Policy, the key achievements have been realized including: enactment of the Environmental Management Act of 2004 as a framework environmental law prescribing legal and institutional framework for environmental management; putting in place comprehensive institutional and administrative framework for environmental management at all levels; mainstreaming of environmental issues into national development frameworks, sectoral policies, local government plans. Through implementation of this policy and other relevant sectoral policies, the country has managed to designate about 40% of the total land area as forest and wildlife protected areas.

42. Therefore, this Policy serves as a national framework for planning and sustainable management of the environment in a coordinated, holistic and adaptive approach taking into consideration the prevailing and emerging environmental challenges as well as national and international development issues. It is worth noting that, effective implementation of this policy requires mainstreaming of environmental issues at all levels, strengthening institutional governance and public participation in environmental management regime. The long-term vision of this policy is geared towards realization of environmental integrity, assurance of food security, poverty alleviation and increased contribution of the environmental

9.3 Environmental Management Act of 2004

43 This Act requires establishment of sector environmental management Units at each Ministry, with the responsibility of ensuring compliance on environmental matters. The sector environmental Units have, among others, the responsibilities of

- i) Advising and implementing policies of the government on the protection and management of environment in the respective sectors
- ii) Coordinating activities related to the environment of all persons within the respective Ministry
- iii) Ensure that environmental concerns are integrated into the Ministry development planning and project implementation in a way which protects the environment
- iv) To prepare and coordinate the implementation of environmental action plans at the national and local levels as required under this Act in each sector
- v) To refer to the council any matter related to the enforcement of the purposes of this Act
- vi) To ensure that sectoral environmental standards are environmentally sound.

9.4 The Plant Health Act, 2020

44. Pesticides and plant health issues in Tanzania are managed by the Tanzania Plant Health and Pesticides Authority (TPHPA), the Authority was established by the Plant Health Act, 2020 No. 04 of 2020. TPHPA was established in order to comply with the requirements of International Plant Protection Convention (IPPC) on sanitary and phytosanitary measures. The establishment of the Authority intended to smoothen coordination, proper utilization of resources and remove duplication of roles in order to enhance efficiency and effectiveness in service delivery. Tanzania is a member of World Trade Organization (WTO) Sanitary and Phytosanitary Agreement (SPS Agreement) as the authoritative standard setting body for plant protection. One of the purposes of the legal component is to ensure the compliance of Tanzanian legislation with these standards. Tanzania is required to comply with the international standards within the WTO framework. Phytosanitary measures include all relevant laws, decrees, regulations, requirements and procedures taken by a state in order to protect plant health and prevent the spread of diseases and pests. However, in order to prevent such measures becoming disguised restrictions on trade, the WTO SPS Agreement requires harmonizing such measures at international level. Also, Maximum Residue Levels (MRL) set by large target export markets such as the EU, US and Japan require that agricultural products do not have pesticides residues that exceed established quantities.

45 The Authority is responsible for the following functions:

- i) Assurance of certificates relating to the phytosanitary standards;
- ii) Surveillance of growing plants, including both areas under cultivation and wild flora and of plants and plant products in storage or in transportation, particularly with the object of reporting the occurrence, outbreak and spread of pests and of controlling such pests;
- iii) Disinfection of consignments of plants, plant products and other regulated articles moving in international traffic to meet phytosanitary requirements;
- iv) Protection of endangered areas;
- v) Designation, maintenance, surveillance and declaration of pest free areas and areas of low pest prevalence;
- vi) Conduct of pest risk analysis (PRA);
- vii) Ensure through appropriate procedures that the phytosanitary security of consignments after certification regarding composition, substitution and re-infestation is maintained prior to export;
- viii) Maintaining a list of quarantine pests, regulated articles and pests of national concern;
- ix) Approving and implementing phytosanitary actions and measures;
- x) Regulating the movement of biological control agents within, from or into the country;
- xi) Establishing procedures for accreditation of any post entry quarantine station, official analyst, official laboratory or any other person or institution;
- xii) Carry out and promote the carrying out of bio-efficacy trials and analysis of pesticides;
- xiii) Evaluate the fundamental aspects of pesticides application equipment and its applicability in relation to control of pests;
- xiv) Evaluate pesticides residues to determine maximum residual levels;
- xv) Approve the recommended use of pesticides for crop quality;
- xvi) Conduct pesticides formulation analysis for quality assurance;
- xvii) Register pesticides and bio-pesticides;
- xviii) Licensing of pesticides and bio-pesticides dealers;
- xix) Manage obsolete pesticides and pesticides empty containers;
- xx) Regulate importation, exportation, manufacturing, distribution, sale and use of pesticides;
- xxi) Establish and maintain a National Herbarium which shall coordinate and render services on the plant taxonomy and related subjects;
- xxii) Maintain a pesticide poisoning node that shall feed into the National Poisoning Center;
- xxiii) Promote Integrated Pest Management Approach;
- xxiv) Set up mechanism for coordination and collaboration with relevant bodies to ensure effective compliance to the regional and international obligations on plant health; and
- xxv) Such other functions as may be required for effective implementation of this

46. The Authority disseminates IPM approaches to farmers through the agricultural extension services. On the aspects of migratory pests and diseases, the Authority

cooperates fully with the neighboring countries (through regional initiatives on outbreak of pests and control) in the collective effort to control the damage of such pests.

9.0 PROJECT INTEGRATED PEST MANAGEMENT MEASURES (IPMM)

47. This section provides an introductory discussion of the various types of pest control strategies known and applied in Tanzania. This includes a brief review of techniques for biological control, cultural control, chemical control, quarantine and physical or mechanical control, chemical control and botanical control are presented.

9.1 Biological Control

48. Every living organism has its natural enemies and diseases which keep its population at equilibrium. The natural enemies include predators, parasitoids, nematodes, fungi, bacteria, viruses etc. The use of predators, parasitoids, nematodes, fungi, bacteria and viruses to maintain the population density of pests at a lower level than would occur in their absence is called biological control (bio-control). The National Plant Protection Policy is conducive to the promotion and use of bio-control as a strong IPM component. Tanzania has some experience based on the successful control of the mealy bug and the green mite (Anon, 1999). However, at national level, the capacity and capability to implement an effective nationwide programme is limited. The most common type of biological control practices in Tanzania is the pursuit of host plant resistance. This is principally sought in the application of selection pressure in crop breeding programs or in the selection of new varieties with stronger resistance to common pests.

49. Resistance to pests is the rule rather than the exception in the plant kingdom. In the co-evolution of pests and hosts, plants have evolved defence mechanisms. Such mechanisms may be either physical (waxy surface, hairy leaves etc.) or chemical (production of secondary metabolites) in nature. Pest-resistant crop varieties either suppress pest abundance or elevate the damage tolerance level of the plant. In other words, genetic resistance alters the relationship between pest and host. The inherent genetically based resistance of a plant can protect it against pests or diseases without recourse to pesticides. Moreover, to use it the farmer has no need to buy extra equipment or learn new techniques. Tanzanian crop breeders regularly select new varieties for their pest and disease resistance. For example, maize varieties (e.g. TMVI, Staha, Kilima) have been selected for resistance or tolerance to maize streak, the viral disease that causes significant yield loss to late planted maize. All of the cotton varieties produced at Ukiriguru had resistance to jassids since they have hairs to interfere with sucking insect pests. Varieties have

also been produced with varying degrees of resistance to fusarium wilt and bacterial blight. Rice varieties have been selected with resistance to RYMV.

50. Host plant resistance (HPR) is recognized in the new Plant Protection Policy as an invaluable component in IPM. Breeding and selecting for resistance to serious pest problems is an issue mandated to the National Agricultural Research programmes. These programmes have produced substantial results in terms of releasing varieties with necessary qualities and tolerance/resistance to a wide range of otherwise devastating pests of maize, sorghum and beans. Therefore, the Tanzania Plant Health and Pesticide Authority (TPHPA) has the capacity and infrastructure to contribute HPR materials to farmers given the necessary logistical support.

9.2 Cultural and Crop Sanitation Practices

51. Pests may also be controlled through the adoption of improved cultural and crop sanitation practices. Practices applied in Tanzania include:

- i) **Crop rotation:** This practice is used to depress weeds and/insect pests and diseases in some crops.
- ii) **Intercropping:** The field is used to grow two or more crops at the same time;
- iii) **Fallow:** The field is not cultivated for some years in order to control various parasitic weeds;
- iv) **Mulching:** This is covering of crop fields by dry grasses to control weeds and conserve soil moisture (e.g. in tomato field etc).
- v) **Hand pulling and hoes weeding:** These practices are the most common and being used by small-scale farmers.
- vi) **Fertilizer/manure application:** The application of nutrients in the form of either inorganic fertilizer or farm-yard manure reduces both the infestation of fields by weeds (e.g. Striga) and losses in crop yield.
- vii) **Use of disease free planting material** e.g. cuttings, etc.
- viii) **Thinning:** Done to reduce plant population in the field.

9.2 Physical and Mechanical Control

52. Physical and mechanical controls are measures that kill the insect pest, disrupt its physiology or adversely affect the environment of the pest. These differ from cultural control in that the devices or actions are directed against the insect pest instead of modifying agricultural practices. For examples, hand picking of fall armyworm from maize plants and American bollworm from tomato plants are the forms of physical control these measures will be applicable to BBT farms

9.4 Chemical Control

53. Although is used as a last resort chemical pesticides are applied in the control of outbreak pests like armyworms etc. Lists of registered pesticides in Tanzania can be found in the pesticides stock management system (psms) under the following link (<https://psms.tphpa.go.tz>) also it is recommended as a component of IPM packages. All of these pesticides are registered by The Plant Health Act, 2020 and Plant Health Regulations 2023.

9.5 Use of botanical pesticides

54. Assessment of botanical pesticides for pre and post-harvest is being done by a number of institutions in the country and some of the potential ones have been recommended for use in crop production (Paul *et al.* 2001). In beans, extracts of *Tephrosia vogelii* and *Neuratanenia mitis* have been recommended and farmers are using them because they are easily available and less costly. Where these do not occur naturally, farmers have also established the plants in their home gardens to ensure availability when needed.

55. The IPM project in Arusha in collaboration with IPM farmer groups and the extension staff has compiled a list of useful botanical pesticides (Table 10) that could be used on a wide range of vegetables and other food crops. The information is useful but has to be used with caution. Most of the botanical extracts are already in use by small-scale farmers as crude in-house preparations. However, they should be used with caution since *not all* botanical extracts are safe. Tobacco extract is one of the deadly substances and should therefore not be promoted for use on vegetable production. *Tephrosia* spp extract and leaves are toxic to fish (local fishermen use the leaves for fishing) and therefore should be used with caution.

56. None of the suggested botanical extracts (Table 10) are registered in Tanzania because they are not adequately researched. In particular, information on dosage rate, mammalian toxicity (LD₅₀), side effects on non-target organisms especially potential bio-control agents, biodegradation and reduce analysis data is not available. However, 3 neem-based and 2 pyrethrum-based commercial formulations are being processed for registration. These two botanicals have been researched and registered in Kenya and elsewhere.

Table 97. List of potential plants that can be used to prepare botanical extracts for pre and post-harvest pest control

Kiswahili name	English name	Scientific name
Mustafeli	Soursoap	<i>Annona muricata</i>

Mtopetope	Bull-oxheart	<i>A. reticulata.</i>
Mtopetope mdogo	Custard apple	<i>A. squamosa</i>
Vitunguu saumu	Garlic	<i>Allium sativa</i>
Mwarobaini	Neem	<i>Azadirachta indica</i>
Kishonanguo	Black Jack	<i>Bidens pilosa</i>
Pilipili kali	Chili	<i>Capsicum frutescens</i>
Mpapai	Pawpaw	<i>Carica papaya</i>
Mnanaa	Thorn apple	<i>Datura stramonium</i>
Mnyaa/utupa	Milk bush	<i>Euphorbia tirucalii</i>
Mchungu kaburi	Barbados nut	<i>Jatropha curcas</i>
Mwingajini	Wild sage	<i>Lantana camara</i>
Tumbaku	Tobacco	<i>Nicotiana spp</i>
Kivumbasi	Mosquito bush	<i>Ocimum suave</i>
Mbagi mwitu	Mexican marigold	<i>Tagetes spp</i>
Alizeti mwitu	Wild sunflower	<i>Tithonia diversifolia</i>
Utupa	Tephrosia	<i>Tephrosia vogelii</i>

Source: Paul (2000) and Madata (2001).

10.0 POLICIES AND STRATEGIES

10.1 National Agriculture Policy (2013)

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 - vi. Conduct of pest risk analysis (PRA);
 - vii. Ensure through appropriate procedures that the phytosanitary security of consignments after certification regarding composition, substitution and reinfestation is maintained prior to export;
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 - xi. Establishing procedures for accreditation of any post entry quarantine station, official analyst, official laboratory or any other person or institution;
 - xii. Carry out and promote the carrying out of bio-efficacy trials and analysis of pesticides;
 - xiii. Evaluate the fundamental aspects of pesticides application equipment and its applicability in relation to control of pests;
 - xiv. Evaluate pesticides residues to determine maximum residual levels;
 - xv. Approve the recommended use of pesticides for crop quality;
 - xvi. Conduct pesticides formulation analysis for quality assurance;
 - xvii. Register pesticides and bio-pesticides;
 - xviii. Licensing of pesticides and bio-pesticides dealers;
 - xix. Manage obsolete pesticides and pesticides empty containers;
 - xx. Regulate importation, exportation, manufacturing, distribution, sale and use of pesticides;
 - xxi. Establish and maintain a National Herbarium which shall coordinate and render services on the plant taxonomy and related subjects;
 - xxii. Maintain a pesticide poisoning node that shall feed into the National Poisoning Center;
 - xxiii. Promote Integrated Pest Management Approach;
 - xxiv. Set up mechanism for coordination and collaboration with relevant bodies to ensure effective compliance to the regional and international obligations on plant health; and
 - xxv. Such other functions as may be required for effective implementation of this

63. The Authority disseminates IPM approaches to farmers through the agricultural extension services. On the aspects of migratory pests and diseases, the Authority cooperates fully with the neighboring countries (through regional initiatives on outbreak of pests and control) in the collective effort to control the damage of such pests.

11.0 MITIGATION AGAINST CHEMICAL CONTROL MEASURES OF PESTS

64. The following measures are proposed to mitigate the potential adverse impacts likely to occur as a result of pesticide use in BBT block farms. The primary mitigation measures include: (i) training in safe and judicious pesticide use and management; (ii) delivery of a mix of Information Education and Communication approaches targeting farmers, pesticide operators and teams; (iii) provision of Personal Protective Equipment (PPE); (iv) training to farmers, and thorough and consistent supervision and monitoring. It is also important to have appropriate pesticide storage facilities and training and equipping health facilities with adequate exposure treatment drugs. Table 11 shows the proposed mitigation measures for various impacts that may arise due to application of pesticides in the catchment.

65. The BBT youth in all block farms will receive detailed training on the emergency steps to take if accidental exposure of the chemical occurs through ingestion, eye or dermal contact with the chemical. The following are basic first aid procedures that will be included in the training program as part of handling pesticide poisoning.

- i) Follow the first aid instructions on the pesticide label. Take the pesticide container or label to the doctor or medical practitioner if seeking medical assistance;
- ii) **For poison on skin:** remove contaminated clothing and drench skin with water, cleanse skin and hair thoroughly with detergent and water, and dry victim and wrap in blanket;
- iii) **For chemical burns:** remove contaminated clothing, wash with large quantities of running water, cover burned area immediately with loose, clean soft cloth (*Do NOT apply ointments, greases, powders or other medications to burn*).
- iv) **Poison in Eye:** wash eye quickly but gently, hold eyelid open and wash with gentle stream of clean running water for 15 minutes or more (*Do NOT use chemicals or medicines in the water; they may worsen the injury*);
- v) **Inhaled Poison:** carry victim to fresh air immediately, open all windows and doors, loosen tight clothing and apply artificial respiration if the victim is not breathing or victim's skin is grey or blue. If the victim is in an enclosed area, do not enter without proper protective clothing and equipment;
- vi) **Poison in mouth or swallowed:** rinse mouth with plenty of water, give victim large amounts (up to 1 liter) of milk or water to drink, induce vomiting only if the pesticide label instructs you to do so

Table 10. Mitigation measures to be employed by using various control methods at the farm level

Control method	Impacts (+ve or -ve)	Mitigation measure
<i>Cultural</i>		
Crop sanitation, mulching, pruning, thinning	<ul style="list-style-type: none"> - Improves the health of the crop and its ability to fight pests and diseases 	<ul style="list-style-type: none"> - No mitigation measure required
Weeding	<ul style="list-style-type: none"> - Improves soil condition and helps to minimize weed infestation - Pulling of weeds have minimum impacts to the environment 	<ul style="list-style-type: none"> - No mitigation measure required
Use of resistant varieties	<ul style="list-style-type: none"> - Use of herbicides can have negative impacts on environment - Use of pesticides is minimized and hence beneficial to environment 	<ul style="list-style-type: none"> - Use measures proposed under chemical control - Wear protective equipment while applying the chemicals - No mitigation measure required
<i>Mechanical</i>		
Use of weeders and tillage equipment	<ul style="list-style-type: none"> - Minimizes use of herbicides - Health and safety may be impacted if operators are not skilled 	<ul style="list-style-type: none"> - Use skilled manpower to operate the equipment - In case of accidents use proper procedures for treatment
Insect traps (light, pheromones, baits)	<ul style="list-style-type: none"> - Early detection of pests results in early application of pesticides before the situation becomes critical 	<ul style="list-style-type: none"> - No mitigation measure required
Manual weeding	<ul style="list-style-type: none"> - Involves no use of pesticides, hence friendly to environment - High labor costs - May impose danger to laborers (snake bites, etc) 	<ul style="list-style-type: none"> - If any accident occurs, rush the affected to hospital or nearby dispensary for treatment

Control method	Impacts (+ve or -ve)	Mitigation measure
Biological		
Application of biological control agents such as Bt (<i>Bacillus thuringiensis</i>), wasps, Entomopathogenic Fungi and Entomopathogenic nematodes.	<ul style="list-style-type: none"> - Cost effective - Involves no use of pesticides hence no environmental or health risks - Applied selectively against one or two pests - Takes long to generate results, hence cannot be used in emergency situations - Possibility of acquiring a new host if the old host is completely eliminated 	<ul style="list-style-type: none"> - If the situation of acquiring new host arises, try to establish the minimum population required for survival - Ensure the biological agents do not get out of control
Botanical extracts (<i>neem</i> , <i>tephrosia</i>)	<ul style="list-style-type: none"> - Friendly to the environment - Application rates are based on estimates. Usually preparation of extracts need a lot of material (such as leaves) for one application 	<ul style="list-style-type: none"> - Try to establish an effective application rate
Chemical		
Lack of knowledge on the toxicity of pesticides to transporters and those involved in application	<ul style="list-style-type: none"> - Exposure to humans through inhalation, ingestion or dermal contact 	<ul style="list-style-type: none"> - Train store keepers, transporters and all those involved with handling of pesticides. Training should be in the aspects of toxicity, steps to be taken in case of accidents or emergency, combustibility and handling of vehicle contamination - Female farmers who will be handling pesticides must be warned of the possibility of fatal exposure - Use of drugs recommended for treatment of exposure - The farmers must be advised to use protective equipment
	<ul style="list-style-type: none"> - High costs of PPEs which makes farmers reluctant to purchase them 	<ul style="list-style-type: none"> - Provide Personal Protective Equipment (helmet, respirators, overalls, gloves and rubber boots) or protective

		<p>clothing (long legged trousers, long sleeved shirts, boots and wide brimmed hat)</p> <ul style="list-style-type: none"> - Train on how to use and the benefits of using such gear
Indiscriminate disposal of pesticide containers	<ul style="list-style-type: none"> - Risks of containers being used by other persons and children 	<ul style="list-style-type: none"> - Containers should never be used to carry anything else apart from the intended formulation - Containers not to be used in households - Follow container disposal procedures provided by TPHPA. - Use authorized and registered hazardous waste disposal by NEMC
Water contamination	<ul style="list-style-type: none"> - Health risks to humans - Impacts on biodiversity (birds, bees, fish) - Impacts on amphibians - Reduced densities of beneficial species 	<ul style="list-style-type: none"> - Train farmers on health risks associated with improper use of chemicals - Regular monitoring of water quality. Check the presence of Organochlorines and other pesticides to determine if a lethal dose has been reached

12.0 SPECIFIC PEST MANAGEMENT MEASURES

12.1 Rules for Safe Handling of Pesticides

66. All pesticides are poisonous and thus rules have to be observed to avoid human health impairment and environmental pollution. In addition to material safety data sheet (MSDS) accompanied with any given pesticide, the following general rules will have to be observed:

- i) Keep only closed original containers with labels.
- ii) Keep pesticides under lock and key in a cool, dry and ventilated place away from fire, food, feed, water and out of reach of children. In the same room also the spraying equipments can be stored.
- iii) Pesticides should be shelved and the floor be of cement to be able to detect leakage and clean it early enough where applicable.
- iv) Equipment for weighing and mixing pesticides should only be used for this purpose and be locked in the store.
- v) Protective clothing should be used only for spraying purposes.
- vi) Absorb spillage immediately with sawdust or earth; sweep up, burn or bury. Have cement floor for better cleaning.
- vii) Do not re-use empty containers. Empty containers should be burnt if possible or crushed and bury in a sanitary landfill.
- viii) Use a well aerated store and sales room.
- ix) Instruct your personnel on safety precautions before it is too late.
- x) Make contacts to a qualified physician for emergencies.

67. In view of the above, the use of Protective Equipment and capacity building on pesticide management aspects will be critical.

13.0 IMPLEMENTATION STRATEGIES OF IPM UNDER BBT

68. This IPMP will address the Project needs to monitor and mitigate possible negative impact of any increase in the use of agrochemicals, particularly chemical pesticides by promoting ecological and biological control of pest management. This will be implemented through four main activities.

(i) First, a set of planning workshops will be implemented to ensure that key implementing agencies are fully aware of the objectives of the IPMP, the work plans and budgets proposed and the outcomes expected. Specific tasks will be allocated to specific individuals or groups of individuals. These will be followed by annual review workshops supporting the discussion and documentation of field logistics, implementation lessons in the targeted Project regions;

(ii) Second, the project will support four levels of IPM training. Level one will be the training of technical staff in IPM techniques and pesticide management based on cropping systems. Level two will support training of trainers who are expected to carry a prioritized selection of these messages to the youth/farmers. Level three will support

the training of youth/farmer groups. To the extent possible, this will be integrated into the participatory testing of new cropping technologies being promoted by BBT. Level four will promote broader awareness of the Tanzania Plant Health and Pesticides Authority (TPHPA) Act of 2020 and associated regulations among BBT Block farms extension personnel and also among shopkeepers selling pesticides.

13.1 Capacity building at national level (optional)

69. To build the capacity of individuals participating in a national-level pest management project, a comprehensive approach is essential. Initiate tailored training programs covering diverse aspects of pest management, including pest identification, monitoring techniques, and the application of integrated pest management (IPM) strategies. Incorporate practical field demonstrations, workshops, and simulation exercises to reinforce theoretical knowledge. Develop specialized modules addressing the unique challenges and contexts at the national level, ensuring participants are well-equipped to adapt strategies to local conditions. Encourage the use of cutting-edge technologies and data-driven decision-making through workshops on data collection, analysis, and the utilization of decision support systems. Foster collaboration and networking among participants, establishing a community of practice where knowledge and experiences can be shared. Implement continuous learning mechanisms, such as mentorship programs and access to relevant resources, to support ongoing professional development. Regular monitoring and evaluation of individual and collective progress will enable the identification of areas for improvement, ensuring sustained and effective capacity building within the framework of the national pest management authority.

1.4.0 MONITORING AND EVALUATION ARRANGEMENT

67. Successful implementation of IPMP will require regular monitoring and evaluation of activities undertaken by individual youth in block farms. It is also crucial to evaluate the prevailing trends in the benefits of reducing pesticide distribution, application and misuse as well as the progress in national policy reform regarding IPM implementation and regulatory control on handling and use of pesticides. New situations on pesticides risks that arise during project implementation should also be monitored. The indicators that require regular monitoring and evaluation during the programme implementation include the following:

- i) The IPM capacity building for youth;
- ii) Numbers of youth who have adopted IPM practices as crop protection strategy in their crop production efforts; evaluate the rate of IPM adoption;
- iii) Economic benefits: increase in crop productivity due to adoption of IPM practices; increase in revenue resulting from adoption of IPM practices, compared with conventional practices;
- iv) Numbers of IPM networks operational and types of activities undertaken;
- v) Efficiency of pesticide use and handling and reduction in pesticide poisoning and environmental contamination;
- vi) Levels of reduction of pesticide use and handling and reduction in pesticide poisoning and environmental contamination;

- vii) Pesticide residues in groundwater or in surface water downstream from irrigation schemes;
 - viii) Pesticide residues in food (e.g.: crops, drinking water, fodder, livestock) Impact on non-target organisms (e.g.: beneficial insects, fish and other aquatic life, wildlife, non-target crops and plants through herbicide drift).
 - ix) Overall assessment of activities that are on-going according to plans; activities that need improvement; and remedial actions required.
68. The above indicators will have to be appropriately made part of Environmental and Social Management Plan (ESMP) and Environmental Monitoring Plan (EMP) for any individual category A or B subproject. The ESMP include monitoring measures, parameters to be measured, sampling methods to be used, sampling locations, analytical techniques to be used, frequency of measurements, recording of data, data analysis, and dissemination of information collected and decision reached. The ESMP and EMP will define thresholds that will signal the need for corrective actions.

14.0 ACTIVITIES AND BUDGET

14.1 Activities

69. A comprehensive approach to Integrated Pest Management (IPM) project implementation involves a range of relevant activities aimed at building the capacity of direct actors. Firstly, training workshops should be organized to cover theoretical aspects of IPM, focusing on pest identification, monitoring, and the application of biological control methods. Practical sessions and field demonstrations can enhance participants' hands-on skills. Implementing community-based extension services is crucial for effective knowledge dissemination, involving direct actors in communication strategies and stakeholder engagement. Incorporating data collection and analysis workshops empowers participants to make informed decisions based on scientific evidence. Moreover, establishing demonstration farms provides tangible examples of IPM practices, allowing for experiential learning. Ongoing collaboration, networking opportunities, and knowledge exchange forums contribute to a community of practice. Finally, continuous monitoring and evaluation activities, coupled with adaptive management approaches, ensure that direct actors can assess the effectiveness of IPM strategies and make necessary adjustments, fostering sustainable pest management practices. By incorporating these activities into an integrated pest management project, you can enhance the knowledge, skills, and confidence of direct actors, ultimately promoting sustainable and effective pest management practices.

i) **Activity 1: Awareness raising**

70. The implementation of this IPMP will be supervised by the designated officers in charge of safeguards management in the Project Coordination Unit (PCU) and the Staff of Environmental Management Unit of the MoA. The two safeguards managers will organize the initial workshops to discuss the implementation of the IPMP, and annual review workshops to assess progress in implementation, in coordination with the Project Coordination Unit.

ii) **Activity 2: Training and capacity building**

71. The training efforts at the core of the project commitment will require collaboration across multiple institutions involved in organizing training curriculum and in administering the training. To the extent possible, this is expected to be a participatory process. The success of IPM largely depends on developing and sustaining institutional and human capacity to facilitate experiential learning for making informed decisions in integrating scientific and indigenous knowledge to solve block farm specific problems. Poor communication between Youth/farmers, extension agents and researchers has often led to poorly-targeted research or to poor adoption of promising options generated by research.

iii) Activity 3: Monitoring and Evaluation

72. The Environmental Safeguards (E&S) Officer will be responsible for guiding the implementation of the monitoring and evaluation activities of the IPMP. The Officer is expected to participate in the drafting of the baseline survey, and the end of project survey, assuring inclusion of relevant questions on pest management practices, agro-chemical use and pesticide management. The E&S Officer is expected to participate in each of the monthly implementation support site visits.

14.2 Budget

73. The BBT project will take responsibility for implementation of a separate but coordinated work plans and budgets under the BBT. The IPM will be supervised by the Environmental and Social Safeguards Officer who is a member of the Project Coordination Team and will closely collaborate with the Environmental Management Unit of MoA.

Table 11: Proposed Budget for IPM Implementation

OUTPUT/ACTIVITY	TIMEFRAME					RESPONSIBLE	COST ESTIMATES (USD)
	YR 1	YR 2	YR 3	YR 4	YR 5		
Output 1.0: Capacities of Extension Officers/Block Farms Managers and Youth to promote and adopt IPM approaches and safe use of pesticides in BBT Block farms							
Activity 1.1: Prepare, print and disseminate popular and/or Swahili versions IPM guidelines on safe use and handling of pesticides; and Community Based Forecasting for outbreak pests (e.g. armyworm, rats etc)						TPHPA, EMU, PCU	25,000
Activity 1.2: To facilitate short courses trainings/workshops for PCU/EMU implementers on IPM related issues so as to improve knowledge and skills						TPHPA, EMU, PCU	20,000
Activity 1.3: To conduct Youth/farmer training to disseminate the IPM technologies and safe practices in the use of pesticides and other agro-chemicals in the BBT project areas						TPHPA, EMU, PCU	20,000
Activity 1.4: Organize field trips and study tours at National, District and farmer level to observe the successful IPM practices for controlling major Crop pests in other areas						TPHPA, EMU, PCU and LGAs	30,000
Activity 1.5: Conduct monitoring and evaluation of BBT-IPMP implementation						PCU and TPHPA	10,000
GRAND TOTAL							105,000

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Annex 1 Grievances Redress Mechanism

The establishment of effective grievance mechanisms is paramount for the successful implementation of Integrated Pest Management (IPM) initiatives. A multi-tiered approach should be considered, beginning with local-level grievance committees comprised of community representatives, extension workers, and relevant stakeholders. These committees can serve as accessible forums where farmers and community members can voice concerns and seek resolutions. Additionally, a centralized helpline or online platform could be established to provide a direct channel for reporting grievances. Training sessions should be conducted to raise awareness about the grievance mechanisms, ensuring that direct actors are well-informed about the process. Regular monitoring and evaluation can help identify potential issues and refine the grievance mechanisms over time, contributing to a responsive and adaptive system that enhances community engagement and satisfaction in the context of IPM implementation. Implementing a combination of these grievance mechanisms can help create a transparent and responsive system that addresses community concerns and contributes to the success and sustainability of the IPM project.

Annex II: Names of experts preparing the IPMP

Name	Title/Profession	Organization
Maneno Chidege	Quality Assurance Officer (Plant Health and Pesticides)	Tanzania Plant Health and Pesticides Authority- Arusha
Eng. Lait A. Simukanga	EIA Expert	Consultant
Ms Aneth Kasabago	Environmental Officer	Environmental Management Unit (MoA)
Method Kahango	Agriculture Officer	BBT Secretariat (MoA)

Annex III: List of Pesticide Registered for Use in Tanzania 2024

Lists of registered pesticides use in Tanzania by The Tanzania Plant Health and Pesticides Authority (TPHPA), January, 2024.

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
1	Gugumagic 10% EC	Metolochlor 10% EC	Herbicides	HE/0462	Pre-emergency herbicide for SIMSIM and SUNFLOWER	Hangzhou Agrochemical (T) Ltd
2	Haraka 80WP	Fosetyl - Aluminium 800g/kg	Fungicides	FU/0526	Control of Late Blight Diseases of Tomatoes	Equatoria Africa Limited
3	jemedari 570EC	chlorpyrifos500g/l+cypermethrin50g/l+indoxacarb20g/l	Insecticides	IN/1235	control of sucking Pests and Bollworm on Cotton	TAJ PVT TANZANIA LIMITED
4	Link Super 76WP	Propineb 70%+Cymoxanil 6%	Fungicides	FU/0450	Control of Blight, Anthracnose, Scab Diseases Downy Mildew And Rust on Tomatoes , Potatoes, Chill, Cucumber and Cabbage	Link Forward Co Ltd
5	MAGUGUM A UNGA	NICOSULFURON 4% GR	Herbicides	HE/0328	Control new germinated broad leaf and grasses on MAIZE	Hangzhou Agrochemical (T) Ltd
6	Maizin 200 OD	Nicosulfron 4% + Dicamba 7% + Fluroxypr 9%	Herbicides	HE/0797	For control of Grasses and broadleaved weeds on Maize	Suba Agro Trading and Engineering Co Ltd
7	Masterquat 276 SL	Paraquat 276g/l SL% Dichloride	Insecticides	RE/0219	Control of Broad Leaved and grassy weed in Maize	BAREFOOT INTERNATIONAL LIMITED
8	Mefeni 350 SC	Thiamethoxam 20.5% + Bifenthrin 14.5%	Insecticides	IN/1354	Control of Helicoverpa armigera, Jassids Aphids on Cotton and Cabbage	Meru Agro-Tours and Consultants Co. Ltd, Tanzania
9	Metocy 22EC	Thiamethoxam 12.6% + Lambdacyhalothrin 9.4%	Insecticides	IN/1374	Control of cashew sucking pests	Suba Agro Trading and Engineering Co Ltd

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
10	MO-BAKONER 720SC	CHLOROTHALONIL 720g/l	Fungicides	FU/0196	Control of fungal diseases on HORTICULTURAL crops.	Chongqing Shining Fine Chemicals co Ltd
11	MO-KARATEP 5% EC	LAMBDA CYHALOTHRIN 50g/l	Insecticides	IN/0500	Control of various insect pests in HORTICULTURAL crops and Insect pests in COTTON	Chongqing Shining Fine Chemicals co Ltd
12	MOVIL 5 EC	Hexaconazole 50g/l	Fungicides	FU/0284	Control of fungal diseases in HORTICULTURAL crops and powdery mildew in CASHEW	Chongqing Shining Fine Chemicals co Ltd
13	MR X-IT AEROSOL (Lemon Fresh)	D-Allethrin	Insecticides	IN/1350	Control of Flying and Crawling insect (Mosquitoes Flies and Cockroaches)	VERONICA NATHALIS BANZI
14	MR X-IT AEROSOL (Orange Fresh)	D-Allethrin	Insecticides	IN/1349	Control of flying and Crawling insect (Mosquitoes Flies and Cockroaches)	VERONICA NATHALIS BANZI
15	MR X-IT INCENSE STICK	Citronella 5%	Insecticides	IN/1351	Control of Mosquitoes	VERONICA NATHALIS BANZI
16	MUNDEZOLE 5 SC	HEXA CONAZOLE 50 G/L	Fungicides	FU/0653	CONTROL OF POWDERY MILDEW ON CASHEW	TAJ PVT TANZANIA LIMITED
17	Nemox 780 WP	Propineb 700g/Kg + Cymoxanil 80g/Kg	Fungicides	FU/0478	Control of late blight diseases on Potatoes	Meru Agro-Tours and Consultants Co. Ltd, Tanzania
18	Pilarcopper 545 SC	Copper hydroxide 545g/L	Fungicides	Fu/0715	Control of bacterial blight of pepper, control of anthracnose in avocado; Control of early blight in Tomato and Potato; Control of	Pilarquim (Shanghai) Co. Limited - China

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
					late blight in Tomato and Potato.	
19	Pilarfast 37 OD	Florasulam 3.7g/l+Pinoxaden 33.3g/l	Herbicides	HE/0818	Control of Grass and Broad Leaf Weeds on Wheat and Barley	Pilarquim (Shanghai) Co. Limited - China
20	Pilarmaize 30% OD	Atrazine 20%+Mesotrione 7%+Nicosulfuron 3%	Herbicides	HE/0815	Weed control in maize.	Pilarquim (Shanghai) Co. Limited - China
21	Pilarnova 300 OD	Atrazine240g/l+Nicosulfuron45g/l+Topramezone15g/l	Herbicides	HE/0817	Control of grasses broadleaf and Sedges Weed in Maize	Pilarquim (Shanghai) Co. Limited - China
22	Pomex 500EC	Oxyfluorfen 5% + Metolachlor 30% + Pendimethalin 15%	Herbicides	HE/0803	Control of broadleaved and annual grass weeds on onion	Meru Agro-Tours and Consultants Co. Ltd, Tanzania
23	Power-Dhibiti 250SC	Picoxystrobin 250g/L	Fungicides	FU/0709	Control of Cashew leaf and nut blight and powdery mildew disease on CASHEW	Mak David Company Limited
24	Power-Kanto 300SC	Picoxystrobin 220g/L + Cyproconazole 80g/L	Fungicides	FU/0708	Control of cashew leaf and nut blight and powdery mildew disease of CASHEW	Mak David Company Limited
25	Power-Maliza 320SC	Tebuconazole 200g/L + Trifloxystrobin 120g/L	Fungicides	FU/0710	Control of cashew leaf and nut blight and powdery mildew disease of CASHEW	Mak David Company Limited
26	Power-Mectin 30EC	Abamectin 20g/L + Emamectin Benzoate 10g/L	Insecticides	IN/1362	Control mealybugs on CASHEW	Mak David Company Limited
27	POWER-METHRIN 150SC	Thiamethoxam 100g/L + Deltamethrin 50g/L	Insecticides	IN/1363	Control of aphids, thrips, Jassids, and bollworms in COTTON	Mak David Company Limited
28	Power-Tokomeza 550EC	Chlorpyrifos 500g/L + Lambda-cyhalothrin 50g/L	Insecticides	IN/1364	Control of Mealybugs in CASHEW	Mak David Company Limited

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
29	Praxprid 80%WDG	Fipronil 40% + Imidacloprid 40%	Insecticides	IN/1087	Control of Diamond Back Moth on Cabbages	FAT P INVESTMENT LIMITED
30	Proma 590SC	Propamocarbhydrochloride 500g/l + Dimethomorph 90g/l	Fungicides	FU/0717	Control of powdery mildew disease on Cashew	Suba Agro Trading and Engineering Co Ltd
31	RAPID-ATTACK 344EC	Cypermethrin 144g/l + Imidacloprid 200g/l	Insecticides	IN/0456	Control of various insect pests on HORTICULTURAL crops and Insect pests in COTTON	Chongqing Shining Fine Chemicals co Ltd
32	Ridax Mosquito Coil	Meperfluthrin 0.08%	Insecticides	IN/1342	Control of Mosquito	Firefly Technology Company Limited
33	Ridimu 80 EC	Abamectin 2% + Acetamiprid 6%	Insecticides	IN/1346	The Control of Leaf Miners (Tuta Absoluta) in Tomato and Fally army worms on Maize	Meru Agro-Tours and Consultants Co. Ltd, Tanzania
34	Rilofu 110 OD	Rimsulfuron 2.5% + Quizalofop - P - ethyl 8.5%	Herbicides	HE/0804	Control of Weeds on Potatoes.	Meru Agro-Tours and Consultants Co. Ltd, Tanzania
35	ROCKET 221 ZC	THIAMETHOXAM 12.6%+LAMBDA CY HALOTHRIN 9.5%	Insecticides	IN/1236	CONTROL OF SUCKING PESTS AND BOLLOWORM ON COTTON	TAJ PVT TANZANIA LIMITED
36	RURUKA 70WDG	SULPHUR 690G/KG+EMAMECTIN BENZOATE 10G/KG	Insecticides	IN/1218	AGAINST FALL ARMYWORM IN MAIZE,TANZANIA	Suba Agro Trading and Engineering Co Ltd
37	Snow Burner Pro 290 OD	Nicosulfuron 40g/l+Terbutylazine 200g/l+Tembotrione 50g/l	Herbicides	HE/0809	Selective Herbicide For The Control of Annual Grasses and Broad Leaf Weeds in Maize and Sugar Cane	Positive International Limited

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
38	Snow Kono Bait	Metaldehyde 4%		MO/002	Control bait for snails in CABBAGE	Positive International Limited
39	Snow Sate 612 SL	Glyphosate 612 SL	Herbicides	HE/0811	Broad Spectrum Systematic, Non-Selective Post Emergence Herbicides For The Control of Annual and Perennial Weeds in Coffee and Non Cropped Areas and before Drilling and Planting any Crop	Positive International Limited
40	Snow Zole 150 SC	Hexaconazole 50g/l+Azoxytrobilin 50g/l+Cyperconazole 50g/l	Fungicides	FU/0711	Fungicides Control of Leaf rust, Leaf Blight Powdery Mildew on Wheat and Maize	Positive International Limited
41	Snowbecco Plus 220 ZC	Lambdacyhalothrin94 g/l+Thiamethoxam 126g/l	Insecticides	IN/1369	Control of Fall Army Worm in Maize and Aphids in Tomatoes	Positive International Limited
42	Snowmite 240 SC	Bifenazate 240 g/l	Insecticides	IN/1368	For The Control of Spider mits in Tomato and Thrips in Onions	Positive International Limited
43	Solo sulf	Sulfur dust 99.9%	Fungicides	FU/0684	Control Powdery Mildew disease on cashew	SOLAR CHEMFERTS PVT. LTD
44	Suraconazole 320SC	Trifloxystrobin 110g/l + Tebuconazole 210g/l	Fungicides	FU/0700	Control blight diseases on Cashew	Sura International Agrochemicals
45	Taifa Sulfur	Sulphur 99.9%	Fungicides	FU/0675	Control of Powdery mildew on cashew	ELEMENTS LIMITED
46	Topstrobilin 310 SC	Azoxytrobilin 310g/L	Fungicides	FU/0701	For control of Leaf and Nut Blight Disease	Sura International Agrochemicals
47	Trairam 300 SL	Triclopyr 200g/L + Picloram 100g/L	Herbicides	HE/0491	For Control of Unwanted Timber, Shrubs and Broad Leaf Weeds.	Meru Agro-Tours and Consultants Co. Ltd, Tanzania

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
48	Tri - Amine 2 4d 720SL	2 4D 720g/L	Herbicides	HE/0543	Control of Annual Weeds on Wheat and Barley	Equatoria Africa Limited
49	Tripinil 600 EC	Thiobencarb 40% + Propanil 20%	Herbicides	HE/0542	Control of Weeds on Rice	Equatoria Africa Limited
50	TWIN 75 WP	Mancozeb 63g/kg+Carbendazim 12g/kg.	Fungicides	FU/0719	Control of later blight on tomato.	ETG INPUTS LTD
51	Vuna - Clon 600 SC	Aclonifen 600 g/L	Herbicides	HE/0799	Control of weeds in Carrots and Potatoes	Asiatic Agricultural Industries Pte Ltd Singapore
52	Weedover	Diuron 45% EC	Herbicides	HE/0089	None selective herbicide control on SHRUBS, REDGROWED TRUNKS, WILD TREES, PERENIAL GRASS and BROAD LEAVED WEEDS on none Agriculture land	Hangzhou Agrochemical (T) Ltd
53	WEEDUP 11%SL	GLUFUSONATE 11%SL	Herbicides	HE/0018	None selective herbicide work on contact to kill available BROAD LEAVED WEEDS and GRASS for land preparation use	Hangzhou Agrochemical (T) Ltd
54	ZAK-SETI 480 SL	Glyphosate IPA 480 g/l	Herbicides	HE/0806	Control of Annual and Perennial Weeds in a non-Crop area	AGRINATURE COMPANY LIMITED
55	Agroban 480 EC	Chlorpyrifos 480 g/l	Insecticides	IN/1386	Control of Sucking insects and Chewing insects on Tomato	Dirma Holding (T) Ltd
56	AMABEANS 24% EC	Bentazone 15% + Quizalofop - p-ethyl 2% + Fomesafen 7%	Herbicides	HE/0819	Post control of weeds in beans	Amarshal Agrochemical Limited
57	Amazima 500SC	Ametryn 250 g/l + Atrazine 250g/l	Herbicides	HE/0764	Control of Grasses and Broadleaved weeds in Sugarcane	Shandong Weifang Rainbow

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
						Chemical Company Limited
58	AMAZINE 660 SC	Metolachlor 290g/L + Atrazine 370g/L	Herbicides	HE/0820	Control of broad and annual weeds in maize field	Amarshal Agrochemical Limited
59	Attackan 344EC	Imidacloprid 200g/l + Cypermethrin 144g/l	Insecticides	IN/1297	Control of Chewing and Sucking Insect Pests on Cotton	ELEMENTS LIMITED
60	Balstar 5 SC	Bifenthrin 5%	Insecticides	IN/1387	Control of Termites in Wood and Soils	Hegatron Limited
61	Balton Azoxy Plus 133 SC	Azoxystrobin 200g/l+Difenoconazole 125g/l	Fungicides	FU/0713	Control of Sheath Blight (Rhizoctonia solani) in Rice	BALTON TANZANIA LTD
62	Balton Nico Plus 87 OD	Nicosulfon 60g/l+Mesotrione 7%+Atrazine 20%	Herbicides	HE/0812	Pre- Emergence Control of Weeds on Maize	BALTON TANZANIA LTD
63	Balton Tebu 250 SC	Tebuconazole 250 g/l	Fungicides	FU/0712	Control of Alternaria leaf Spot in Apple	BALTON TANZANIA LTD
64	Bastnate Plus 200 OD	Flumioxazin 15g/l + Glufosinate ammonium 185g/l	Herbicides	HE/0767	Post- Emergence herbicide for the control of annual, perennial grass and broadleaf weeds in uncultivated areas	Shandong Weifang Rainbow Chemical Company Limited
65	Beanslin 24% EC	Bentazone 15%+Quizalofop-p-ethyl 2%+Fomesafen 7% EC	Herbicides	HE/0822	Post Control of Weeds in Beans	Fakulin Agriculture Limited
66	BENARMY 1 20SC	LUFENURON 100G/L+ EMAMECTIN BENZOATE 20G/L	Insecticides	IN/1054	Control of Tuta Absoluta on TOMATO	Bens Agrostar co. ltd
67	Bestrole 200SC	Chlorantraniliprole 200g/l	Insecticides	IN/1300	Control of Tomato Leafminers (Tuta absoluta)	Shandong Weifang Rainbow Chemical

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
						Company Limited
68	BULDOZA 480SL	Glyphosate 480g/L	Herbicides	HE/0834	Broad and narrow weeds.	Agribase Bioscience International (T) Ltd
69	Byter King 72 WP	Mancozeb 640g/kg+Metalaxyl80 g/kg	Fungicides	FU/0707	For The Control of Downy Mildew Grapes and Early and Late Blight Disease in Tomatoes, Potatoes	BYTER CROP PROTECTION COMPANY TANZANIA LIMITED
70	BYE BYE MOSQUITO REPELLENT STICKS	Citronella oil,lemon grass oil, wood power, Bamboo sticks,perform	Insecticides	IN/1388	Control of Mosquitoes	Sungura Commodity Enterprises
71	Byter Makovu 1.0% GR	Bifenthrin 0.5%+Clothianidim 0.5%	Insecticides	IN/1359	For Control of Grab and Cutworm in Tomatoes and Potatoes	BYTER CROP PROTECTION COMPANY TANZANIA LIMITED
72	Byter Ninja 15% SC	Lambdacyhalothrin 5%+imidacloprid 10%	Insecticides	IN/1358	For Control of Aphids Thrips and Jassids in Wheat and Cotton	BYTER CROP PROTECTION COMPANY TANZANIA LIMITED
73	Byter Wildfire 32.4% SL	2,4-D Acid 2.4%+ Glyphosate 30%	Herbicides	HE/0807	Post Emergence and Non Selective herbicides For Weed Control in Uncultivated Areas	BYTER CROP PROTECTION COMPANY TANZANIA LIMITED
74	Conductor 480EC	Clomazone 480g/l	Herbicides	HE/0763	Control of Weeds in Rice	Shandong Weifang Rainbow Chemical Company Limited
75	DD FORCE	Tetramethrin 0.3% + Cypermethrin 0.3%	Insecticides	IN/1402	Control of flying and crawling insects on households.	Jubaili Agrotec Tanzania

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
76	Dekker Dudu swirskii	Amblyseius swirskii	Insecticides	BCA/IN/0026	For management of thrips on chrysanthemums	DEKKER CHRYSANTHEMUMS TANZANIA LTD.
77	Dekker Dudu Atheta	Athetacoriaria	Insecticides	BCA/IN/0028	For management of thrips on chrysanthemums	DEKKER CHRYSANTHEMUMS TANZANIA LTD.
78	Dekker Dudu Californicus	Amblyseius californicus	Insecticides	BCA/IN/0027	For management of thrips on chrysanthemums	DEKKER CHRYSANTHEMUMS TANZANIA LTD.
79	Dekker Dudu Cucumeris	Amblyseius cucumeris	Insecticides	BCA/IN/0029	For management of thrips on Chrysanthemums	DEKKER CHRYSANTHEMUMS TANZANIA LTD.
80	Dirasate 480 SL	Glyphosate 480 g/l	Herbicides	HE/0823	For Control of Perennial and Annual Weeds in Maize grown Under Minimum tillage	Dirma Holding (T) Ltd
81	Diraquate 20 SL	Paraquate Dichloride 200 g/l	Herbicides	HE/0824	Control of Weeds in banana orchards	Dirma Holding (T) Ltd
82	Fakutin 5% EC	Abamectin 2%+Acetamiprid 3% EC	Insecticides	IN/1383	Control of Thrips on Onions	Fakulin Agriculture Limited
83	Fennut 3.3% EC	Quizalofop-p-ethyl 33g/l	Herbicides	HE/0488	For control weeds in PEANUTS	Hangzhou Agrochemical (T) Ltd
84	Geo 2,4-D Amine 720 SL	2,4-D Amine Salt 720 g/L	Herbicides	HE/0656	Control of Broadleaved Weeds on Maize, Rice and Sorghum	BioQuest International Private Limited
85	Glyphosnow Plus 310 SC	Saflufenacil 10g/l+Glyphosate 300g/l SC	Herbicides	HE/0810	Non Selective Herbicide For The Control of Annual and Perennial grasses and Broadleaf weeds on Non Crop Land	Positive International Limited

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
86	Gugu Stop 500 EC	Pretilachlor 500 EC	Herbicides	HE/0837	Pre- Emergence Herbicides For Control of Narrow and Broad leaved weeds in Rice	Bukoola Chemical Industries Ltd
87	HARROW 480 SL	Glyphosate 480g/L	Herbicides	HE/0826	Control of weeds in non-crop area.	EVOLVE AGRI SCIENCE LIMITED
88	JAZZ 40% WP	Mancozeb 200g/kg + Carbendazim 200g/kg	Fungicides	FU/0723	Control of Late blight in Potatoes Against false Smut and Blast diseases of Rice in lowland cultivations in Tanzania	Agribase Bioscience International (T) Ltd
89	KAMANDA 537.5SE	Mesotrione 37.5g/L + S-metolachlor 375G/L + Terbutylazine	Herbicides	HE/0833	Broad and narrow weeds in Maize field.	Agribase Bioscience International (T) Ltd
90	Kiboko Super dust	Pirimiphos-methyl 1.8%+Thiamethoxam 0.4%	Insecticides	IN/1385	Control of Larger grain borer (Truncatus and Other Primary Storage insect Pests	Dirma Holding (T) Ltd
91	Lastrole Plus 150ZC	Chlorantraniliprole 100g/l + Lambdacyhalothrin 50g/l	Insecticides	IN/1299	Control of Fall Army Worms in Maize	Shandong Weifang Rainbow Chemical Company Limited
92	Mali 242EC	Lambdacyhalothrin 200g/l + Thiamethoxam 141g/l	Insecticides	IN/1298	Control of Key Insect Pests of Cotton	ELEMENTS LIMITED
93	Metafur 120 EC	Acetamiprid 100g/l+ Abamectin 20 g/l	Insecticides	IN/0868	Control of Diamond back Moth on Cabbages	Equatoria Africa Limited
94	NANO GOLD 280 WP	Thiocylam hydrogen oxalate 250kg/Kg + Acetamiprid 30g/Kg	Insecticides	IN/1396	Control of leaf Miners (Tuta absoluta) in Tomato and fall Armyworms on Maize	Agribase Bioscience International (T) Ltd

No.	Trade Name	Common Name	Type	Registration Number	Usage	Registrant
95	Nicogold 60 OD	Atrazine 200g/l + Nicosulfuron 400g/L	Herbicides	HE/0827	Control of annual broadleaf and annual grass weeds in MAIZE	KESAI EAGROW TANZANIA LIMITED
96	Nitron 105 OD	Mesotrione 75g/l+Nicosulfuron 30g/l	Herbicides	HE/0838	Pre- Emergence Herbicides Control of Grass and Broad Leaves Weeds on Maize	Bukoola Chemical Industries Ltd
97	NO PEST 60% WG	Chlorantraniliprole 48% + Emamectin 12%	Insecticides	IN/1389	Control of Rice leaf roller in RICE	KESAI EAGROW TANZANIA LIMITED ,
98	Novaquat 200 SL	Paraquat 200 g/l	Insecticides	RE/0222	Control of Annual and Perennial Weeds	SATONOVA LIMITED
99	Novasate 480 SL	Glyphosate IPA 480 g/l	Herbicides	HE/0835	Control of Annual and Perennial Grasses	SATONOVA LIMITED
100	Pilar Tiger 14%	Abamectin 4% + Chlorfenapyr 10%	Insecticides	IN/1397	Control of Tuta absoluta in tomato	Pilarquim (Shanghai) Co. Limited - China