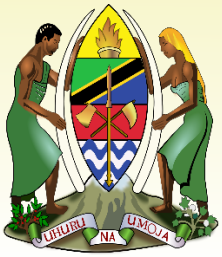
UNITED REPUBLIC OF TANZANIA

MINISTRY OF NATURAL RESOURCES AND TOURISM

FORESTRY AND BEEKEEPING DIVISION

GUIDELINE FOR MANAGEMENT AND USE OF HONEYBEE COLONIES FOR POLLINATION SERVICES IN TANZANIA

MAY 2022



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PREFACE

Beekeeping is widely recognized for its contribution to environmental conservation and socio-economic development. It has recently acquired much attention due to its significant role in enhancing food security and household income through Managed Pollination Service (MPS).

Most plants and food crops rely on animal pollinators. Insects, particularly bees are the most effective pollinators of agricultural and horticutural crops. However, there is growing evidence indicating an alarming decline in diversity and abundance of pollinators due to degradation of natural habitats, excessive use of chemical pesticides and climate change, which has a negative impact on crop production.

With a decline in naturally occurring pollinators, animal pollination particularly honeybee has assumed an increasingly important role as pollination-service providers both in agriculture and forestry. MPS is therefore an emerging novel enterprise that enhance pollination of crops, by increasing the yielding and quality of crop production. This practice is vital in addressing the global food challenges as well as wood demands considering the growing human population which is estimated at 7.9 billion people in 2022.

MPS is also widely practiced in Tanzania. A good number of farmers and enterpreners are engaged in the practice through the use of honeybee colonies in pollination services in order to increase the quality of crop production. However, this practice is unregulated and hence the need for these Guidelines in order to set the required standards and procedures on how to use and manage the honeybee colonies for the purpose of pollination services.

The Guidelines for the Management and Use of Honeybee Colonies for Pollination Services in Tanzania is therefore prepared with the aim of providing directives,

standards and procedures for the use and management of Pollination Services. The preparation of these Guidelines is very crucial to the protection of the beekeeping sector since the practice may cause negative impact, if it remains unregulated. Therefore, we call for all stakeholders at different capacities in the beekeeping sector to provide support and cooperaton in enhancing effective implementation of the Guidelines.

Dr. Francis K. Michael

Permanent Secretary

MINISTRY OF NATURAL RESOURCES AND TOURISM

ACKNOWLEDGEMENTS

The Guideline for Use of Honeybee Colonies for Pollination Services in Tanzania has come in the right time when stakeholders dearly need clear instructions on management of pollination services. Several individuals and institutions at different capacities played key roles in the genesis, development and production of this guideline. The Forestry and Beekeeping Division (FBD) conceived the idea whereas development of the guideline was led by a group of experts chaired by Dr. Samora A. Macrice from the University of Dar es Salaam (UDSM). Other members of the group were Dr. Nicephor P. Lesio (Tanzania Wildlife Research Institute), Dr. William J. Kindeketa (Tanzania Forestry Research Institute), Mr. Daniel C. Pancras, Mr. Filipo E. Mwampamba and Ms. Veneranda M. Mnyambii (FBD), Ms. Beatrice Y. Tonola (UDSM) and Mr. Bahati M. Yusuph (Ministry of Agriculture). Members are greatly appreciated for the commitment and expertise that led to the successful completion of the guideline.

The Forestry and Beekeeping Division is also grateful to many stakeholders who provided useful data, first-hand information and field experiences. Feedback from stakeholders using honeybees for MPS in Ruvuma, Kilimanjaro, Arusha and Dodoma helped to shape the guideline. The contributions provided were critical for the successful development and production of this guideline. All institutions and personnel involved in the whole process are gratefully acknowledged.

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Dr. Ezekiel E. Mwakalukwa

Director of Forestry and Beekeeping Division

MINISTRY OF NATURAL RESOURCES AND TOURISM

GLOSSARY OF TERMS

For the purpose of this document:

Residual toxicity	-	toxins that are left as residue after pesticides application
Systemic Pesticide	-	any pesticides that is absorbed into the plant and distributed throughout its tissues
Pollination	-	is the transfer of pollen from an anther (male) to the stigma (female) parts of the same or different flower of the same plant species
Beehive	-	is an enclosed structure in which honeybees live and raise their young
Honeybee Queen	-	is an adult, fertile female bee in a bee colony which is usually the mother of a colony
Bee brood	-	refers to the eggs, larvae and pupae of honeybees
Worker bee	-	a sterile female honeybee that perform most activities for the colony
Apiary	-	is a bee farm which contains several honeybee colonies kept in hives
Apitherapy	-	a type of alternative treatment of illnesses by using products that come directly from honeybees
Beekeeping	-	is the art and science of managing honeybees for production of bee products such as honey, beeswax, bee venom, bee brood, apilarnil, propolis, pollen, and royal jelly, and services such as pollination and apitherapy
Beekeeper	-	a person who owns or has under his control or possession bee colonies or rent bee colonies for pollination service
Chief Executive Officer	-	the chief officer of the administrative, professional and technical services of an authority by whatever name called

Pollination Services Contract	-	a signed, written agreement between a beekeeper and a farmer in respect of supply of honeybee colonies for pollination services
Director	-	the person for the time being responsible for Beekeeping Sector
Honeybee Enemies	-	organisms that attack individual honeybee or honeybee colony, including various pests and predators
Honeybee Colony:	-	is a group of stinging or stingless bees composed of queen, workers and drones that can be managed for production of bee products, including provision of pollination services
Inspector	-	a person authorised by the Director/Chief Executive Officer to be an inspector under section 6 of the Beekeeping Act Cap. 224
Managed Pollination Services	-	pollination services carried out by managed honeybee colonies
Managed Pollinators	-	any group of honeybee colonies managed for pollination services
Pest	-	any organism that spreads diseases, cause destruction or is otherwise a nuisance
Pesticide	-	any substance including insecticides, herbicides, fungicides, rodenticides, nematicides, avicides, molluscicides and antimicrobials that kill, repel, or control certain forms of pest.
Pesticide applicator	-	a skilled or trained person who applies pesticide to control the target pest, using standard dosage and right equipment.
Safety	-	The condition of protecting honeybees, honeybee colonies, beekeepers, livestock and surrounding community from danger, risk or injury
Beekeeping expert	-	a person who received beekeeping training from a recognized institution
Agricultural expert		a person who received training on agriculture from a recognized institution

LIST OF ACRONYMS AND ABBREVIATIONS

ASDP II	Agricultural Sector Development Programme Phase II
ET	Extension Services
IPM	Integrated Pest Management
LGAs	Local Government Authorities
MOA	Ministry of Agriculture
MoA	Memorandum of Agreement
MNRT	Ministry of Natural Resources and Tourism
M&E	Monitoring and Evaluation
MDAs	Ministries, Departments and Agencies
MPS	Managed Pollination Services
NABERM	National Beekeeping Research Master Plan
NBP	National Beekeeping Policy
NFP	National Forest Policy
NFPIS	National Forest Policy Implementation Strategy
NBPIS	National Beekeeping Policy Implementation Strategy
NGCPS	National Guidelines for Controlled Pollination Services in Tanzania
PO-RALG	President's Office Regional Administration and Local Government
PFM	Participatory Forest Management
PSC	Pollination Services Contract
TAWIRI	Tanzania Wildlife Research Institute

TAFORI	Tanzania Forestry Research Institute
TP	Transit Pass
UDSM	University of Dar es Salaam

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background information

Beekeeping is a long established traditional economic activity that employs more than two million Tanzanians. Beekeeping industry became a formal sector in 1949 as a Department under the Ministry of Agriculture, providing guidance and management for development of bees and bee fodder resources in the form of technical and administrative orders and directives. Following different times of government structuring, beekeeping sector is currently supervised by the Forestry and Beekeeping Division (FBD) under the Ministry of Natural Resources and Tourism (MNRT). The government efforts were previously geared towards modernization of beekeeping practices to maximize production of honey and beeswax as primary products. Advancement in technology has led to ability to harvest other products than honey and beeswax, including bee venom, bee brood, apilarnil, propolis, pollen, and royal jelly and services such as apitherapy and pollination. Pollination services in particular, contribute to food security, biodiversity conservation and ecosystem sustainability. It increases productivity in agricultural crops such as fruits, vegetable and edible oilseeds, and natural vegetation.

Pollination by both stinging and stingless honeybees compared to other pollinators, is considered more efficient for a wide variety of important plant species of food and seed crops. The efficiency of stinging honeybees (Apidae: Apis), is demonstrated by the ability of many foragers going out at the same time, but each individual collecting from flowers of the same plant species throughout the entire forage trip (the phenomenon known as flower constancy). The flower constancy is important to the plants visited because pollen is transferred between flowers of the same plant species. On the other hand, stingless honeybees

(Apidae: Meliponini) are also major contributors of pollination in tropical and subtropical areas of the world. Variation in their body sizes and large numbers in their colonies give them added advantage of foraging intensively in a wide range of plant species with different sizes of flowers. Despite the importance of pollinators, there are empirical evidences that habitat degradation, diseases, increased use of pesticides, competition from invasive species, and climate change have led to decline in their global abundance and diversity. The decline of pollinators and increased need for high productivity to meet global demands for food and forest products has necessitated employment of Managed Pollination Services (MPS) in agricultural and forest production systems. Honeybees, compared to other pollinators, are considered more appropriate for provision of pollination services because can be managed, transferred and induced to collect pollen, hence pollinating in due course.

The use of bee colonies for managed pollination services has largely been conducted in some developed countries in pursuance of improved agricultural and forestry systems. In Tanzania, local farmers who grow crops and trees strive to increase production by using farm inputs such as fertilizers, quality seeds and pesticides; and good agronomic practices including ploughing, weeding and watering. However, recent development shows that there emergency of large scale farmers who recognize the importance of MPS in the wake of changing agricultural environment. Available reports show that almost 168 farmers use honeybee colonies in pollination services to increase production and productivity in agriculture by hiring honeybee colonies from beekeepers in Tanzania. This service helps in creating a mutually beneficial relationship between beekeepers that get paid for providing pollination services and farmers who receive higher yields and quality of produce in return. Unfortunately, the use of honeybee colonies in Managed Pollination Services (MPS) is practiced without any guidance to the beekeepers, transporters or farmers, leading to low protection of the involved colonies, and complains by the involved parties. This document is intended to guide both beekeepers and farmers on MPS by honeybees while ensuring safety of honeybees and users of the service for enhanced agricultural and forestry productivity.

1.2 Legal and Institutional frameworks

Through various legal and Institutional directives on pollination, the Government encourage farmers and other stakeholders to use honeybee colonies in pollination services to increase agricultural, beekeeping and forest production. The directives include:

i. National Beekeeping Policy of 1998, through policy statements number 13 and 17 which encourage crop producers to use bee colonies to improve production. The policy stresses also the use of Integrated Pest Management (IPM) to protect pollinators and pesticides applicators (statement 21) (URT 1998);

ii. National Beekeeping Policy Implementation Strategy (2021 – 2031) has set a target to increase number of farmers, who use honeybee colonies in pollination of plants from 168 up to 500 farmers by June, 2031 (URT 2021);

iii. National Beekeeping Research Master Plan I (2020 – 2030) has set a target to conduct research and evaluation on pollination services in forests and agricultural areas;

iv. National Forest Policy (1998) recognizes pollination services as one of the important beekeeping products;

v. Guidelines for Establishment and Management of Bee Reserves and Apiaries in Tanzania (2021) appreciate contribution of beekeeping to crop productivity and enhancement of biodiversity conservation through pollination services by bees;

vi. The National Agricultural Policy 2013 recognizes beekeeping as an important natural resource that interacts directly with many aspects of agriculture;

vii. The Tanzania Development Vision 2025's attribute is high quality livelihood through, among other things, increased productivity of high quality and quantity farm products that are necessary for improved economy and food security; and

viii. The National Five Year Development Plan III (2021/22 – 2025/26) through its 10th Specific Objective strives to strengthen the relationship between the sectors that are endowed with natural wealth and resources with other economic and social sectors.

1.3 Objective of the Guideline

The objective of the guideline is to provide Standard Operating Procedures (SOPs) for management and use of honeybee colonies for provision of pollination services.

1.4 Scope of the Guideline

This guideline focuses on, among other things, management of honeybee colonies for pollination; selection and transportation of honeybee colonies to the pollination sites; management of honeybee colonies on pollination sites; protection of honeybee colonies against pests, diseases and pesticides; safety of beekeepers, farmers, surrounding communities and livestock; parameters to be considered when setting prices for hire of pollinator honeybee colonies; and monitoring and evaluation.

1.5 Users of the guideline

This guideline has been developed timely to provide basic instructions and activities using simple language. It embodies coordinated practical skills, principles and techniques accumulated from local, regional and global experiences for stakeholders of pollination services. The guideline has been put forward to adequately inform stakeholders, transform the sector and improve pollination services for enhanced agriculture, beekeeping and forest productivity. It is intended for farmers, beekeepers, practitioners, extension agents, trainers, community development workers, environmental advocates, agriculture/ forestry advisors, researchers, academicians and interested potential investors in pollination services enterprise. Similarly, the guideline can also be used as a handbook for early career workers including students in colleges and universities, beginners and volunteers.

CHAPTER TWO

2.0 SITUATION ANALYSIS

2.1 Global Overview

Pollination is an essential ecosystem service that enhances both quantity and quality of agricultural and forest produces. More than 75% of the leading global crops depend on animal pollination (Klein *et al.* 2007). Also, about 84% of approximately 300 commercial crops are pollinated by insects such as honeybees (Khalid *et al.* 2012). Honeybees are therefore considered important pollinators in that, 35% of the world's food production relay on pollination of which honeybees accounts for 70% to 80% (Klein *et al.* 2007).

Pollinators perform key ecosystem services for ecosystem functioning, global food security and biodiversity conservation. The scopes of global food security include availability, accessibility, and utilization, with a focus on nutritional well-being, stability, and sustainability. Pollinators improve the quality, shelf life, nutritional value and commercial value (attractiveness) of crops and increase the genetic diversity of wild flowering plants. On the other hand, many biofuel, fibre and fodder crops and other trees harvested for timber production also depend on insect pollination. Furthermore, majority of plants used for production of phytopharmaceuticals also depend on pollinators honeybees being one of them.

Globally, pollination services amounted to $212 billion, equivalent to about 9.5% of the total value of world agriculture production in 2005 (Gallai *et al.* 2009). In countries such as Brazil, South Africa, United States (US), the Netherlands, Canada and the United Kingdom honeybee colonies have been used in provision of pollination services. The industry contributed $14.6 billion in pollination services to the US in 2000 (Morse and Calderone 2000) and $3.2 billion to the South African economy in 1998 (Allsopp, 2004). Nevertheless, many crops and

wild plants require pollination for the setting of fruits and seeds. Honeybees forage on a mixture of flowering plants including tree species and collect a large proportion of their diet from woody plant species (Appendix 1).

In some countries, such as South Africa, fruit growers are largely reliant on managed honeybees for pollination specifically for apples, plums, pears and apricots (Allsopp *et al.* 2008). Approximately 87% of the honeybee hives in the Western Cape are used for pollination services (Allsopp 2004). Studies show that, increments of food crop production in the United States of America and Europe are due to introduction of honeybees in farming systems.

Globally, both wild and domesticated pollinators have been declining (Biesmeijer *et al.* 2006). Yield of many insect-pollinated crops may be adversely affected by widespread pollinator declines (Potts *et al.* 2016). Development of pollinators' friendly management and proper agricultural practices are promoted to rescue the situation. Furthermore, creation and restoration of pollinators' habitats within and away of agricultural land is of help in rescuing pollinators' habitats.

2.2 Bee Pollination Services in Tanzania

In Tanzania beekeeping activities are currently conducted mainly in forest, game and bee reserves for producing mostly honey and beeswax. Despite the presence of about 9.2 million honeybee colonies and abundant floral resources, Managed Pollination Services (MPS) by using honeybee colonies is minimally conducted. Tanzania has about 168 farmers who are using honeybee colonies in pollination services and most of them are large scale farmers. According to the National Sample census of Agriculture 2019/2020, this is less than 1% of all 65.3% (7,837,405 households) farmers in the country. This percentage is very low compared to the potentials of the country.

The National Beekeeping Policy Implementation Strategy 2021-2031 and consultation with different stakeholders in beekeeping and agriculture sectors both indicated the reasons for minimal engagement of farmers in using honeybees for pollination including, lack of technical directives and lack of formal cross-sectoral arrangement for coordination and cooperation between

the beekeeping and agriculture sectors in planning and implementing pollination services among others.

Agricultural practices to improve yields in Tanzania usually focus on improving growing conditions for the crops by emphasize use of fertilizers, pesticides and irrigation leaving aside role of pollination. However, empirical evidences show that, maximum pollination ensures the quantity and quality of the produce especially on large scale farming systems. For example, Silverlands Ndolela farm Ltd in Madaba, Ruvuma, has increased production of certified seeds of different crops including sunflower, avocado and soya by using MPS. Also, Africado Ltd in Siha, Kilimanjaro maximizes avocado productivity due to introduction of honeybee colonies on their orchards. Empirical evidence in Northern Tanzania indicates that, 67% of crops grown depend on animal pollination. Additionally, farmers can increase their yields from animal pollinated crops by adopting more pollinator-friendly farming practices (Sawe *et al.* 2020a). Another study, in northern Tanzania found that, extra pollination significantly increases watermelon quality and quantity compared to additional fertilizers and irrigation (Sawe *et al.* 2020b).

Tanzania has a diversity of food and cash crops grown that need pollination services especially that done by insects including avocado, coffee, watermelon, cocoa, sunflower and beans. Moreover, pollination is not only done in agricultural crops but also in other seeds and fruit plants. Nevertheless, due to environmental degradation, diversity and abundance of pollinators are declining.

CHAPTER THREE

3.0 DIRECTIVES IN THE GUIDELINE

3.1 Preamble

The Ministry of Natural Resources and Tourism has the legal responsibility of providing the directives on sustainable use of natural resources which include the conservation and protection of pollinators like honeybees. This is done in collaboration with the other sectoral ministries including those which are responsible for agriculture, environment, livestock and local authorities in making formal arrangements to encourage the conservation of honeybees in order to intensify production of bee products and pollination of agricultural crops.

The Guideline for Management and Use of Honeybee Colonies for Pollination Services in Tanzania ensures effective pollination of agricultural crops and other vegetation while at the same time maintains safety of honeybees, environment and users of the services. This guideline incorporates the views and opinions of the wide stakeholders in beekeeping, agriculture, forestry, environment and other relevant sectors. The Government, farmers, beekeepers and other users shall adhere to these directives.

This chapter has the following main parts: Preparation of Honeybee Colonies for Managed Pollination Services (MPS), Transportation of Honeybee Colonies for Pollination Services, Management of Honeybee Colonies on Pollination Sites, and Safety and First aid. These parts are further elaborated in the next sections:

3.2 The Directives

3.2.1 Preparation of Honeybee Colonies and Pollination sites for Managed Pollination Services

Naturally, honeybees as pollinators live in the wild habitats. As a result of development, various beekeepers started keeping bees for different purposes including increasing bee products and pollination services. Honeybee colonies intended for use in pollination services and pollination sites must be properly prepared in order to perform the envisioned function correctly. During preparation of honeybee colonies and pollination sites, the following should be adhered to:

i. Every pollination services provider should be registered to the Director or Chief Executive Officer. Failure to register leads to an offence in accordance with the National Beekeeping Act. No. 15 of 2002. In doing registration the service provider needs among other documents introduction letter, passport size photos and national identity card;

ii. Beekeeper should use appropriate beehives, with movable frames made of reinforcement wire to tie combs, ventilation, flexible entrance for closing and opening;

iii. Beehives that can be stacked with supers are recommended to be used for pollination services since beekeepers can easily add supers following the growth of colony population and honey store;

iv. Beehives should be sited in a such a way that it will be easy for management of honeybee colonies;

v. Select strong colonies with at least 6 to 10 frames with enough worker bees that their bodies form a continuous layer at the top of the frame. This shows that the honeybee colonies have sufficient worker bees to provide effective pollination services;

vi. The honeybee colony should have an actively and healthy laying queen and uncapped broods to motivate worker bees to forage for pollen;

vii. The beehive should contain a minimum of two frames with honey and

pollen, and free space for honey storage to ensure nectar collection from the target crop;

viii. Choose colonies that are free from any diseases and parasites;

ix. At least 10% of the honeybee colonies should be inspected by a beekeeping expert, to determine strength before being brought in the farm;

x. Farmer should consult an agriculture expert on number of days for pollination services and when it should be conducted based on floral phenology;

xi. Farmer should consult an agriculture expert on appropriate uses of pesticides before and during managed pollination services;

xii. Honeybee colonies should be moved into the pollination site at the onset of flowering of targeted plants;

xiii. Farmer and beekeeper should have a written contract that provides terms and conditions for undertaking pollination services (Appendix 2).

3.2.2 Transportation of Honeybee Colonies for Pollination Service

In determining about whether, when, where and how to move honeybees to provide pollination services; beekeepers need to consider a number of factors so as to protect them from effects which might arise from transportation. Long-distance transportation of honeybee colonies is associated with increased colony stress and loss, as honeybees may be subjected to excessive heat or cold, depending on the season. Transportation stress can be mitigated with enhanced management strategies.

A beekeeper shall take into account the ecological zones (same ecological zone), distance, geographical terrain and weather conditions to ensure effective service provision. Further, in order to ensure safe transportation of honeybee colonies from apiaries to pollination site, the following must be observed:

i. Beekeeper shall obtain Transit Pass (TP) prior to transportation of any honeybee colony from respective authority and possess them at all

times of the journey;

ii. Transporter shall use a well ventilated vehicle/truck to transport honeybee colonies;

iii. Transporter shall obtain permit(s) from other relevant authorities responsible for transportation;

iv. Transporter shall ensure movement of honeybee colonies is conducted at night or early morning when temperature is low and most of the honeybees are inside the hive;

v. Beekeeper shall close all hives entrances and seal any other openings, tight hives with rope and add net cover to ensure safety;

vi. Beekeeper may use mechanization e.g., Folk Lift while loading and unloading the beehives but should ensure that, it causes minimum disturbance; and

vii. Transporter shall ensure vehicle/truck loaded with stinging honeybee colonies does not stop in public areas;

viii. Transportation of honeybee colonies shall be accompanied by beekeeping expert throughout the journey;

ix. When honeybee colonies are transported more than 12 hours, resting should be done under shade and away from residential areas;

x. Whenever necessary, on transit honeybee colonies can be fed with supplements like sugar syrup, honey solution and fruit juices;

xi. If honeybee colony is transferred to less than 7 km (for stinging honeybees) and 2 km (for stingless honeybees) from its original point; a beekeeper shall ensure that, before opening the hive entrance, a branch is rested against it to orient honeybees to the new location.

3.2.3 Management of Honeybee Colonies on Pollination Sites

3.2.3.1 Distribution, siting and supervision

In order for honeybees to perform effective pollination services, they should be prepared with conducive environments in order to maintain their activeness, health and foraging patterns. Management of colonies and their environment in pollination site is an important aspect to ensure maximum pollination efficiency. Thus, the following should be adhered to: -

i. Place at least seven (7) hives with stinging honeybee colony in one acre, followed with the opening of hive entrances;

ii. Place at least 12 hives with stingless bees in one acre of the farmland;

iii. Honeybee colonies should not be kept in low-lying areas that are prone to flooding or high humidity;

iv. Honeybee colonies should be protected from strong winds and direct sunshine;

v. Honeybee colonies should be positioned away from areas frequently visited by farm workers or animals;

vi. The hive entrance should be located on opposite direction of human/ animal pathway at the pollination site;

vii. Honeybee colonies should be kept on stand, bee cage or pallet within the farm land or any other pollination site;

viii. If a water source is not available, alternative source of safe water (e.g. pesticide – free water) be provided;

ix. Management of honeybee colonies for pollination within the farm should be done by a qualified beekeeping expert with the knowledge from registered institution;

x. A beekeeper should ensure no contaminated bee products from colonies used in pollination services is placed into the market by prior testing it in an authorized laboratory. Failure to do so is an offence in accordance to

the Beekeeping Act Cap. 224;

xi. Both farmers and beekeepers should keep records;

xii. Farmers should make sure that; the farm land has some patches of natural vegetation and/or flowering plants in order to ensure diversity of floral resources and stability of the ecosystem;

xiii. There should be inspection of honeybee colonies few days after positioning the colonies in the pollination site and during the entire pollination period;

xiv. The inspection should be done by opening the hives, assessing the presence of brood and a substantial number of adult bees;

xv. Honeybee colonies that have been inspected should be marked in order to replace below standard colonies or for reassessment in a second inspection, if necessary;

xvi. When a grower or beekeeper discovers a problem in the field such as crops or bee diseases and pest invasions that will entail the grower to use pesticides or the beekeeper to treat bees, they will have to remove honeybees from the pollination site and take other appropriate measures as agreed;

xvii. At a pollination site, a beekeeper should also manage colonies in order to avoid swarming by removing queen cells, ensuring the presence of effective laying queen and free space for honey storage by adding super or harvesting of excess honey;

xviii. Beekeepers should avoid feeding honeybees with other supplements like sugar syrup, honey solution and fruit juices on pollination site; and

xix. Devices that interfere with the free movements of bees at the entrance should be avoided.

3.2.3.2. Protection of Honeybee Colonies against Pesticides

Honeybee can be the victims of pesticides poisoning when the precautions of pesticide application are violated. Pesticide may affect honeybees through

consuming pesticide contaminated pollens, nectars, water or dusts. In order to prevent the negative effects caused by pesticides to honeybees the following should be adhered to:

i. There should be a sign post for clear identification of hive locations on pollination site. The sign should be placed in a location that can be seen by ground and aerial pesticide applicators;

ii. In case pesticides application is needed, it should be done late in the evening when most of the honeybees have returned to the hives and 7 km away from the pollination sites;

iii. Pesticide applicators should always read labels carefully before deciding which pesticide to apply and follow the label instructions;

iv. During pre-bloom, pesticide applicators should not use pesticides with a long residual time (extended-residual toxicity), systemic (translocated) activity and which are highly toxic to bees;

v. Pesticides applicators should not directly spray to honeybees, beehives, or bee nesting sites with any pesticide;

vi. Pesticide application should only be made when pests reach economic threshold level and encouraged to adopt Integrated Pest Management (IPM) to maintain healthy crops and minimize pesticide use;

vii. Avoid the formation of pesticide-contaminated dust when planting pesticide-treated seed or applying pesticide granules or pellets;

viii. Pesticide applicators should make sure that there is no contamination of water sources with pesticide; and

ix. Farmer should dispose correctly all pesticide disposable materials soon after pesticide application as per instruction given on the label.

3.2.3.3. Protection against Honeybee Diseases and Enemies

To ensure good production and productivity it is important that the health of honeybees is ensured in managed pollination services. Like all other living organisms, honeybees suffer from many diseases and enemies (pests and

predators). Examples of pests and predators include wax moths, wasps, birds, ants, hive beetles, mites, mice and honey burgers which destroy combs, hives and kill bees. It is important therefore that regular monitoring and surveillance of colonies for early detection of diseases and enemies is undertaken to reduce frequency and prevalence of such threats for sustained production and investment returns. To protect bees from honeybee enemies and diseases the following should be followed:

i. Farmer and/or beekeeper should make sure that the honeybee colonies are protected from pests and predators, including ensuring that the surrounding environment is clean, appropriate hive siting, use of metal plates and plant extracts;

ii. Farmer should immediately report to beekeeper any incidence of pest or predator within his/her farm land; and

iii. As soon as a farmer/ beekeeper notices honeybee colonies infected with notifiable disease he/she should report immediately to the responsible Inspector or Director.

3.2.4 Returning Honeybee Colonies to the Apiary

Immediately after the end of contractual period, beehives should be moved out to allow the grower to continue with other activities. When removing the beehives from the pollination site care must be taken to ensure that honeybees leave the pollination site safe. When doing so, the following should be adhered to:

i. If there is any excess honey discovered during the inspection, it should be harvested to reduce the risk of combs breaking during transport;

ii. Inspection should be done to check if there is any disease or pest invasion and in case honeybee colonies are infected, they should be treated before being returned to the apiary;

iii. Close the entrance and seal other beehive openings and remember to open entrance after positioning the beehive in apiary; and

iv. The beehives with colonies should be moved at night or early morning to avoid leaving foraging bees behind.

3.2.5 Safety and First Aid

It is known that benefits from bee pollination services depend on maintenance of the health and safety of bee colonies, people and other living organisms. Thus, ensuring safety is an integral part of pollination services activities. Pollination services ought to be conducted in a safe and good quality environment to ensure optimal production of bee products and services. Pollination like many other inputs needs to be given due consideration during planning of integrated production system. This means that precautionary measures during rendering of pollination services need to be taken right from the preparation of bee colonies, transportation to pollination site and management of bee colonies once on the site. It is important that both bees and humans are not exposed to dangerous environments or death conditions. Use of correct handling procedures, facilities and equipment minimizes negative effects, accidents and deaths. However, in case bee stings, injuries or accidents happen, first aid should be immediately given. First aid aims to reduce pain, prevent serious injury from worsening or death and targets quick recovery. Therefore, to ensure safety during undertaking of pollination services process the following must be observed:

i) Avoid irritating honeybees during preparation, transportation and during active pollination on site. Honeybees tend to often dislike dark colour and are sensitive to strong odours both pleasant and unpleasant, which should therefore be avoided;

ii) Appropriate clothing e.g., hat, bee veil, coverall, gloves and footwear should be put on to prevent bee sting, allergic skin reactions (e.g., itching, swelling and flushed or pale skin) and injuries;

iii) Avoid working with bees when it is hot to circumvent overheating and dehydration, which leads to decrease in honeybees' productivity;

iv) Whenever pollination site is close to human settlements, use of stingless honeybees should be considered;

v) Hive inspection should be done only when it is confirmed that it is safe to the person doing it and anyone else nearby;

vi) Opening of hives and examining combs should be done gently and carefully to ensure that bees are not injured or killed. Do your best to ensure that bees are disturbed as little as possible;

vii) Trained personnel should be assigned a responsibility of offering first aid in case of health risk, emergency, accident or injury;

viii) A first aid kit needs to be available, functional and placed in a visible and easily accessible place;

ix) In case of bee sting, injury or accident immediate actions should be taken including offering first aid. If the condition persists, seek further medical attention;

x) Promote awareness raising and frequent education to all staff on best beekeeping practices to avoid safety hazards;

xi) The farmer should avoid theft and vandalism of properties (e.g., beehives, equipment and crops) but should also ensure that fire is prevented;

xii) The farmer should inform relevant local authority and shall make aware the general public by erecting a sign post; and

xiii) All cases of injuries or accidents should be recorded for monitoring and future prevention (Appendix 3).

CHAPTER FOUR

4.0 COSTING

4.1 Factors to consider in price determination

As a growing economic venture in beekeeping sector, provision of Managed Pollination Services (MPS) has cost implications and raise concern for price setting consideration. MPS trigger increased production in agricultural crops, horticulture and forestry which result to increased earnings of farmers. Provision of pollination services using honeybee colonies will at some point include cost component as per provisions in the service provision contract. In establishing cost to be charged for pollination services there are several factors which need to be considered. In setting price for pollination services provision using honey bee colonies service provider (beekeeper) and receiver (farmer) should consider:

i. Honeybee colonies preparation costs including registration, inspection, baiting, siting and stocking of colonies costs;

ii. Transport costs; securing of transit pass, transportation charges, loading and unloading of beehives, labour charges;

iii. Management costs on pollination site; siting, inspection, water supply and security costs;

iv. Time of stay; number of days which honeybee colonies will be subjected on the service;

v. Number of honeybee colonies required for the service;

vi. The beneficiary of other bee products (e.g., honey and propolis) that will be obtained;

vii. Total operation costs of the farmer in crop production; and

viii. Any other costs that may arise during the process.

CHAPTER FIVE

5.0 MONITORING AND EVALUATION

5.1 Monitoring and Evaluation

This section provides the mechanism for monitoring and evaluation of implementation of the National Guideline for Use of Honeybee Colonies for Pollination Services in Tanzania. The guideline will be implemented by wide multi-sectoral stakeholders including those mentioned in this Guideline. It is one among the tools for implementation of the National Beekeeping Policy 1998. The sectorial ministries, local government authorities and government agencies will monitor the implementation and progress of the Guideline in their daily activities. The Ministry of Natural Resources and Tourism shall coordinate continuous and systematic data collection, analysis, interpreting and reporting in collaboration with relevant ministries, departments, agencies and Local Government Authorities (LGAs) during implementation of the guideline. This will further provide information to the Ministry responsible for Natural Resources and Tourism and stakeholders on ongoing implementations, for the purpose of assessing the extent of progress and achievements made.

The Ministry responsible for Natural Resources and Tourism will conduct evaluation periodically after every five (5) years in a participatory manner for assessment and evaluation of the effectiveness, efficiency, impact and sustainability on implementation of this Guideline. Performance evaluation will be a periodic assessment on achievement of guideline objective. These evaluations will assess progress towards attainment of the broad national beekeeping sectoral objectives. Lessons learnt will be used to improve the guideline and shared to the stakeholders. The existing frameworks within MNRT, MoA and PO-RALG will be used to monitor the implementation of this guideline.

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APPENDICES

Appendix 1: Some of crops and trees pollinated by honeybees in Tanzania

Honeybees can pollinate a wide variety of crops and trees to increase production and productivity. Table 1 shows some of the crops and trees which are pollinated by honeybees.

Table 1: Some of crops and trees pollinated by honeybees

Pulses Crops	Horticultural crops	Cash crops	Oil Crops	Trees
Peas (*Pisum sativum*)	Pawpaw *(Carica papaya)*	Cocoa (*Theobroma cacao*)	Coconut *(Cocos nucifera)*	Miombo species including *Brachystegia spp.*, *Jubernadia spp.*, *Afzelia quanzensis* and *Isoberlinia spp.*
Beans (*Phaseolus* spp.)	Avocado (*Persea americana)*	Cotton *(Gossypium* spp)	Sunflower *(Helianthus annuus)*	Mangroves species including *Bruguirea gymnorhiza*, *Ceriops tagal*, *Avicennia marina* and *Rhizophora mucronata*
Pigeon pea (*Cajanus cajan)*	Guava (*Psidium guajava)*	Sisal (*Agave sisalana*)	Groundnuts	Teak (*Tectona grandis)*
Pepper (*Capsicum annuum),*	Passion fruits (*Passiflora edulis*)	Coffee (*Coffea* spp) both Arabica and Robusta species	Oil palm (*Alaeis guineensis*)	Eucalyptus species including *E.saligna*, *E.grandis* and *E.camaldulensis*

Pulses Crops	Horticultural crops	Cash crops	Oil Crops	Trees
Cowpea (*Vigna unguiculata)*	Water melon *(Citrullus lanatus)*	Cashew nuts *(Anacardium occidentale)*	Sesame (*Sesamum indicum)*	Acacia species including *A.mearnsii*, *A.melanoxylon* and *A.nilotica*
Soybean (*Glycine max*)	Cucumber *(Cucumis sativus)*			
	Pumpkin (*Cucurbita* spp.)			
	Orange (*Citrus* spp.)			
	Tangerine *(Citrus tangerine)*			
	Limes (*Citrus limetta)* Strawberry (*Plebeia tobagoensis*; *Trigona Minangkabau*)			
	Okra (*Abelmoschus esculentus*)			
	Tomato (*Solanum lycopersicum*)			
	Grapes (*Vitis* spp.)			
	Lemon (*Citrus limon)*			
	Mango (*Mangifera indica)*			
	Apples (*Malus domestica* or *Malus sylvestris*)			

Appendix 2: Template of Pollination Service Provision Contract

This part gives information to be used to guide growers to understand what beekeepers expect and need. When growers rent honeybee colonies for pollination, it is important that the grower and the beekeeper have a clear understanding of each other's expectations. In order to protect all parties and eliminate misunderstandings between beekeepers and growers, there should be a signed contract which will enable them to benefit from the adoption of best practice pollination services. A written pollination contract should clearly specify the responsibilities of both parties.

Although pollination contracts can vary, the following key aspects of a pollination contract should be adhered to.

i. Names and addresses of the parties concerned and the date of the contract;

ii. Locations of the apiary and pollination site;

iii. Number of honeybee colonies to be provided;

iv. Duration of honeybee colonies on pollination site;

v. Distribution and siting of honeybee colonies in pollination site;

vi. Provision of important notices before and during pollination services;

vii. Honeybee colonies rental fees and terms of payment;

viii. Permission and protocol for an independent inspector of honeybee colony quality if required;

ix. Pesticides to be used and necessary precaution for protection of honeybee colonies in the site;

x. Right of entry to the beekeeper, for honeybee colonies management;

xi. Who will be responsible for extra movements, vandalism or theft of

honeybee colonies on the pollination site;

xii. Responsibilities of the beekeeper and grower should be outlined; and

xiii. Witness to the contract.

Sample Pollination Services Contract

Note: This sample contract is provided as a service and is not a substitute for legal advice.

This contract dated _____ is made between the following parties:

Beekeeper's name:
Grower's name:

.....
.....

CONTACT INFORMATION		
Address	Beekeeper	Grower
P.O. Box number:		
Region:		
District:		
Ward:		
Village/Street:		
Hamlet:		
Phone number (s):		
Home phone number:		
Emergency phone number:		
Email address:		

The parties agree to the following terms

POLLINATION SITE AND HONEYBEE COLONIES OVERVIEW			
This agreement involves the .....(year) growing season			
Description of pollination site and crops to be pollinated by honeybee colonies.			
Address (including region, district, ward, village/street) and or GPS coordinates of pollination site where the honeybee colonies will be placed.			
Address (including region, district, ward, village/street) and or GPS coordinates of apiary site where the honeybee colonies originate			
Date of colony placement (Subjected to the field)		Date of colony removal from the field	
If actual flowering dates differ from date above, the grower will provide – hours' notice to the beekeeper regarding when colonies should be placed and removed			
Number of honeybee colonies rented.		Rental price per honeybee colony	Tsh
Total rental price of honeybee colonies	Tsh	Date(s) on which the rental fee is payable to the beekeeper	
Describe in detail or illustrate the colony placement in the pollination site e.g. crop field/orchard.			
The grower will provide right of entry to beekeeper visiting the property so that she/he can manage colonies.	Yes ( )		No ( )

Before services are provided, the beekeeper will locate area to place colonies during pesticide application arrangement.	Yes ( ) No ( )
If water source is to be provided to the honey bee colonies the following party shall supply.	Beekeeper ( ) Grower ( )
The grower and beekeeper agree to comply with all applicable government laws, including pesticide label restrictions designed to protect honeybees.	

The beekeeper agrees to provide honeybee colonies of the following standards:

HONEYBEE COLONY STATUS	
Minimum number of frames of bees in a hive	
Minimum number of frames of brood in a hive	
Minimum number of frames with food (honey and pollen)	
Presence of an active laying queen	Yes ( ) No ( )
Colonies are free from diseases	Yes ( ) No ( )
The beekeeper agrees to open and demonstrate the health and status of colonies randomly selected by the grower at least one (1) time following placement of the hives and thereafter as reasonably requested by the grower.	
Who will maintain colonies in good pollinating conditions by providing protection against pests. Beekeeper ( ) Grower ( )	

The grower agrees to the following responsibilities

GENERAL RESPONSIBILITIES
The grower will provide a suitable place(s) for the hives that are accessible by truck or other vehicle types. ( )

The grower will hold the beekeeper harmless from any and all claims of injury or property damage arising from beekeeper's performance of this contract, including but not limited to, claims arising from bee stings to animals or people, and claims for field or crop damage or loss resulting from the use of beekeepers vehicle(s). ( )
Grower will adhere to all pesticide labels instructions. In addition, grower will not apply pesticides that are labelled as toxic to bees, systemic and long-time residual toxicity.

MINIMIZING RISK OF PESTICIDE EXPOSURE	
The beekeeper will be notified of an application of a pesticide	
In case of death of colonies following pesticides application on pollination site, who will be responsible	Grower ( ) Beekeeper ( )
The grower will dispose of all pesticide products in a manner that bees will not be able to contact it while searching for water/food	

Additional agreements:

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ADDITIONAL CONSIDERATIONS
Either party will be excused from obligations of this contract if, before or after delivery of honeybee colonies, performance is prevented by events beyond their control. Notification will be given to the other party as soon as reasonably possible.
If disputes that cannot be resolved amicably arise, each party has a right to seek intervention from the court in the United Republic of Tanzania. This contract shall be governed by Tanzania laws.

Signature of beekeeper: _____Date:_____

Signature of grower: _____Date:_____

Signature of witness: _____Date:_____

Signature of witness: _____Date:_____

Appendix 3: Aspects to consider for proper records keeping

SN.	Aspect	Explanations
1.	Address	Name, phone number, street/village, district, region
2	Apiary	Location of the apiary
3	Equipment records	equipment available, due date for maintenance
4	Inspection records (on apiary and pollination site)	Name of inspector, inspection date, number of hives inspected, general observations, actions taken, recommendations given
5	Pesticides uses records	Date of application, type of the pesticide used, targeted purpose and dosage used
6	Expenditure records	Amount used for each cost item (e.g., rental fee, transport, labour charges, professional fees, beehives costs and purchases of inputs)
7	Harvests records	Type of product, quantity, date of harvest,
8	Value addition	Type raw (primary) product, quantity, processing done and value added product

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