



KENYA FORESTRY RESEARCH INSTITUTE

GUIDELINES FOR DODDER WEED MANAGEMENT IN KENYA



**Mutitu Eston, Njuguna Jane, Kimondo James, Amwata Jared,
Mwangi Linus, Cheboiwo Joshua, Gathogo Miriam and Kariuki Barbra**

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Dodder (*Cuscuta campestris*) infesting herbaceous plants

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Foreword

Invasive plant species are a major threat to various ecosystems all over the world. Dodder, a group of parasitic weeds, is one of such plants that are invasive and occur in many parts of the world. The weed attacks many plants and can cause heavy economic losses. In Kenya, the weed is rapidly spreading and has already been observed in about 12 counties mostly in Eastern, Western and the Rift Valley. It has become a threat not only to trees but also crop yields thereby compromising both biodiversity and food security. Dodder also attacks ornamental and native plants, and trees and can reduce the aesthetic value of landscapes. Due to these challenges, management strategies for Dodder are required.

The KEFRI National Forest Health Research Strategy (2018-2033) has identified invasive plant species as one of the forest health issues of concern. Dodder, a parasitic annual plant is currently spreading fast in Kenya and if left unmanaged is likely to threaten a wide range for trees and crops, and may affect food security. Rigorous awareness creation is therefore critical to impart knowledge for successful management of Dodder. Collaboration among relevant institutions and stakeholders is also required for effective management of Dodder and to halt its spread and impact. This guideline therefore outlines practical methods that can be used to manage and control Dodder. Information contained in this guideline is expected to enhance the capacity of foresters, farmers, agricultural extension agents, and other stakeholders in managing and controlling Dodder.



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Glossary

Biological control	Method of controlling pests such as weeds through use of living natural enemies, antagonists or competitors and other self-replicating living entities
Biological control agent/ biocontrol agent	A natural enemy, antagonist or competitor, or another organism, used for control of pests such as weeds
Chemical control	Use of chemicals/herbicides to manage pests such as weeds by killing or inhibiting development
Disease (on a tree)	A sustained and progressive impairment of the structure or function of any part of a living tree due to attack by a living organism
Exotic	Not native to a particular country, ecosystem or eco-region
Genetic diversity	Genetic variability within a population or a species. It is one aspect of biological diversity
Haustoria	Modified root-like structure of a parasitic plant that penetrates the tissue of a host plant and absorbs nutrients and water

Host plant	A plant which aids, shelters, or protects another plant in its growth. Host plants supply food resources to its dependant plant
Host range	Species capable, under natural conditions of sustaining a specific weed or other organism
Native species	Species or genotypes that have evolved in a specified same area, region or biotype and are adapted to those specific, predominant ecological conditions. Species native to the country or area
Infestation	Presence of a weed causing competition with a plant or plant product of interest to man
Inoculum	Microbial spores or parts that develops to a whole plant
Invasive plant	Species that is not native to a particular ecosystem and whose introduction and spread cause or are likely to cause, socio-cultural, economic or environmental harm, or harm to health
Management (of a pest)	Suppression, containment or eradication of a weed population

Natural enemy	An organism that lives at the expense of another organism in its area of origin and which may help to limit the population of that organism. This includes parasitoids, parasites, predators, generalist organisms and pathogens
Parasite	An organism which lives on or in a larger organism feeding upon it
Pest	Any species, strain or biotype of a plant, animal or pathogenic agent injurious to plants or plant products
Species	A population or series of populations of organisms capable of interbreeding freely with each other but not with members of other species
Taxonomic	Classification system in which closely resembling organisms or plants are placed in groups. Various grouping levels or ranks are known as taxonomic categories
Vascular tissue	The tissues in vascular plants that circulates nutrients and water to all parts of the plant
Vector	Living organism that transmits an infectious agent from one host to another host e.g. able to move parasitic plant vegetative material from one host plant to another

Weed

Plant pest growing where it is not wanted. It is generally used to describe plants which colonize readily and can compete for resources with a planted crop. An aggressive, invasive, easily dispersed plant, one which commonly grows in cultivated ground to the detriment of a crop

1. Introduction

1.1 Description and distribution of Dodder

Dodder (*Cuscuta spp.*) comprises of parasitic annual plants belonging to the Family Custaceae. The species are sometimes included in the family Convolvulaceae (Morning Glories). Dodder infests many crops, ornamental plants, native plants, and weeds worldwide. Dodder has slender, twining or thread-like bright stems that vary from pale green to yellow or bright orange which are readily seen against the foliage of the host plants. The genus, *Cuscuta* which has more than 150 species, is found throughout the temperate and tropical regions of the world, with the greatest species diversity in sub-tropical and tropical regions. *Cuscuta campestris* (Field Dodder) is the most widely distributed, attacking a wide range of hosts leading to large economic loss on many flowering plants (Parker and Riches, 1993).

1.2 Biology of Dodder

Dodder, being parasitic obtains nearly all its nutrients and water from the host plant. As dodder plants grow, they continually re-attach to the host, forming a dense mat of intertwined stems, and can grow and cover an entire tree or shrub with their thick, yellow-gold, orange or green stems. Didders are prolific seed producers each plant being capable of producing several thousand seeds per season. Although only about 5% of the seed germinates in the year following seed production, the remaining seeds remain dormant in the soil and can be viable for more than 20 years, depending on the species and environmental conditions.

Dodder seeds are mainly spread: from host plant to host plant by vectors such as birds and other animals; during pruning through use of infected tools; through composting of infected material; by improper disposal of infested plant material; by movement of infected soil and equipment; in

mud attached to shoes and car tyres; or as contaminants in crop seed. Water also plays a role in seed dispersal, particularly for species near aquatic environments. Dodder seed germinates at or very near the soil surface, usually independent of the host plant influence. The germinating seed sends up a slender, twinning stem that coils around any object, including host plants (Plate 1). Some *Cuscuta* species however do not seed and therefore spread vegetatively through cuttings.



Plate 1: Dodder seedling attached to a potential host plant

When Dodder contacts a host, it produces structures called haustoria that penetrate the host's vascular tissue and begin to extract nutrients and water from the host. This gradually leads to wilting and host death.

Deprivation of nutrients, leads to weakening or complete death of the infected host plants. The impact varies from moderate to severe reductions of host plant growth and, in some cases, complete loss of vigor and death. Severity of an infestation depends on the growth stage of the host plant at the time of initial Dodder attachment. The greatest reduction in growth occurs when the parasite attaches to seedlings, where death is common. The weakened state of infected plants also pre-disposes them to secondary attack by diseases, insect pests, and nematodes.

1.3 Taxonomy of Dodder in Kenya

The taxonomic identity of Dodder species in Kenya is unknown. Different scientific names have been given to the species found in Kenya. The scientific names include: *Cuscuta reflexa*, *Cuscuta japonica*, and *Cuscuta campestris*. Naming is informed by variation in morphological features of Dodder on different hosts. To resolve this taxonomic gap, there is need to carry out molecular species identification to determine both population and genetic diversity of this parasitic genus in Kenya.



Plate 2: Dodder infestation on *Croton macrostachyus* tree



Plate 3: *Makhamia lutea* infested by Dodder

1.4 Status of Dodder spread in Kenya

Dodder is currently spreading fast in Kenya. It is most prevalent in Western, Eastern and Rift Valley regions of Kenya but less pronounced in Central region. The species are found on a broad host range of both native and exotic plants including; trees, shrubs, hedges, and important cash crops such as tea and coffee. Dodder has been reported to have preference for certain species, the most susceptible being *Thevetia peruviana* (yellow oleander) commonly found along farm boundaries. The rapid spread and a large host range indicate that Didders are likely to threaten sustainability of many crops, shrubs and trees, if left unmanaged. It is projected that Dodder invasion will lead to huge agricultural yield loss by 2029.



Plate 4: Dodder damage on *Thevetia peruviana* live homestead fence

2. Purpose of this Guideline

Dodder species are parasites of economic importance on a wide range of plants that include trees and crops, usually leading to losses in crop yield and death of infested plants. Farmers, foresters and other stakeholders are concerned that the rapid spread of dodder plants may lead to destruction of sources of livelihoods and compromised biodiversity. The biggest challenge is that Dodder is attacking plants of great economic importance including tea, coffee, popular fruit trees as well as other agricultural crops. This guideline is a consolidation of best practices for Dodder management that are relevant to Kenya. The best practices are consolidated from areas of heavy infestation worldwide.

The purpose of this guideline is to provide information and build capacity of farmers, landowners, tree growers, foresters and other stakeholders on available strategies for management of Dodder in order to control spread of the weed.

3. Management Options

The most successful control strategy involves a systematic approach that combines several methods. Dodder usually cannot be eliminated with a single management option or within a single year. The most immediate action is to eliminate or reduce the infestation before the invasion gets out of control. Effective management requires: control of the current populations; prevention of Dodder seed production; and suppression of new seedlings in subsequent years.

The control approaches include: prevention, cultural, physical, and mechanical methods; chemical and biological control methods; and awareness creation. These methods can be used singly or in combination.

3.1 Prevention

- Clean and inspect clothing and equipment before moving from Dodder infested areas to “clean” areas.
- Manage infested areas to prevent further spread by isolating small infestations and removing them manually by hand before the plant produces seed.
- Monitor larger infestations, and mow, prune, burn, or spray with herbicides to prevent seed production.

3.2 Cultural control

- Practice crop rotation with non-host plants. This denies the parasite a suitable host to attach to and therefore reduce the seed bank in the soil with time.
- Prune infected branches to prevent further spread on the host plant.
- Burn infested plants to reduce levels of inoculum for potential dispersal.
- Till the land repeatedly to kill germinating Dodder seedlings.

- Delay sowing of crops by 2-3 weeks after tillage to ensure that there are no suitable hosts for Dodder attachment.
- Mow and weed early to destroy potential suitable hosts for Dodder.

3.3 Mechanical control

- Remove Dodder stems by hand and pruning to control the weed. Hand-pulling is tedious and only suitable for scattered infestations.
- In the nursery and green house, remove and destroy infected host plants.
- In the landscape, it is usually more effective to remove the host and the Dodder simultaneously. If only a small portion of a plant is infested, pruning the host below the point of attachment is an effective management option.
- Remove the Dodder stems using rakes.
- Burn all removed Dodder material



Plate 5: Manual removal of Dodder from fence

3.4 Chemical control (Herbicide use)

Herbicides have been tried but these chemicals also affect the host plants. A search in the registered Pesticide Control Product Board (PCPB) Product List 2019 indicates no herbicide or product has been registered for the management of Dodder in Kenya. However it is important to note that post-emergence herbicides with glyphosate as the active ingredient can be applied in the soil to reduce Dodder seeds and seedlings development. There is need to screen herbicide for registration by PCPB. The choice of herbicides to use depends on the Dodder species and associated plants. Herbicides may be selective or non-selective. They can also be contact or systemic. In Kenya four herbicides (Gramoxone 200 SL, Agrimine 2-4D, Willosate 360 SL and Herbikill 20SL) were identified by KEFRI to manage Dodder at Michuki Memorial Park. Two herbicides Gramoxone and Herbikill when sprayed were effective by killing the Dodder *Cascuta campestris* species and associated herbaceous plants.

Gramoxone 200SL



Before



After

Plate 6: Dodder management with Gramoxone herbicide

Herbikill 20SL



Plate 7: Dodder management with Herbikill herbicide

3.5 Biological control (Use of natural enemies)

An attempt to control Dodder using natural enemies (bio-control agents) has not been successful anywhere in the world. A search for biological control would require collaborative approaches with other relevant institutions and countries with similar problem and interest.

3.6 Awareness creation

Currently, farmers are using manual methods to control Dodder weed which include uprooting infested plants and burning them. However, in many areas people are yet to understand the dangers that the parasite causes on plants. People spread Dodder from place to place confusing it to be an ornamental plant. There is need to sensitize the public to:

- desist from carrying Dodder plant parts
- destroy the parasite immediately
- dry the parasite stems and dispose by burning.

4 Way Forward

Priority research activities to be undertaken include to:

- a) Map extent of the Dodder parasite in the country to identify hot spots and other levels of infestation for immediate intervention.
- b) Determine the socio-economic and environmental impact of the parasite in hot spot areas.
- c) Carry out molecular identification to determine species present in Kenya.
- d) Conduct further studies as required to understand its biology and population ecology to aid management options.
- e) Screen herbicides for possible use in control of Dodder
- f) Determine potential uses of the parasite and its secondary metabolites
- g) Create awareness on impact of the parasite and also appropriate control /management measures
- h) Search for an appropriate biological control agent in collaboration with partners.

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