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Farmers' Perception on Dodder (*Cuscuta Spp*) Parasitic Plant in Uasin Gishu County, Kenya

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Abstract

Dodder plant is an annual holoparastic plant, widely distributed and colonizing diversity of habitats. It is an invasive weed that causes ecological and economic damage to crop production and biodiversity. Its massive invasion causes a lot of panic to farmers as it may lead to total crop failure and degradation of forests with little information known about it. The study aimed at determining the farmers' knowledge, attitudes and practices on dodder plant in Uasin Gishu County for the purpose of coming up with strategies to cope with the menace. A survey study was done in all the sub counties within the county to ascertain the trend of the parasitic weed. Stratified, Purposive and convenient sampling were used to collect data from 384 farmers in the County. Data was analyzed both qualitatively and quantitatively. Descriptive statistics was employed. From the results, most of the respondents (98%) were aware of dodder plant though most of them (76 %) did not have a local name of referring the weed. Also 40% of the respondents had their farms invaded by the weed while 60% did not, citing that the weed was a mysterious plant and that it was spotted in the area less than 5 years ago (64%). Children play a significant role in its dispersal (41%). Most of the respondents could do nothing about the weed (57%) though they could only try to control it manually (40%) as they could not understand it. Therefore, there is need by the stakeholders to intensify awareness among the locals, including use of media to reach wider audience on the dangers of dodder weed to food security, biodiversity and their livelihoods and encourage collaboration with other relevant Institutions to better understand dodder and devise mechanisms to control and manage it.

Keywords: Dodder Weed, Holoparasitic, Perception, Menace, Invasive

INTRODUCTION

Dodder plant (*Cuscuta spp*.), an annual holoparasitic plant in the family Convolvulaceae, is a cosmopolitan occurring genus. Cuscuta species are widely distributed and colonize diverse habitats throughout the temperate and tropical zones (Belize, 1987). Some dodders (15–20 species) cause economic or ecological damage to crop production worldwide in agricultural, horticultural or exotic plants (Dawson et al., 1994) and more crop species are endangered or threatened, demanding conservation strategies (Costea & Stefanovi´, 2009). *Cuscuta spp*. ability to grow on different hosts varies considerably, stems may twine around the host plant and within 2-4 days of attachment it produces haustorium. Once

Cuscuta spp. has parasitized a host, it may grow as much as 8 cm per day, with a single plant covering more than 3 m in diameter in one growing season (Dawson et al., 1994). Flowers produce seed capsules with each plant producing several thousand seeds. Seeds can stay dormant and viable in the soil for up to 60 years subject to environmental conditions and the species. The parasitic weed not is only posing a threat to this region's ecosystem, it is also affecting the livelihood of thousands of people in Kenya since it parasitizes most important perennial cash crops.

Cuscuta spp is one of the most invasive weeds and infestations can cause severe economic crop yield loss of as high as 80% to 100% (Dawson et al., 1994). The stem parasites attach to the host by haustoria and depend exclusively (or nearly so) on their hosts for the necessary water and nutrient supplies. Haustoria are authentic absorption organs, capable of extracting 100% of the soluble organic compounds from host (Weih, 1998). It is very difficult to control *Cuscuta species*, though exclusion method (not to introduce it into a farm or field) is the most appropriate. Its massive invasion causes a lot of panic to farmers as it may lead to total crop failure and degradation of forests.

Dodder plant in most parts of the world has raised a lot of concern especially in agricultural production sector. In India the weed affects both grass and legume crops, making it difficult to control it chemically, for instance, pigeon pea plants were severely affected that almost all the branches dried during early growth stage leading to nearly complete loss of plants before reproductive stage (Choudhary et al., 2010). Kagezi et al. (2021) reported that in Uganda, the weed is becoming very invasive affecting crops especially coffee plantations which is one of the crops that contributes to food security since farmers use the proceeds from its sales to cater for their daily needs.

In Kenya the weed is still new and little is known about it yet its adverse effects are majorly felt by the farmers. A study by Kangeethe et al. (2020) on dodder invasion in Kisumu County, showed that the weed is causing panic among farmers as it is visibly seen engulfing most tree crops and commercially important trees like Grevellier (*Grevillea robusta*) and acacia (*Acacia mensii*) among others . The weed has now become invasive killing plant, destroying indigenous species; changing ecosystem functioning and reducing pasture lands. Okeya (2021) in his interview with Koskei at Kenyatta University reported prediction that if this dodder is not checked early enough Africa's economy which is anchored on agriculture could reduce by nearly 30 per cent by 2029. Though, newspapers and even social media have reported, there is no sufficient information or documentation on the people's knowledge, attitudes and practices done on the weed in Kenya, hence, the need to shade sufficient light about dodder. This study was therefore conducted to obtain information from the people on the weed in order define strategies on proper understanding of the weed for the purpose of minimizing further spread and mitigation measures in the Country.
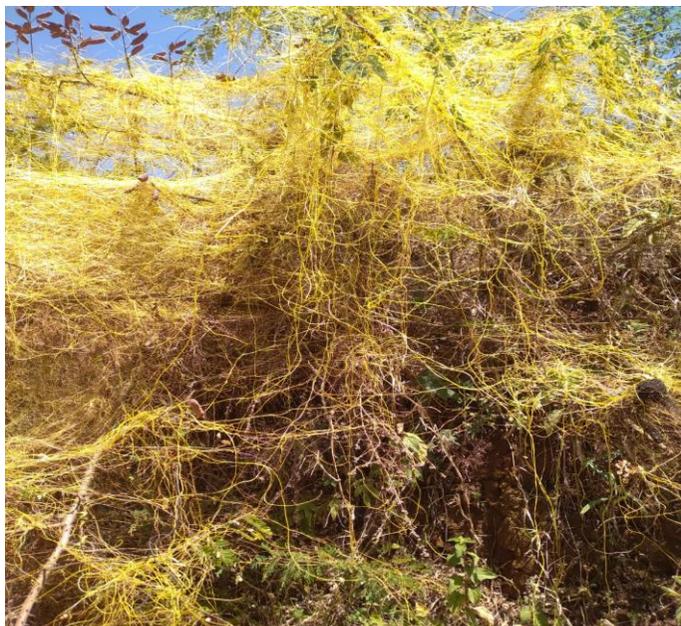
Plate 1: Photo of *Cuscuta* spp (2021).

MATERIALS AND METHODS
Study Area

The study was conducted in Uasin Gishu County, Kenya. The County has six sub-counties namely; Soy, Kapseret, Kesses, Turbo, Ainabkoi and Moiben. It covers a land area of 3,345 km^2 with a population of 304,943 households (Kenya National Bureau of Statistics, 2019). It borders Trans Nzoia County to the north, Elgeyo Marakwet County to the east, Baringo County to the southeast, Kericho County to the south, Nandi County to the southwest and Kakamega County to the northwest. The County has three agro-ecological zones (AEZs) namely; the upper highlands (UH), upper midlands (UM) and lower midlands (LM) zones. The major crops in the county are maize, beans, wheat, sunflower and potatoes while the livestock include dairy farming, beef cattle, poultry, sheep, goats, pigs, beekeeping, rabbit farming and fish farming. Uasin Gishu County is referred to as the breadbasket of Kenya as it has high and reliable rainfall, relatively large farm sizes, and highly mechanized farming and more than 90% of its land being arable (MoALF,

2017). This is why any threat to its agricultural systems need to be seriously addressed.

Sampling Frame and Sample Size

The formula by Cochran (1977) was used to determine the sample size for the study population as highlighted hereunder

$$n_o = Z^2pq/e^2$$

where, n_0 is the sample size

z is the selected critical value of desired confidence level (1.96)

p is the estimated proportion of an attribute that is present in the population (0.5)

q= 1-p

e is the desired level of precision (0.05)

From the formular;

$(1.96)^2 0.5(1-0.5) / (0.05)^2 =$ **384**

A sample of 384 respondents was obtained and this was proportionately distributed to the six Sub counties in the County, by dividing the total number of households in each Sub County by total number of

households in the whole County then multiply by the sample size. This will give

the number of households to be interviewed in each Sub-County as follows: -

Table 6: Sample distribution of Sub-counties in Uasin Gishu County household population

County	Sub County	Household's Population	Sample size
Uasin gishu	Ainabkoi	34,892	44
	Kapseret	59,746	75
	Kesses	34,653	43
	Moiben	46,729	59
	Soi	53,784	68
	Turbo	75,139	95
Total		304,943	**384**

Sampling design

Sampling was done in areas where dodder plant was present. Stratified, Purposive and convenient sampling were employed in the study. Uasin Gishu County was stratified into the sub counties for the purpose of getting insight of dodder plant in each of the sub-counties. Purposive sampling was also used basing on the availability of the dodder, that is, the researchers could move purposively within the sub- counties with the aid of community members who could assist to locate the areas where they had spotted the plant. Any available respondent within the locality could then be interviewed to form part of the sample. Respondents were also selected basing on their availability and accessibility as the researcher moves along the located sites. This was repeatedly done until the required sample was attained in each of the Sub-Counties. Key informants from the following sectors were also interviewed to give their understanding about the plant; the Ministry of agriculture, Environment and National Environment Management Authority (NEMA).

Data Collection

A survey involving both qualitative and quantitative methods was employed. Qualitative survey was employed using focus group discussions of between 8-10 respondents. The quantitative data was obtained using semi- structured questionnaire to understand famers' demographic characteristics, perceptions, practices and knowledge about the plant, origin, economic losses and uses of the plant.

The questionnaires were administered to the 384 respondents by trained personnel.

Data Analysis

The information gathered was coded and analyzed using SPSS- IBM software Version 20. The results of analysis were interpreted and discussed using descriptive statistics where tables, bar charts and pie- charts were used to present the data.

RESULTS AND DISCUSSION

About 60% of the respondents were male while 40% were female (Table 2). This implies that most of the households were either headed by men or most of the women were involved in other household chores thus their availability was minimal.

The education status showed that, majority of the respondents were at secondary level (37%), followed by tertiary level (30%) while very few (9%) were of primary level (Table 2). This implies that most of the people in the county were well enlightened, thus uptake of information on dodder plant could be easy and at a faster rate.

Majority of the respondents were between the ages of 31-40 years (32%), followed by those above 50 years (27%) and those below 30 years were only (19%) as indicated in the table. This could be an indication why most of them had little understanding on dodder since most of them were at the bracket of youth.

It is also clear that most of the respondents were self-employed (47%), while 31% had

no employment. A few were formally employed (20%) and very minimal were on both formal & self-employment (2%). Most of those who were on self-employment indicated farming as their major activities and source of income. This implies that if this invasive dodder plant is not contained and managed well, then the future of agriculture

as a source of employment will be under threat. Furthermore, majority of the people interviewed were fathers and mothers (53%) and (37%), respectively. Very few children were interviewed. This indicates that information was received from the right people of the households.

Table 2: Percentage of Demographics of the Respondents in Uasin Gishu County

Variable	Percentage (%)
Gender	
Male	60.26
Female	39.74
Age (yrs)	18.80
Below 30	32.05
30-40	22.22
41-50	26.92
Above 50	
Education Level	
No formal Education	9.83
Primary	23.50
Secondary	36.75
Tertiary	29.91
Employment	
No employment	30.77
Self-employment	47.44
Formally employed	20.09
Both self and formal employment	1.71
Household role	
Father	52.99
Mother	37.18
Child	9.07
House/garden help	0.85
Heard of dodder	
Yes	98.29
No	1.71
First information on dodder	
Personal experience	64.12
From neighbors	33.82
Through community meetings	0.62
Government officials	0.00
Others	1.45

Most of the respondents (98%) were aware of dodder plant though could not know its original name, thus most of them (76%) did not have a local name of referring the weed, whereas 24% had a name for it that depicts the devastating effect of the weed that varied. The names include; Chepchuchunit, Mondoywet/ Namtoiwet, Namuget,

Chepnirnir, Chepisali, Kipnamta/Chepnamta (Kalenjin), Thina (Meru and Kikuyu), and Maliza, Kamata, "Cancer ya miti" and Malaya (Swahili).

Majority of the respondents knew the weed through personal experience (64%), some (33%) saw it from the neighbors. None of them got any information from the

government (0.00%). This implies that the government has played very minimal role sensitizing the people about the weed. This is as a result of lack of information and understanding, thus no information to give

the farmers about the weed. Respondent who cited other sources cited media, through internet and newspaper as their first source of information on dodder.
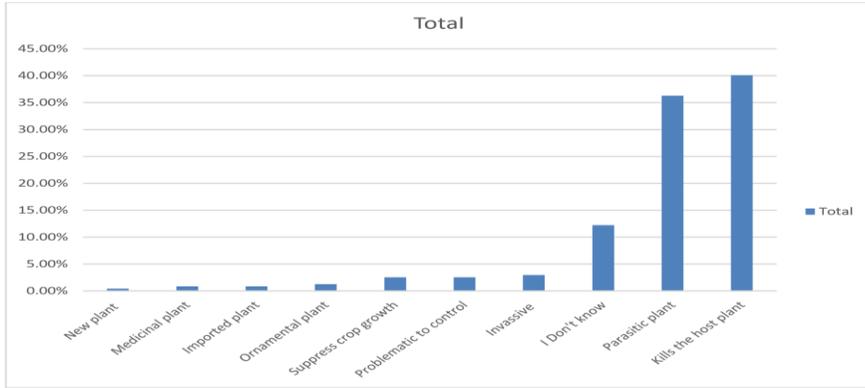

Figure 1: Knowledge and perception on dodder plant from respondents in Uasin Gishu County.

Majority of the respondents believe that there are no myths associated with the dodder plant (92.7 %) whereas 7.3% believe that there are myths associated with the weed. In Soi sub-county, Ziwa area, some farmers believe that if not removed in homestead, it will kill the plant then start killing people in the family. In another place in Moiben sub-county, other farmers indicated that the weed is like HIV/AIDS that kills the plant slowly, and might also be the cause of cancer. In the same

area, few people believe that the weed is medicinal. Most of the respondents (40%) indicated that the weed kills the host plant as soon as it attaches itself, this response is similar to that of 33% who indicated as parasitic though some 12% did not have any knowledge about the weed (Fig. 1). This implies that majority of the farmers are aware of the weed killing the host plants, but do not know of other effects of the weed, whether positive or negative.

Table 3: Respondents' farm invaded by dodder in Uasin Gishu County

Farm invaded	Ainabkoi	Kapseret	Kesses	Moiben	Soi	Turbo	Mean
No (%)	58.00	49.09	65.12	73.33	44.83	68.72	**59.85**
Yes (%)	42.00	50.91	34.88	26.67	55.17	31.28	**40.15**

It is indicative that that 60% of the respondents have not been affected by the weed while 40% have the weed in their farms (Table 3). This means that the weed has invaded more than half of the farms in the county, more significantly in Soi and Kapseret sub-county as indicated as 55% and

51% respectively. This shows how invasive the weed is, thus calls for an urgent action to be done. This agrees with a report by CABI (2021) from a study done in western Kenya that a large number of farms in the area have been invaded by dodder plant.

Table 4: Knowledge of origin of dodder by respondents in Uasin Gishu County (%)

	Soi	Kapseret	Ainabkoi	Kesses	Moiben	Turbo	Mean
Don't know	30.59	76.36	74.00	86.05	66.67	84.02	**69.66**
Within the sub-County	48.24	20.00	14.00	13.95	20.00	14.65	**21.81**
Outside the County	17.65	3.64	8.00	0.00	13.33	1.33	**7.33**
Outside the county	3.53	0.00	4.00	0.00	0.00	0.00	**1.25**

It is clear that majority of the respondents (70%) are not aware about the origin of the weed (Table 4). Though some (29%) could highlight the places within the county where they first spotted the weed before it invaded their farms. They indicated that the first time the weed was noticed, it was very beautiful thus most people took to their home as flowers. A small percentage of the respondents indicated that the weed is a foreign plant brought by the whites to destroy Africans especially athletes. Others pointed out that the whites brought to fence their lands, after which the locals picked it as a very good plant for fencing their homesteads leading to the spread.

Table 5: Duration (Years) of appearance/existence of dodder plant in Uasin Gishu County

Years	Soi	Ainabkoi	Kapseret	Kesses	Moiben	Turbo	Mean
Less than 5	55.84	66.00	63.41	80.00	53.33	67.34	**64.32**
6 - 10	32.47	8.00	29.27	20.00	13.33	21.74	**20.80**
11 – 15	5.19	0.00	7.32	0.00	0.00	0.12	**2.11**
Over 15	5.19	4.00	0.00	0.00	0.00	0.00	**1.53**
Don't Know	1.30	22.00	0.00	0.00	33.33	10.80	**11.24**

Table 5 shows that majority of the respondents (64%) indicated that the weed appeared in the area less than 5 years ago, others (21%) indicated they noticed the weed between 6-10 years ago. Very few people (4%) came across the weed more than 10 years ago, though 11% could not really comprehend when the weed first appeared in their area. This agrees with a study by (Forest et al., 2020) that the weed started sprouting in Kisumu county 3-4 years ago. This implies that the weed is still new in the country thus little is known about it making it difficult to understand its management measures.
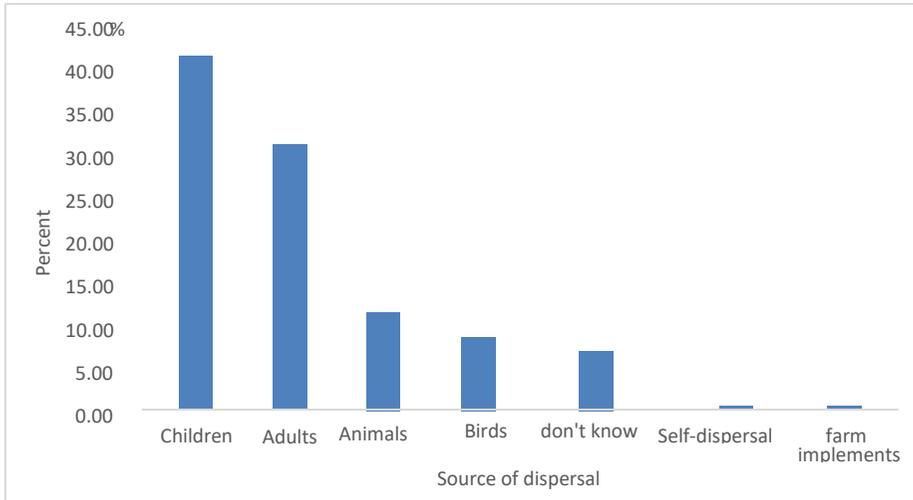
Figure 21: Dispersal agents of dodder plant percentage in Uasin Gishu County.

Majority of the respondents (42%) indicated that the weed is dispersed majorly by school going children (Fig.2). This justifies the reason why there was high infestation of the weed along roads mostly those heading to schools and churches. The reason behind children dispersal was that children were attracted to the beauty of the weed, also that after discovering that it kills any plant attached, they enjoyed attaching the weed to any plant along the road so that they could see how it could kill the host plant. This is a very serious scenario that needs intervention by sensitization of the weed especially in these institutions. From the results, adults also play a role in the weed dispersal (31%), they indicated that most of the people who were not aware of the weed could pick it to plant as a flower in their homes. There was minimal dispersal by animals or by self. A study in Uganda revealed that the weed is also majorly dispersed by humans with children playing a significant role (Kagezi et al., 2021).
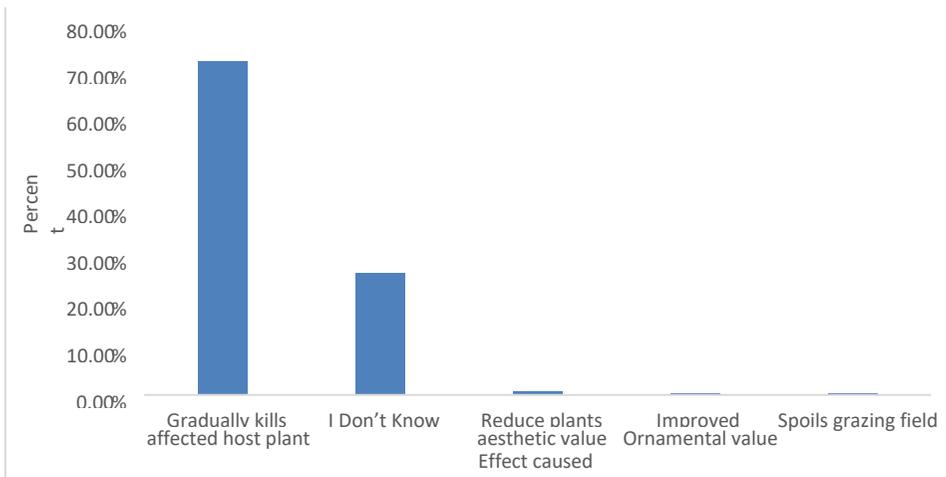

Figure 3: Effects of dodder plant in the farms in Uasin Gishu County.

Fig.3 indicates that the major problems associated with the weed in the farm is that it gradually kills the affected plant (72%). Very few respondents indicated that it reduces the aesthetic value of the plant and spoils the grazing fields. Others (0.2%) perceive the weed as ornamental. However, 28% were not aware of any effect of the weed in their farms.

Table 6: Control measures of dodder plant in the farms in Uasin Gishu County

Control measure (%)	Ainabkoi	Kapseret	Kesses	Moiben	Soi	Turbo	Mean
Nothing	60.00	54.55	79.17	64.29	28.17	53.12	**56.55**
Cutting down the affected plants	18.00	36.36	12.50	28.57	32.73	28.34	**26.10**
Pulling the weed off the plant	14.00	3.03	8.33	7.14	34.55	17.56	**14.10**
Burning the affected plants	2.00	6.06	0.00	0.00	0.91	0.00	**1.50**
Use of Herbicide	4.00	0.00	0.00	0.00	3.64	0.98	**1.44**
Control unwanted plants	2.00	0.00	0.00	0.00	0.00	0.00	**0.33**

From the results, most of the respondents (57%) indicated that they could do nothing to control the weed since they could not understand the weed (Table 6). This is because they perceive the weed as mysterious thus nothing was to be done about it. However, some controlled the weed by cutting the affected plants (26%), pulling the weed from the host (14%), burning the affected plants (2%) and using herbicides (1%). Some few farmers use the weed to kill unwanted plants that is they uproot it and dispose it on unwanted plants (0.33%). Furthermore, the farmers indicated a concern on controlling the weed since it is difficult to control as it multiplies rapidly. A study by CABI (2021) cited similar findings that farmers in western and Nyanza region control the weed manually by pilling with little use of herbicides. Also similar study by (Kagezi et al., 2021) done in Uganda cited that Most of the respondents were managing dodder by physically removing it.

Table 7: Perceptions of respondents on whether dodder is beneficial in Uasin Gishu County

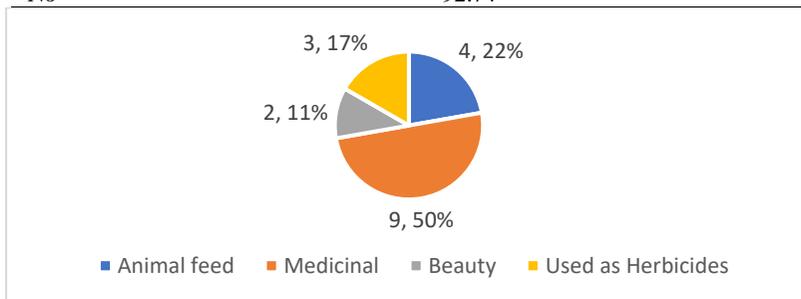| Dodder is beneficial	Percentage (%)
Yes	7.26
No	92.74

Figure 4: Benefits of dodder plant.

The 7.26 % of the farmers who indicated that dodder plant has benefits (Table7), mentioned that it is used for medicinal purposes, as livestock fodder, improving aesthetic value as a flower, as a biological agent to kill unwanted plants (50%,22%, 11% and 17% respectively), and it was alluded that in Western Kenya, the Tiriki community use it during circumcision ceremony. This agrees with a study by (Kagezi et al., 2021) in Uganda that the weed is used for medicinal purposes though most of the people believed that it is used by witchcrafts.

Table 8: Training needs by respondents in Uasin Gishu County

Need for training	Percentage (%)
Yes	**96.89**
No	**3.11**

Table 9: Areas of important training aspects by respondents in Uasin Gishu County

Important Training Aspects	Soi (%)	Kapseret (%)	Kesses (%)	Ainabkoi (%)	Moiben (%)	Turbo (%)	Mean (%)
Effective management	90.91	70.00	38.64	90.70	100.00	78.31	**77.94**
Utilization and Value addition	3.03	28.33	61.36	2.33	0.00	16.56	**18.60**
Sensitization and Awareness	6.06	0.00	0.00	2.33	0.00	5.13	**2.53**
Dispersal factors	0.00	1.67	0.00	4.64	0.00	0.00	**1.05**

It was also noted that most of the farmers had not been given any training on the weed. Majority of them (96%) indicated that they need to be trained to understand the plant well since it had become problematic in their farms (Table 8). They indicated the important aspects they needed include how to effectively manage the plant (76%), its importance as well as utilization and value addition (21%). Few indicated that they need awareness and information on its dispersal mechanism (Table 9). A study done by Kenyatta university on similar concern indicated that it will be nearly impossible to control this weed in the next decade if national governments do not take quick action thus there is need to focus in this weed (Okeya, 2021)

CONCLUSION

Most farmers were aware of the adverse effects of dodder plant though they had minimal information on its management. Also, there is minimal contact between County staff in the relevant ministries and the farmers on sensitization on dodder plant.

RECOMMENDATIONS

1. Intensify awareness among the locals including school going children using media to reach wider audience on the dangers of dodder weed to food security, biodiversity and their livelihoods.

2. There is need for government collaboration with other relevant Institutions to better understand dodder and devise mechanisms to control and manage it.

3. Further research on appropriate and sustainable methods of controlling dodder plant

Acknowledgements

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