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Extension Approaches In The Promotion Of *Melia Volkensii* In Lower Eastern, Kenya

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ABSTRACT
The study was conducted in Kitui, Machakos and Makueni counties covers a total area of 44,739.10 Km^2. This study was undertaken to document various extension methods used to promote tree planting in the drylands among them being Melia volkensii in the drylands. In an effort to curb deforestation and land degradation, the government employed various extension methods such as contact farmers, group approach, farming systems approaches, farmer to Framer, train and visit, farmer field schools, Social Forestry Extension Model, Agroforestry for Integrated Development in Semi-Arid Areas of Kenya project and Intensified Social Forestry Project. Individual interviews and focused group discussions were used collect data from a total of 101 respondents using a semi structured questionnaire and checklist respectively. Kitui County had the highest respondents (50.5%). Machakos and Makueni Counties had 29.7% and 19.8% respondents respectively. The collected data was captured in excel spread sheets and analysed using SPSS version 20. The popular extension methods in all counties were demonstrations and field days, seminars, farmers' field schools and barasas (formal local meetings); while ASK shows, Open days and churches were least popular. Major tree species promoted were Melia volkensi, Azadirachta indica, Grevillea robusta, Eucalyptus spp and Senna siamea among others. However, the study found out that the adoption of planting high value tree species including M. volkensii is still low. For increased tree planting in the drylands, the study recommends an integrated extension approaches that combines two or three popular methods should be used to promote tree planting. Farmers should be supported through research and ready technical knowledge though demonstrations plots, seminars and field days.
Key words: Extension, Melia, tree planting, drylands

I. INTRODUCTION

The Arid and Semi-Arid Lands (ASALs) cover about 80% of the total land surface of Kenya and holds 25% of the human population and 65% of the country's wildlife (Milimo *et al.,* 1994, Government of Kenya, 2015). Furthermore, ASALs present a very important socio-economic potential valued at about Kes. 180 billion annually (Muga *et al.*, 2011). Important natural resources in the drylands are woodlands that provide wood (timber, poles, posts, wood fuel, materials for handicrafts) and non-wood products (gums and resins, fibres, vegetables, herbal medicine, fragrances, silk, indigenous fruits, fodder and honey) for income generation and subsistence. The other functions provided by trees in the ASALs include mitigation of climate change and deforestation which ensures an increase in the land's productivity.

M. volkensii is one of the key indigenous tree species being promoted in Lower Eastern, Kenya (Milimo *et al.,* 1994, Muturi *et al.,* 2003*,* Luvanda *et al.,* 2015). *M. volkensii* is an indigenous deciduous tree species of the drylands of East Africa and is found growing naturally in semi-arid areas of Kitui, Taita Taveta, Makueni, Marsabit, Isiolo, Mwingi, Mbeere, Tharaka and Mandera in Kenya. The tree is fast growing, drought, pest and disease resistant, requires minimum management after establishment and provides high quality timber comparable to camphor (Milimo *et al.,* 1994, Muturi *et al., 2003*). It grows well in areas that receive 300-800mm of rainfall per annum (Beentje, 1994). *M. volkensii* is easily intercropped at the initial establishment stages and provides fodder during the dry season (Luvanda *et al.,* 2015). Notwithstanding it's excellent qualities (KEFRI, 2011), *M. volkensii* has been characterized by low uptake levels by farmers and this has been attributed to the unavailability or high cost of seedlings, poor tree survival due to heavy browsing or other silvi-cultural and socio-economic factors. Therefore, the low uptake levels can be explained by lapses in knowledge transfer, ignorance of local people, or alternatively, the use of extension methods which are unpopular among the communities.

The promotion of on-farm tree growing depends on sound extension system. Extension is defined as a non-formal education system that aims at reaching farmers in their own context and life situations by identifying their problems and needs (Blackburn, 1989). On the other hand, agricultural extension is defined as a two-way communication and training process involving adult learning techniques aimed at improving local people's knowledge, attitude and behavioral change leading to adoption of new technologies (MoALD, 2001). Forestry extension is defined as a systematic process of exchange of ideas, knowledge and techniques leading to mutual changes in knowledge, attitude, practices, values and behavior aimed at improved forest and tree management (Anderson, 1996). It has also been described as any situation in which local people are directly and willingly involved in tree planting activities which they derive some benefits (Sim and Hilmi, 1987). Forestry extension is highly related to agricultural extension as it recognizes innovation, community and extension systems as critical components of extension. The Government of Kenya recognizes the role extension plays in the provision of information, technologies and organizational skills that allow farmers to make better use of available resources and increase their production and marketing opportunities. Some of the past extension approaches include training and visit (T&V) and Farmer Field Schools (FFS) (Muga *et al.*, 2011). Forestry Extension Services continue to receive less government funding than agricultural extension services thus subjecting its operations to the external and internal policy changes (FAO, 1996).

History of extension in Kenya

Forest extension in Kenya started with the establishment of the Rural Afforestation Extension Scheme (RAES) in 1971. This was a follow up of the Revised Forest Policy (Sessional Paper No. 1 of 1968) under the former Ministry of Environment and Natural Resources (Tegnas, 1994). Under RAES, forestry extension involved the production of tree seedlings in central nurseries and distribution to communities during tree planting season. In 1984, a comprehensive study of energy supply and demand in Kenya that revealed a large and increasing deficit with standing stock of wood projected to decline by 30% in 2000. This intensified tree growing in farmlands and numerous tree-planting projects were started in line with RAES (Tegnas, 1994).

RAES was rebranded into Forestry Extension Services Division (FESD) in 1990 where farmers were facilitated to raise their own seedlings and plant on their farms (Wamugunda, 1989). The farmers were facilitated with tree nursery materials such as polythene tubes and seeds by non-governmental organizations and donor agencies in the late 80s and early 90s (Mugonyi, 2001).

Due to dwindling financial resources, forestry extension in Kenya underwent another change during the mid and late 1990s with emphasize shifting from provision of production materials to facilitation through learning (Kerkoff, 1994). The implementation of the structural adjustment

programmes within the civil service in the late 1990s resulted in increased understaffing in Forestry Extension Service Division. This necessitated the development of new forestry extension approaches that put emphasis on community participation (Table 1) as a means of scaling up dissemination of forestry technologies to a wider audience.

Table 1: Examples of farm forestry extension approaches in Kenya

Approach	Description	Programmes where used
Individual	Face-face contact with individual farmers. Includes farm and office visits.	Forestry Department before the mid-1990s
Contact farmer	Information passed to a contact farmer who then passes to follower farmers	Adventist Development and Agency (ADRA)
Group approach	Farmers provided with technical package as a group	Vi Agroforestry in Kitale, CARE Kenya
Farming systems approach	Holistic development of packages for existing farming problem	KEFRI (before 1995)
Farmer to Framer	Essentially a contact farmer approach but with an increased emphasis on the diffusion of the information to surrounding farmers.	KEFRI under SOFEM (1997-2002)
Farmer field schools	This is a practical approach of training that empowers farmers to be their own technical experts	Intensification of Social Forestry Project (ISFP). Kitui, Mbeere and Tharaka Nithi

a). The Social Forestry Extension Model

The Kenya government initiated the Social Forestry Extension Model Development Project (SOFEM) to develop sound farm forestry extension approaches in order to strengthen the dryland communities' capacity to grow and manage trees in 1997. The project adopted a farmer-to-farmer extension approach to promote dryland farm forestry technologies in three administrative divisions of Kabati, Chuluni and Central in the present day Kitui County. This approach emphasized the farmer interactions with the extension agent as a facilitator and recognized that interactions and exchange of experiences were necessary stimuli to adoption (Chambers, 1993). A total of 67 core farmers and 935 follower farmers were exposed to this extension approach by the year 2002. The tree species promoted under SOFEM were *Senna siamea*, *Eucalyptus camadulensis* and *M. volkensii volkensii*.

b). The Agroforestry for Integrated Development in Semi-Arid Areas of Kenya project (ARIDSAK)

Agroforestry for Integrated Development in Semi-arid Areas of Kenya (ARIDSAK) was an integrated research-cum-extension project which emphasized dryland farming and rangeland production systems in Makueni and Kajiado counties. Its main agenda were the development and dissemination of agro-silvi-pastoral technologies for soil improvement, increased crop and livestock production and increased income generation. The project used adaptive on-station and on-farm research to develop site specific technologies addressing land-use bottlenecks and extension to improve outreach and adoption through contact farmer extension approach. This approach focused on the training, demonstrations, field days and barazas, a slight off-step from the standard contact farmer extension approach. There was an increased involvement of CBO's and schools.

c). The Intensified Social Forestry Project (ISFP)

The purpose of the Intensified Social Forestry Project (ISFP) was to enable individual farmers, farmer groups and other stakeholders to intensify social forestry practices in order to improve the living standards of the rural people while enhancing sustainable environmental conservation. The project sought to improve institutional and technical capacity for social forestry extension, promote forestry extension activities and avail enough practical knowledge and techniques in social forestry. The project further enhanced information sharing on social forestry extension and related issues among stakeholders in semi-arid areas. This project piloted the Farmer Field School (FFS) extension approach in farm forestry in Kitui (now Kitui County), Mbeere (Embu County) and Tharaka Nithi. The project focused on livelihood improvement through commercialization of *M. volkensii*, *Grevilea robusta*, *Senna siamea*, and *Jatropha curcus* with fruit trees including *Mangifera indica* and avocado. The project encouraged networking between farmer groups in the FFS target area.

d). KEFRI Technology Dissemination Strategy

KEFRI established and initiated technology dissemination unit in 2004/05 financial year. The strategy focused on field days, ASK Shows and exhibitions, stakeholder training, establishment of demonstration plots, radio talks, newspaper supplements and publications. The target tree species included *M. volkensii*, *J. curcus*, *Osyris lanceolata*, *Vitex payos* and *Bambusa vulgaris*. *Melia volkensii* propagation, management and utilization technologies were intensively disseminated between 2005/05 and 2012/13 financial years.

Table 2: The beneficieries of *M. volkensii volkensii* dissemination activities

Activity	Those/No. exposed to *M. volkensii*	Counties and areas covered
Field days	1,500	Kitui, Machakos, Makueni, Embu,Tharaka Nithi Mutitu, Tiva, Mwingi, Kwavonza, Matinyani, Kibwezi
ASK Shows and exhibitions	8,795	Machakos, Garissa and Kitui
Stakeholder training	285	EDK and INADES
Demo plots	4	Ithumbi, Mutha, Matinyani, Mutitu
Radio Talks	20	Kitui, , Embu , Makueni
News Paper supplement	4	National
Assorted Publications	2	Dryland forestry DERP
Visitors	200	Kitui, Machakos, Makueni, Embu, and Tharaka Nithi

Source: extracted from KEFRI annual reports, 2005-2012

Extension methods for promotion of tree planting are not well documented. It is difficult to assess the total number of stakeholders covered through newspaper articles and radio programmes. However, there has been active participation (personal contact with the stakeholder) in excess of 10,600 in Kitui, Machakos, Makueni and Garissa, Embu and Tharaka Nithi counties.

This study attempted to answer the following research questions:

a. Which extension methods have been used in the promotion of tree and *M. volkensii* planting in the study areas?

b. What are the key tree species promoted under the different extension approaches?

c. Who are the main stakeholders in the promotion of *M. volkensii* in Kitui, Makueni and Machakos counties?

The broad objective of this study was to evaluate various extension methods that have been used to promote *M. volkensii* planting in Lowere Eastern, Kenya. The specific objectives were to identify:

a. Document extension methods used by various stakeholders in the promotion of *M. volkensii volkensii* in Kitui, Makueni and Machakos counties.
b. Identify key stakeholders in the promotion of *M. volkensii* planting in Kitui, Makueni and Machakos counties,
c. Identify important tree species promoted under different extension approaches Kitui, Makueni and Machakos counties.

II. MATERIALS AND METHODS

Study area

Kitui County: Kitui County is located between latitudes 0°10‟ and 3°0‟ south and longitudes 37°50‟ and 39°0‟ east. Kitui County has a low lying topography with arid and semi-arid climate (Government of Kenya, 2014). It covers an area of 30,496.4 km^2 including 6,369 km^2 occupied by Tsavo East National park. The county shares its borders with seven counties: Machakos and Makueni to the west, Tana River to the east and south-east, Taita Taveta to the south, Embu to the north-west and Tharaka-Nithi and Meru to the north. The altitude of the Kitui County ranges between 400m and 1800m above sea level. The County experiences high temperatures throughout the year, ranging from 14°C to 34°C. The hot months are between September and October to January and February. The maximum mean annual temperature ranges between 26°C and 34°C whereas the minimum mean annual temperature ranges between 14°C and 22°C. July is the coldest month with temperatures falling to a low of 14°C while September is the hottest month with temperature rising to a high of 34°C. Rainfall distribution is erratic and unreliable. The annual rainfall ranges between 250mm-1050 mm per annum with 40% reliability for the long rains and 66% reliability for the short rains. The population of Kitui County stood at 1,012,709 people in 2009 (Republic of Kenya, 2009). The commercial trees species commonly grown include *M. volkensii , Cupressus lusitanica*, *Pinus* spp and *Grevillea robusta* (Government of Kenya, 2014).

Machakos County: Stretches from latitudes 0º 45’ South to 1º 31’ South and longitudes 36° 45’ East to 37° 45’ East. The county has an altitude of 1000 - 1600 meters above sea level (Government of Kenya, 2015). It has a population of 1,098,584 people, 264,500 Households and covers an area of 6,208 km^2 (Republic of Kenya, 2009)

Makueni County: Covers over an area of 8,034.7 km^2 with a projected population of more than 0.9m people and is one of the forty-seven counties in Kenya (Republic of Kenya, 2009). The County borders Kajiado to the West, Taita Taveta to the South, and Kitui to the East and Machakos to the North. It lies between Latitude 1^0 35´ and 3^0 00’ South and Longitude $37^0$10´ and 38^0 30´East (Government of Kenya, 2013). The terrain is low-lying from 600m above sea level in Tsavo. The County is largely arid and semi-arid and usually prone to frequent droughts. The lower side which is very dry receives little rainfall ranging from 300mm to 400mm. The County experiences two rainy seasons, the long rains occurring in March /April while the short rains occur in November/December. The hilly parts of Mbooni and Kilungu receive 800-1200mm of rainfall per year (Government of Kenya, 2013). High temperatures of 35.8^C are experienced in the low-lying areas causing high evaporation which worsens the dry conditions.

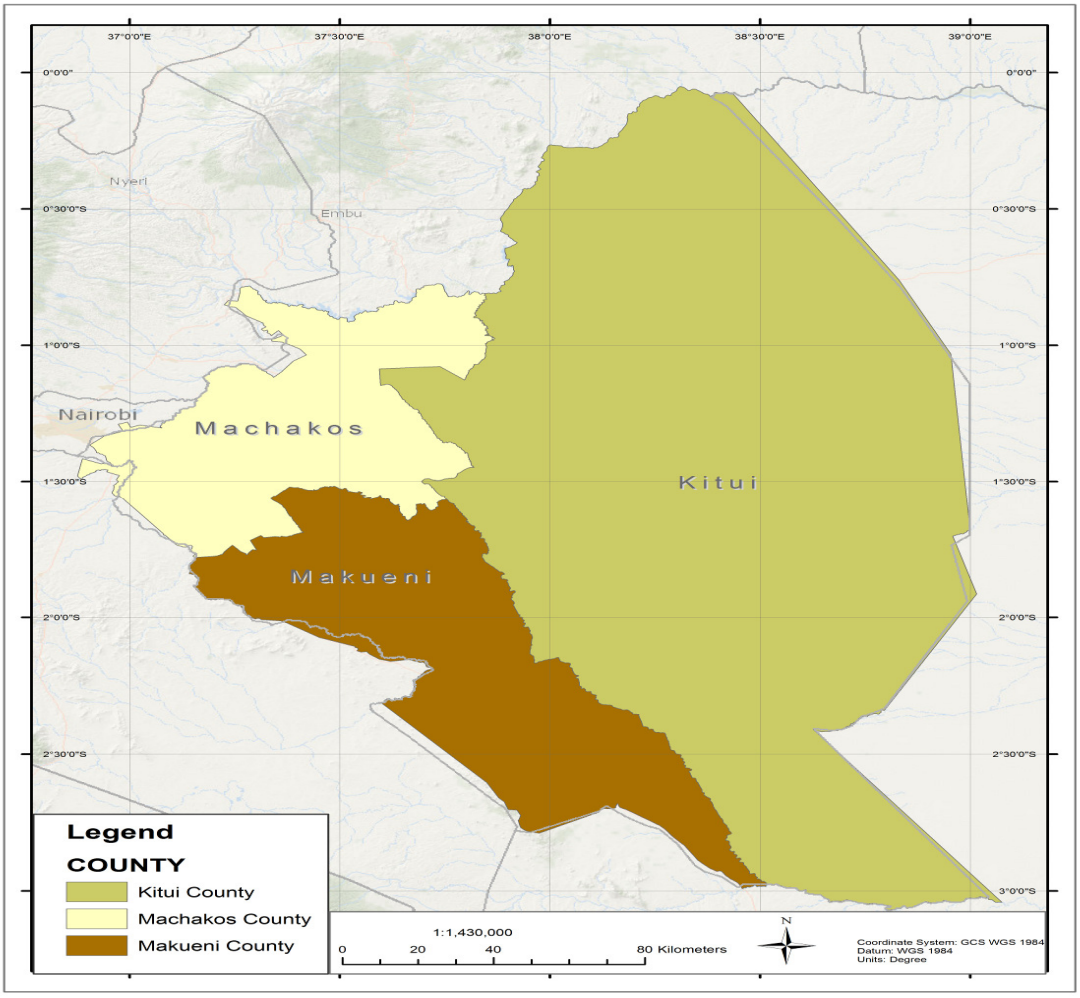

Figure 1: Location of the study area

III. RESULTS AND DISCUSSIONS

Socio-economic characteristics of stakeholders

A total of 101 respondents were interviewed: 51 respondents (50.5%) were from Kitui, 30 respondents (29.7%) from Machakos and 20 respondents (19.8%) from Makueni. There were 58 male respondents (57.4%) and 43 female respondents (42.6%) as both sexes were involved in *M. volkensii* planting. There was a significant male dominant in Makueni and Machakos counties (Figure 2).

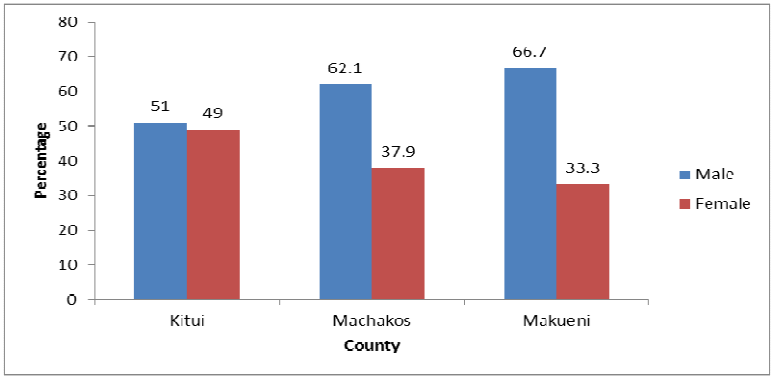

Figure 2: Gender representation in the study sample by County

There were four levels of education (Figure 3) in the study area: informal (4%), primary (46%), secondary (29%) and Tertiary (21%). The majority of respondents in Kitui and Makueni had attained primary or secondary levels of education. There was no respondent with informal education in Machakos. There was no significant difference in the level of education between male and female respondents in all the study sites.

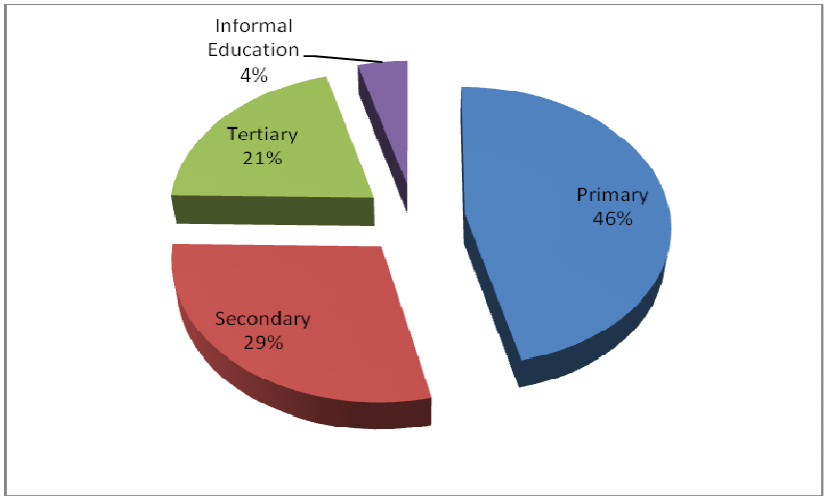

Figure 3: Level of education

The respondents were aged between 25 and 83 years with the majority of them falling under the 40 to 49 and 50 to 65 age classes (Figure 4)

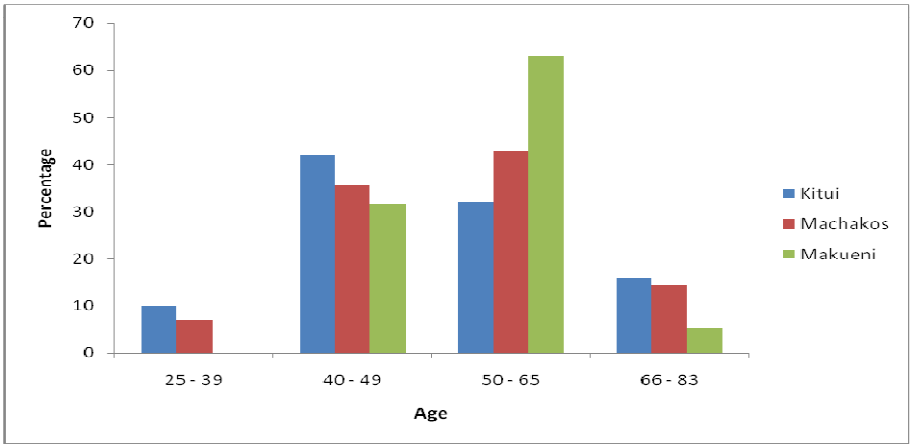

Figure 4: Age classes of respondents

Income analysis

Respondents derived their income from on-farm economic activities such as crop, livestock and tree sales (Figure 5). Farm income was significantly higher in Makueni than in Kitui and Machakos counties. Other income sources included sale of fodder, vegetables and pottery. Income from tree sales was significantly higher than the other farm activities in all the three counties. Tree sales were higher in Makueni as compared to the other counties. The number of respondents deriving incomes from the sale of tree products was generally higher across the tree counties which were followed closely by incomes from the sale of livestock and other farm produce (Figure 5).

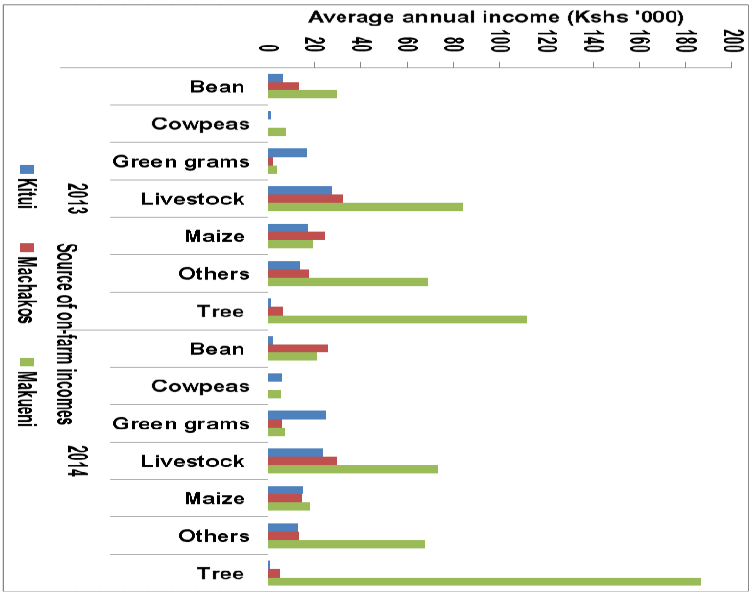

Figure 5: On-farm income sources in 2013 and 2014

Off-farm income was reported among 50% of the respondents. The sources of off-farm incomes included employment, commercial activities and rent.

Land ownership and Labor requirements

The land holding across the study sites ranged from 0.5 – 5 acres (56%), 6 – 10 acres (26%), 11-20 acres (4%) and 21- 30 acres (14%). The majority of the respondents (81%) were small scale farmers with maximum of 10 acres of land.

Most of the respondents (80%) were engaged in farming as their main economic activity. Whereas the majority of the farmers spent 11-20 days (54%) on farming, 26% spent more than 21 days. Respondents from Kitui spent over 20 days in a month on farming (42%)) than Makueni (20%) and Machakos (7%) counties (Table 3).

Table 3: Labour requirements in farming per month

	Days (%)			
County	**1 – 10**	**11 – 20**	**21 - 25**	**n**
*Kitui	14.0	44.2	41.9	**43**
Machakos	19.4	74.2	6.5	**31**
Makueni	35.0	45.0	20.0	**20**
Total	20.2	54.3	25.5	**94**

An average of three people provided on-farm labour per household in all the study sites. On-farm labour accounted for an average of 2, 3 and 3 people in Kitui, Machakos and Makueni Counties respectively.

Tree planting activities

Most of the respondents (99.1%) had established trees the last three years. Only one respondent had not established any trees within the three years. The respondents sourced their planting materials from farmers' nurseries (59.4%), local farms (14.8%), KEFRI (7.8%), KFS (4.7%) and Ministry of Agriculture (3.9%). Slightly more than half of the respondents (53.5%) were members of a community group. At least 41% of the respondents were members of farmer association such as savings and credit, tree planting and tree seed associations (Table 4).

Table 4: Some farmer groups that were considered during the study

Name of Group	Frequency	(%) Total Frequency
Kadeg	4	11.4
Kaluluini Jishinde Ushinde	5	14.3
Kamunuuni	2	5.7
Kitende FFG	2	5.7
Mangumu	3	8.6
Mithini SHG	3	8.6

Extension methods used

A number of extension methods were used in the three counties. These included ASK shows, Demonstration and Field Days, Open Days, Seminars, Farmer to Farmer, Barazas, Churches and Media. Media inlcudes Tvs, radios and websites (Fig. 6).

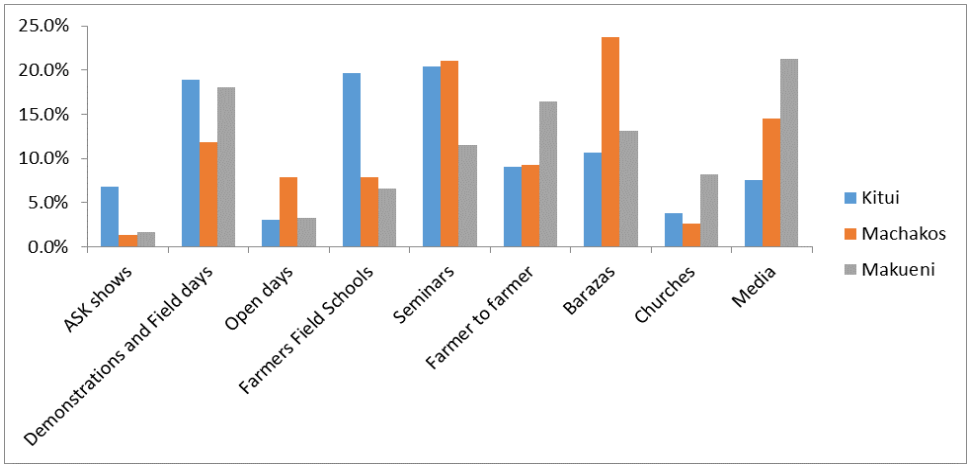

Figure 6: Extension methods used

The most common means of information transfer (Figure 7) the three counties was the use of seminars (18.6%), Demonstration and Field days (16.7%) and Barazas (14.9%). The other methods include Farmer Field Schools (13.4%), Media (12.6%) Farmer to Farmer (10.8%), Open days (4.5%), Churches (4.5%) and ASK shows (4.1%)

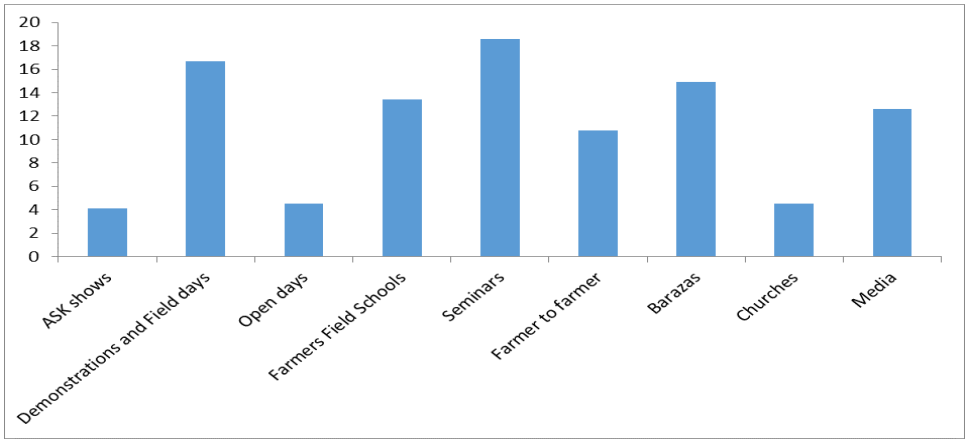

Figure 7: Common means of information transfer

Key tree species promoted under different extension approaches

Table 5: Tree species planted during the period

Tree species	2012		2013		2014		Total		% Survival
	Planted	survived	Planted	Survived	Planted	survived	Planted	survived	
***Acacia* spp**	200	180	0	220	200	91	220	200	**91**
Azadirachta indica	0	0	20	20	18	90	20	18	**90**
Grevillea robusta	151	122	30	212	153	72	212	153	**72**
Senna siamea	10	10	0	30	20	67	30	20	**67**
Melia volkensii	207	194	0	307	194	63	307	194	**63**
***Eucalyptus* spp**	1695	1018	0	1695	1018	60	1695	1018	**60**
***Jacaranda* spp**	4	2	0	4	2	50	4	2	**50**
Moringa oleifera	10	3	10	26	8	31	26	8	**31**
Mangifera indica	78	8	15	93	18	19	93	18	**19**

Various tree species planted during the 2012-2014 period (Table 5) include *Acacia* spp, *Grevillea robusta*, *Senna siamea*, *M. volkensii*, *Eucalptus* spp, *Jacaranda* spp, *Moringa oleifera*, *Mangifera indica* and avocado. *Jacaranda mimosifolia* for aesthetic purposes. Tree survival ranged from a high 91% for Acacia spp to the lowest for and *Mangifera indica* (19%).The survival rates for *Grevillea robusta*, *M. volkensii*, *Eucalyptus* spp and *Senna siamea* averaged between 60% and 72%. *Eucalyptus* spp, *Mangifera indica*, *M. oleifera* and *G. robusta* were gown in all the counties whereas *M. volkensii* was mainly grown in Kitui and Makueni counties. These was attributed to KEFRI's research and development activities in Kitui and Makueni Counties.

In, *M. volkensii* was the most common on farm tree species (Table 6). The other trees include *Azadirachta indica*, *Terminalia brownii* and *Teclea simplicifolia*. The popularity of *M. volkensii* on this occasion can be explained by the attention that the tree has received in terms of extension methods for its promotion on the various counties.

Table 6: Major on-farm tree species and their uses

Tree Species	Frequency	Percent	Fuelwood	Poles & post	Timber	Medicine	Shade	Fodder
M. volkensii	56	26.2	X	X	X	X		
Azadirachta indica	37	17.5	X	X		X	X	
Grevillea robusta	32	15.1	X	X	X		X	
Eucalyptus spp	22	11.4	X	X	X			
Senna siamea	23	10.9	X	X	X		X	
Acacia spp	18	8.5	X	X			X	X
Lucaena spp	5	2.4	X	X	X			X
Terminalia brownii	4	1.9	X		X	X	X	
Teclea simplicifolia	4	1.9	X	X		X	X	

IV. CONCLUSION AND RECOMMENDATIONS

Tree farming is a popular activity within the drylands counties of Makueni, Kitui and Machakos however, the adoption rate of planting high value tree species such as M. volkensii is still low. *Melia volkensii* is an important dryland tree species which is drought tolerant. Therefore, *M. volkensii* forms an alternative source for sustenance of livelihoods in times of reduced rainfall. Its wood produces high quality timber which has a high economic value. Apart from fodder for livestock during dry seasons, it

can also be intercropped with food crops during the initial period of establishment, which may be up to four years depending on the initial spacing.

Promotion of *M. volkensii* through different fora is recommended in order to increase its adoption rates among farmers. There is also need to have more research and demonstration plots of *M. volkensii* and other promising tree species across the three counties for easy comparison. Since each county has its most effective extension method, customized methods are recommended for each county. For instance, in Kitui, Farmer Field Schools (FFS), seminars, Field days and demonstration plots have proved to be effective for the transfer of information. The National and county governments should promote the use field days, seminars, farmers' field schools, baras (formal local meetings) and media either individually or in combination. These extension methods have proved to be effective in each county and involve all stakeholders more so at the grass root level.

V. ACKNOWLEDGEMENT

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BIBLIOGRAPHY

[1] Anderson J., Farington J. (1996). Forestry Extension: Facing the challenges of today and tomorrow. Unasylva vol 47. 214-225. Rome, Italy.
[2] Attanas A., (2002). Profile survey of SOFEM farmers. Project implementation report. Kenya Forestry Research Institute. Nairobi Kenya.
[3] Beentje, H.J. (1994). Kenya Trees, Shrubs and Lianas. National Museums of Kenya, Nairobi, Kenya. 722p.
[4] Blackburn D. J. (1989) Foundations and changing practices in extension. Guelpt, Ontario, Canada: University of Guelph.
[5] Chambers, R. (1993). Reversals, institutions and change. In: Chambers, R., Pacey, A. and Thrupp, L.A. (Eds.) Farmer First: Farmer Innovation and Agricultural Research. Intermediate Technology Publications. London. 181-195.
[6] Emerton, L., Kanyanya E., Kiunga K. (1996). Socio-economic techniques for farm forestry extension. Forest Extension Services Division. Nairobi, Kenya.
[7] FAO (1996). Organization and management of agricultural development for small scale farmers, Rome. Italy
[8] Feder, G. Just R. Zilberman, D. 1985. Adoption of agricultural innovations in developing countries. A survey. Economic Development and cultural Change 33 (2) 255-298.
[9] Government of Kenya (2013) Makueni County Integrated Development Plan (2013-2017). Nairobi, Kenya. Government Printer.
[10] Government of Kenya (2014) Kitui County Integrated Development Plan (2013-2017). Nairobi, Kenya. Government Printer.
[11] Government of Kenya (2015) Machakos County Integrated Development Plan (2013-2017). Nairobi, Kenya. Government Printer.
[12] Government of Kenya (2015) National Policy for the Sustainable Development of Northern Kenya and other Arid Lands. Ministry of Devolution and Planning. Government Printer. Nairobi, Kenya.
[13] KEFRI (2011). Significant Achievements 1986 -2011. Print Maxim. Nairobi, Kenya. 177 pp.
[14] Kerkoff, P. (1992). Agroforestry in Africa: a survey of project experience. Panos Publications. London, UK.
[15] Luvanda A. M., Musyoki J., Cheboiwo J., L. Wekesa and Ozawa M. (2015). An assessment of the socio-economic importance of *M. volkensii volkensii* based enterprises in Kenya. Kenya Forestry Research Institute (KEFRI). Nairobi, Kenya.
[16] Milimo, P.B., McP Dick, J. & and C Munro, R.C. (1994). Domestication of trees in semi-arid East Africa: the current situation.
[17] MoALD (2001) national agriculture and livestock extension program (NALEP): an implementation framework. Ministry of agriculture and livestock development, kenya government, 44.
[18] Muga. M.O, Oriwo. V, Kitheka. E, Nyamai. D, Muthike. G and Choge. S (2011) *Promotion of tree-based alternative livelihoods while conserving the Environment and rehabilitating degraded ASAL ecosystems in Kenya (Phase II).* Kenya Forestry Research Institute (KEFRI) progress report on KEFRI-NALEP partnership. Nairobi, Kenya. 42pp.
[19] Mugonyi Z. (2001). Review of extension approaches in Kenya. Proceedings of the regional social forestry extension seminar for semi-arid areas. Kenya Forestry Research Institute. Nairobi, Kenya.

[20] Muturi, G.M., Mutua G.K. and Maingi F.M. (2003). Inter-specific variation of biomass production and root morphology among 20 drylands species after 15 months of growth in an arid site in Kitui district, Kenya: Implication to dry land silviculture. In: Odera, J.A. and Kamondo, B.M. (Eds). Management of drylands biodiversity in Eastern Africa. Proceedings of the Regional Workshop held at the National Museums of Kenya, Nairobi; 30th July to 1st August, 1997.
[21] Republic of Kenya (2009) Kenya National Bureau of Statistics census report. Nairobi, Kenya. Government Printer.
[22] Sim, D., Hilmi, H., 1987. Forestry extension methods. FAO forestry Paper No. 8. Rome. Italy.
[23] Tegnas, B., (1994). Agoforestry extension manual for Kenya. ICRAF. Nairobi, Kenya.
[24] Wamugunda, B.G. (1989) Effective forest extension in support of agroforestry development. In: Kilewe, A.M., Kealey, K.M. and K.K. Keboara, ed., Agroforestry development in Kenya. Proceedings of the Second Kenya National Seminar on Agroforestry held in Nairobi, Kenya, 7–16 November 1988. Nairobi, Kenya, National Council for Science and Technology and International Council for Research in Agroforestry.
[25] Word Bank Group (1993). Basic education and agricultural extension: Costs, effects and alternatives. World Development Report 1993. Oxford University Press. Washington DC, USA.

