# Factors influencing farmer-to-farmer extension of forage legume technology

**Sinja, J.[a,c*], Nyangaga, J.[c], Karugia, J.T.[a], Waithaka, M.M.[b,c], Mwangi, D.M.[b] and Romney, D.L.[c]**

[a]University of Nairobi, Department of Agricultural Economics, P.O. Box 29053, Nairobi, Kenya

[b]Kenya Agricultural Research Institute, P.O. Box 58334, Nairobi, Kenya

[c]International Livestock Research Institute, P.O. Box 30709, Nairobi, Kenya

*Corresponding author: email j.sinja@cgiar.org tel: 254 20 4223000, Fax: 4223001

## Abstract

Forage legumes have been introduced to farmers in Central Kenya between 1980 and 2002 through various Institutional and Projects' efforts. The adoption rate of these forages among farmers has been found to be rather low, with the NDDP reporting only 1.9 % of farms surveyed and an ICRAF report indicating that the technology was only reaching 1 % of smallholder farms. An evaluation of adoption of *Calliandra* and *Desmodium* was conducted to identify farm characteristics affecting the likelihood of sharing of *Desmodium* and *Calliandra* technologies as well as to characterise the spread or diffusion of the technology from the original contact groups and the effect of distance from those groups. Three groups of farmers were approached. A first generation who received planting material from the distributors, a second generation who received planting materials from the former, and a randomly selected group of farmers at various distances from the first contacts. Informal discussions were held with the farmers and formal questionnaires filled. Out of the 133 first generation farmers contacted 64.7% still had *Desmodium* and 89.5% still had *Calliandra*. More farms in the contact sub-locations had the plants than the sub-locations further away. The small sample size of those with the forages could not allow effect of distance to

be worked out. Tobit estimates of effects of farmer attributes influencing sharing of planting materials shows that the status of the household head in the community positively affected the likelihood of giving out planting material. The technology has a rather slow spread as indicated by percentages of farms with the forages. For better adoption and spread proponents of the technology should have the technology introduced to farmers who have substantial positions in farmer groups or have been bestowed community responsibility.

*Key words: adoption, legume technology, central Kenya*

**Introduction**

Forage legumes have been introduced to farmers in Central Kenya between 1980 and 2002 through various efforts. *Desmodium* species were introduced in the early 80's by the National Dairy Development Project (NDDP). In early 90's both herbaceous and shrub legumes introduced by Kenya Agricultural Research Institute (KARI) to be incorporated with food crops. In the mid 90's the Legume Research Network Project (LRNP) introduced herbaceous legumes as green manure crops in Embu. Between 1996 and 1998, KARI gave out *Desmodium* to 15 farmers in Maragua district under the National Agricultural Research Program (NARP) II, for incorporation in Napier grass. Between 1997 and 2000, KARI and the International Centre for Research in Agroforestry (ICRAF) through the System-wide Livestock Programme (SLP) activities distributed *Calliandra* to more than 100 farmer groups.

The adoption rate of these forages among farmers has been found to be rather low, with an NDDP report in 1994 indicating that only 1.9 % of farms surveyed in Eastern province had the forage. A report of the SLP efforts (Franzel, 1999) indicates legume forage technology has only been planted by 1 % of smallholder dairy farms. In SDP farm characterization surveys conducted 1996 – 2000, reports show only 2.3 % and 0.9% of the 3,311 households visited (or 3.3% and 1.3% of farms

with cattle) in 16 districts had *Calliandra* and *Desmodium*, respectively (Staal et al, 2001). Following SDP distribution of *Desmodium* to *Calliandra* farmers, it was decided that evaluation an evaluation of adoption and diffusion of both *Calliandra* and *Desmodium* was important. A survey was conducted to identify farmer and farm characteristics affecting the likelihood of sharing of *Desmodium* and *Calliandra* technologies i.e. farmer to farmer diffusion. During the same time efforts were made to ccharacterise the spread of the technology from the original contact groups and the effect of distance from those groups.

**Methods**

The study was done in the highlands of central Kenya. A combination of cluster and random sampling was applied with three groups of farmers interviewed. The first generation group had received *Calliandra* seed between 1999 and 2000. From this generation interviews were conducted on a random sample of 60% of those who still had and 60% of those who no longer had the forage on their farms. The second generation farmers were non-members of the original group but who had obtained planting materials from the latter. A diffusion survey was then conducted on another group of farmers from the following zones: 150 randomly selected from sub-locations where the original contact groups were located (designated 0 km radius), 133 from sub-locations in a 5 km radius, and 142 from sub-locations in a 15 km radius further.

Informal discussions were held with the farmer groups to identify and rank various forage and farm factors considered of value regarding use of the legume and sharing out. Formal questionnaires were used on first and second generation farmers to collect characteristics of the household and farm, the technology, as well as details of planting material shared. A very short formal questionnaire was filled by farmers selected in the different distance zones, focusing only

on farm size, livestock kept, if they ever heard about the forages, sources of the information and planting materials and quantities of any forages they had growing on the farm.

**Results**

Out of the 133 first generation farmers contacted in Embu, Maragua, Kirinyaga and Nyeri 64.7% still had *Desmodium* and 89.5% still had *Calliandra*. Collectively they had shared planting material to 215 other non-group (second generation) farmers (Table 1). There were 128 second generation farmers in Maragua and Kirinyaga. Out of these of only 98 could be traced and 93 were interviewed. Table 2 shows levels of adoption among various types of farmers. Table 3 shows adoption rates of *Calliandra* and *Desmodium* among the randomly selected farms in sublocations at specified distances from the original contact points (sublocations). Adoption in this study is defined as the presence of any amount of the forage on farm; no minimum amount was specified. The amounts per farm of those who had at least some is also shown. More farms in the contact sub-locations had the plants than the sub-locations further away. The small sample size of those with the forages did not allow significance of distance to be worked out.

Tobit estimates of effects of farmer attributes influencing giving out *Calliandra* and *Desmodium* planting materials to other farmers are shown in Table 4. The larger the coefficient the more likely the effect is positive. A positive sign indicates a positive effect – i.e. for every unit increase in the variable you would expect the farmer to give materials to the number of extra farmers indicated in change in intensity.

**Discussions**

The low percentage of farms with the forages among the random samples implies a slow adoption rate from the original contact farmers. Adoption rates are still very low despite the concerted

efforts of various projects to introduce the forages. However, there is no clear relationship between distance and amounts of forage on farm, an observation that was also made from other SDP findings: there is yet no pattern on who has the tree forages based on location, household characteristics, land size etc. (Steve et al 2001).

The status of the household head in the community appeared to affect the likelihood of giving out planting material. Group officials or those with community responsibilities were more likely to give out materials. These people were most likely by nature to be outspoken and active, resulting not only in their being elected to community roles, but sharing information and ideas. The community role could also imply wealth status but it is not clear how public status is confounded with wealth. Data is being analysed to develop a wealth indicator that combines resource endowment and income generation. If significant, this could mean targeting technology at more influential members of the community. As a follow-up, off-farm income had a positive significant effect at 10% level for *Calliandra*. However, this variable should not imply that farmers with off farm income are wealthier. Off-farm income could be an indication of limited home farm resources necessitating outside ventures and thus more exposure to new ideas.

The amount of *Desmodium* a farmer has on the farm had the greatest effect on both the extent and probability of giving out *Desmodium* but was negative for *Calliandra*. This could have been due to the mode of propagation since the biggest limitation in sharing *Calliandra*, as pointed out during group discussions, was the availability of seeds. Use of cuttings as planting materials made *Desmodium* more available, especially if one had a relatively large area of the crop. The longer the time a farmer had had the fodder on the farm allowed an experience of benefits that could lead to sharing out the technology. For *Calliandra* this also allows for seed harvesting and seeds are easier to distribute.

The negative significance in 'other farm visits' (taken to be contacts with other farmers) for both giving out *Calliandra* and *Desmodium* is rather surprising and probably indicates that these visits did not involve discussion of the forages and sharing out of planting material. The number of goats owned by a farmer was positively significant for giving out *Calliandra* at 10% level. This can only be related to the fact that farmers who received the material originally belonged to goat rearing groups, and the more goats one had, the longer they had had the material and hence the seeds to share.

Insignificant factors in sharing out planting material included the age, particularly the older farmers, and education of the household head. Old farmers had been introduced to the technology far before the more recent projects and they were not active in the later farmer groups and sharing of information. Farmers with a higher level of education may be more conversant with the technology and its benefits but they may prefer other alternatives, though the reasons for this were not collected. These types of farmers were also likely to have higher wealth or resources that may allow them to use these other options.

**Conclusions**

Proponents of the technology may have demonstrated its advantages and strived to have it spread as much as possible but its uptake from original contacts to the wider community is rather slow.

**Recommendations**

According to these results, any efforts to promote or further increase adoption of legume forages should have the technology introduced to farmers who have substantial positions in farmer-groups or have been bestowed community responsibility. Forage banks, for distribution, could be

established on farms where the technology has been for a longer time or there is a relatively large area of the crop.

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Table 1. Percentages of first generation farmers who gave out *Calliandra* and *Desmodium* by districts.

| | **Embu** | | **Kirinyaga** | | **Maragua** | | **Nyeri** | |
|---|---|---|---|---|---|---|---|---|
| | Desm | Call | Desm | Call | Desm | Call | Desm | Call |
| n | 18 | 18 | 39 | 39 | 56 | 56 | 8 | 8 |
| % that gave out | 8 | 71 | 21 | 52 | 34 | 40 | 25 | 83 |
| Mean no. of farms given per farmer | 0.25 | 1.6 | 0.5 | 1.1 | 0.8 | 1.3 | 0.6 | 0.4 |

Table 2. Levels of fodder tree adoption among the various types of farmers in Central Kenya

| **Farmers type** | **n** | **% currently with forage** | | **Mean quantities per farm** | |
|---|---|---|---|---|---|
| | | ***Desmodium*** | ***Calliandra*** | ***Desmodium*** area ($m^2$) | ***Calliandra*** no of trees |
| 1st generation farms | 133 | 65 | 90 | 449 (SD 987) | 300 (SD 569) |
| 2nd generation farms | 93 | 50 | 56 | 278 (SD 734) | 40 (SD 68) |
| Random farms (total) | 425 | 9 | 9 | 181 (SD 150) | 38 (SD 77) |

Table 3. Levels of fodder tree adoption among randomly selected farmers at different radius lengths from the original contact points.

| | **Kms** | | | **All Farms** |
|---|---|---|---|---|
| **Radius from first contact sublocation** | **0** | **5** | **15** | |
| **No of farms visited** | **150** | **133** | **142** | **425** |
| *Calliandra* (% of farms with forage) | 13.3 | 6.8 | 6.3 | 8.9 |
| *No of trees per farm* | *24 (SD 32)* | *50 (SD 117)* | *56 (SD 71)* | *38 (SD 69)* |
| *Desmodium* (% of farms with forage) | 10.7 | 7.5 | 7.7 | 8.7 |
| *Area $m^2$ per farm* | *210 (SD 528)* | *142 (SD 324)* | *176 (SD 390)* | *181 (SD 430)* |
| No of farms with *Calliandra* or *Desmodium* | 22.0 | 13.5 | 11.3 | 15.8 |

*Source: Authors' survey 2003*

Table 4. Tobit estimates of effects of farmer attributes influencing giving out *Calliandra* and *Desmodium* planting materials to other farmers

| **Variable** | **Coefficient** | **Std. Error** | **Total change in giving out** | **Change in intensity of giving out** | **Change in probability of giving out** |
|---|---|---|---|---|---|
| *CALLIANDRA* | | | | | |
| Age of household head (years) | 0.02 | 0.03 | 0.01 | 0.01 | 0.23 |
| Education of household head (years) | 0.05 | 0.10 | 0.02 | 0.02 | 0.61 |
| Household head group official (Yes/No) | 1.29[c] | 0.72 | 0.56 | 0.43 | 16.98 |
| Household head has community responsibility (Yes/No) | 1.50[b] | 0.76 | 0.69 | 0.51 | 19.81 |
| Household head has off farm income (Yes/No) | 1.38[c] | 0.76 | 0.63 | 0.47 | 18.29 |
| Household head enjoys other farm visits | -0.58 | 0.87 | -0.26 | -0.19 | -7.67 |
| Number of *Calliandra* trees on farm | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Years of *Calliandra* on farm | 0.47[a] | 0.15 | 0.20 | 0.15 | 6.24 |
| Number of cattle owned (TLU) | 0.23 | 0.31 | 0.10 | 0.08 | 3.08 |
| Number of goats owned (TLU) | 0.49[c] | 0.28 | 0.21 | 0.16 | 6.47 |
| Distance from farm to road (Km) | 0.26[c] | 0.14 | 0.11 | 0.08 | 3.39 |
| Constant | -5.68 | 2.78 | -2.43 | -1.85 | -75.12 |
| ***DESMODIUM*** | | | | | |
| Age of household head (years) | 0.03 | 0.04 | 0.01 | 0.01 | 0.36 |
| Education of household head (years) | 0.06 | 0.14 | 0.02 | 0.02 | 0.73 |
| Household head is group official (Yes/No) | 1.96[b] | 0.97 | 0.57 | 0.51 | 22.86 |
| Household head has community responsibility (Yes/No) | -0.20 | 0.86 | -0.05 | -0.05 | -2.25 |
| Household head with off farm income (Yes/No) | -0.14 | 1.00 | -0.04 | -0.03 | -1.56 |
| Household head enjoys other farm visits | -2.48[b] | 1.10 | -0.85 | -0.71 | -30.78 |
| Area ($m^2$) of *Desmodium* on farm | 3.12[b] | 0.22 | 0.92 | 0.83 | 50.10 |
| Number of cattle on farm | -0.72[c] | 0.43 | -0.20 | -0.18 | -8.33 |
| Number of goats (TLU) | -0.22 | 0.32 | -0.06 | -0.06 | -2.55 |
| Years of *Desmodium* on farm | -0.06 | 0.07 | -0.02 | -0.02 | -0.71 |
| Distance from farm to road (Km) | -0.29 | 0.23 | -0.08 | -0.07 | -3.41 |
| Constant | -0.82 | 3.36 | -0.23 | -0.21 | -9.55 |

*a=significant at 1%, b= significant at 5%, c= significant at 10%*

*Source: Authors' survey 2003*