A baseline socio-economic evaluation of an European Union funded project on use of Micro-Symbionts in agroforestry systems in Zimbabwe

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Abstract

The main objective of the survey was to establish the use of micro-symbionts in agroforestry systems by the smallholder dairy farmers in the different agro-ecological zones of Zimbabwe. Specific objectives of the survey were to (i) Characterize the farmers in terms of resource endowment and agricultural activities they are engaged in (ii) Assess the extent of inoculant use in agroforestry systems (iii) Assess the extent of the use of multipurpose trees by the Zimbabwean smallholder dairy farmers and (iv) provide a baseline report to be used as a basis for the impact assessment of the project. Baseline information on inoculant and *Calliandra calothyrsus* use and/or awareness was collected through structured questionnaires from farmers in Rusitu (Natural Region 1), Tsonzo (Natural Region 11), Nharira (Natural Region 111) and Mshagashe (Natural Region 1V). Results show that 50 to 70 % of the farmers interviewed have raised some agroforestry tree species in the past five years. However, there were low levels (2.7% in Nharira) of inoculant use in smallholder agroforestry systems in almost all the areas surveyed. This suggests that farmers were not aware of inoculants in tree species. There is therefore a knowledge gap, which the project can fill in terms of testing and evaluating the different species with and without inoculants in the areas. Majority of the farmers interviewed were willing to grow *Calliandra* (>95%). In addition farmers were also probed on the reasons that they would want to grow *Calliandra*. Almost 70 % of the sample size mentioned that they would grow *Calliandra* for livestock feed. Other reasons were for improving soil fertility, preventing soil erosion, firewood and for providing windbreaks.

Key Words*:* Micro-symbionts, inoculants, Multi-purpose trees, agroforestry.

Introduction

Zimbabwe's smallholder farming sector is faced with problems of food and fodder shortage, degradation of non-renewable resources and decreasing access to fuel wood supplies. This farming sector especially in semi-arid areas is characterized by mixed crop-livestock systems where cereal crops such as maize, sorghum, finger millet and pearl-millet are grown together with livestock rearing (mostly cattle, goats, sheep, poultry and donkeys). Ruminant livestock in

Zimbabwe depend on natural pasture that is usually in short supply and poor in nutritive quality during the prolonged dry season. On the other hand crop productivity is low due to inherent poor soil fertility, lack of adequate draft power to till the land; among other factors. Generally households with cattle have large arable land areas and achieve higher crop yields per hectare compared to those without (Shumba, 1984).

Agroforestry interventions to alleviate problems of livestock feed and inherent poor soil fertility in the smallholder sector are being evaluated by the International Center for Agro-forestry (ICRAF). Many multi-purpose trees (MPTs) and shrubs have been evaluated for livestock feed production, soil fertility restoration and other subsidiary uses (such as firewood, live fences, timber and organic manure) in tree-crop rotational (improved fallow) systems, contour band plantings and fodder banks (Dzowela, 1992).

Various MPTs that have been evaluated in various communal areas of Zimbabwe include *Leuceana lucocephala*, *Calliandra calothyrus*, *Acacia angustissima*, *Glyricidium sepium, Sesbania sesban* and others. Of these MPTs, *Leuceana Lucocephala* is the most widely grown tree legume, with high nutritive value and high palatability. However, its poor performance in acid soils and of late its susceptibility to *Psyllid* attacks has necessitated the search for alternative species within and outside the genus *Leuceana*. After three years of successive agronomic evaluations in Zimbabwe; *Acacia angustissima* and *Calliandra calothyrus* have consistently matched *Leuceana Lucocephala* in terms of leaf biomass production (Hove, 1999).

Smallholder dairy production is being encouraged in Zimbabwe with a view to improve the economic and nutritional status of the rural population. Mupeta (cited by Dzowela *et al* 1996) cited shortages of affordable protein rich feeds, particularly during the dry season as the major limitation to the productivity of the dairy enterprise. Farmers' dairy milk yields are in the region of about 6-8kg/cow/day (Machaya 1994 cited by Dzowela *et al* 1996). This is in contrast with 10-14 kg/cow/day under fertilized grass pastures (Mupeta, cited by Dzowela *et al* 1996). This implies that a great potential exist for improving milk production in the smallholder sector.

Objectives

The main objective of the survey was to establish the use of inoculants by the smallholder dairy farmers in Zimbabwe. Some of the specific objectives of the survey include:

- To characterize farmers and their areas
- To assess the extent of innoculant use in the smallholder dairy sector
- To provide a baseline report to be used as a basis for the impact assessment of the project.

Field Site and Methodology

The study was carried out in 3 Provinces of Zimbabwe namely Masvingo, Manicaland and Mashonaland East. In Manicaland, two districts Rusitu and Tsonzo were selected for investigation. In Masvingo, Mshagashe small scale was selected whilst Nharira was selected for study in Mashonaland East. These areas were chosen on the basis of their level of involvement in smallholder dairy production. The survey was carried out with a random sample of households in the three areas of study. The questionnaire was administered to 61 farmers in Nharira, 49 farmers in Mshagashe, 59 and 42 farmers in Rusitu and Tsonzo respectively to give a total of 211 respondents. The data was collected and then analyzed by district.

Structure of the survey

The survey was divided into three broad based categories. The first dealt with the socio-economic variables, such as household composition, education level of members, labour resources, ownership of animals and household assets e.g. farm size. Farmers were asked to provide details about the quantity of available labour (both family and non-family labour), description of farmland resources and farming system. The section also elicited on the income sources and the rating of the main use of farm income. Finally, respondents were asked about their livestock as well as the income from livestock and livestock products.

The second part of the survey dealt with specific details concerning the Agroforestry systems and inoculation. Respondents were asked of the Agroforestry trees species they have or intend to have on the farm, knowledge about the inoculants and whether they have used the inoculants. In addition the farmers were also asked about the sources of tree seedlings or seeds as well as the inoculants if they have ever used them. Cultural practices that are done on the trees by farmers were also asked, questions such as whether they apply fertilizer or not, time of application of fertilizers and so on.

The third and last section of the questionnaire dealt with farmer willingness to grow fodder tree species especially *Calliandra*. There were also follow up questions on reasons why farmers were willing to put some area under *Calliandra*, the maximum hectrage that the farmers would be willing to put under *Calliandra*, constraints to growing *Calliandra* and so on.

Statistical Analysis

Data from the questionnaires was coded and entered into the SPSS analytical programme (version 7.5) for descriptive, frequency and other statistics.

Results and Discussion

Characteristics of the survey respondents

The results of the gender characteristics of the households are shown in Table 1.

Table 1: Gender proportions (%) of household heads in four districts

Gender	Rusitu	Tsonzo	Nharira	Mshagashe
Male	83.05	69.05	72.13	71.43
Female	16.95	30.95	27.87	28.57
Grand Total	100.00	100.00	100.00	100.00

Although the selection of the households within the districts was mainly random, most farmers interviewed were mainly male. Noteworthy among the data appearing in Table 1 is that exactly one quarter (25%) of the survey respondents were women. This aggregate figure, calculated across the entire sample, conceals considerable variability between areas, with the proportion of women respondents ranging from about 16% in Rusitu to just over 30% in Tsonzo.

Table 2 shows the level of agricultural training of the household head. Agricultural training is important especially in the farm production. Non-formal education such as agricultural training through extension contacts has been shown to have a significant positive impact on agricultural production (Duraisamy, 1992; Tilak, 1993). Although it has been shown that face to face extension especially in Africa (Zimbabwe included) have had very little limited impact especially on production of new crops and innovations such as multi-purpose trees due to poor funding, farmer/ extension worker ratios and other factors.

Table 2: Level of Agricultural training of household head in the four districts

Training	Rusitu	Tsonzo	Nharira	Mshagashe
Certificate	3.39%	11.90%	1.64%	4.08%
Diploma	0.00%	0.00%	1.64%	2.04%
Master farmer	49.15%	54.76%	55.74%	67.35%
Other	45.76%	33.33%	18.03%	16.33%
None	1.69%	0.00%	22.95%	10.20%
Grand Total	100.00%	100.00%	100.00%	100.00%

It is worth noting that there have been huge efforts in all the surveyed areas in training farmers to a Master Farmer level. About 56% of the farmers in all the areas are master farmers. This implies that over half the farmers in these areas are at a level where they can comprehend and

understand much of the innovative practices as well as allocative effects such as fodder tree species cultivation and innoculation (Chaudri, 1979).

Related to the non-formal education is the formal schooling. The results are shown in Table 3. Again, various studies have shown that education level is important in the adoption of technologies (Feder, Just and Zilberman, 1985). Additional years of schooling have significant positive effect on farm output and gross values of farm production. Duraisamy (1992) found that an additional year of schooling of the household head increases rice output by a percent and gross value output by 4 percent.

Table 3: Level of formal education of household head in the four districts

Education	Mshagashe	Nharira	Rusitu	Tsonzo
None	6.12%	1.64%	11.86%	2.38%
Primary	28.57%	31.15%	54.24%	33.33%
Secondary	59.18%	60.66%	30.51%	57.14%
Adult literacy	0.00%	0.00%	3.39%	0.00%
Diploma	6.12%	3.28%	0.00%	7.14%
Degree	0.00%	3.28%	0.00%	0.00%

It is worth noting from Table 3 that most of the household heads had over 7 years of formal education (secondary school). This might also be ideal for the take up of the multi-purpose trees and inoculants in these areas.

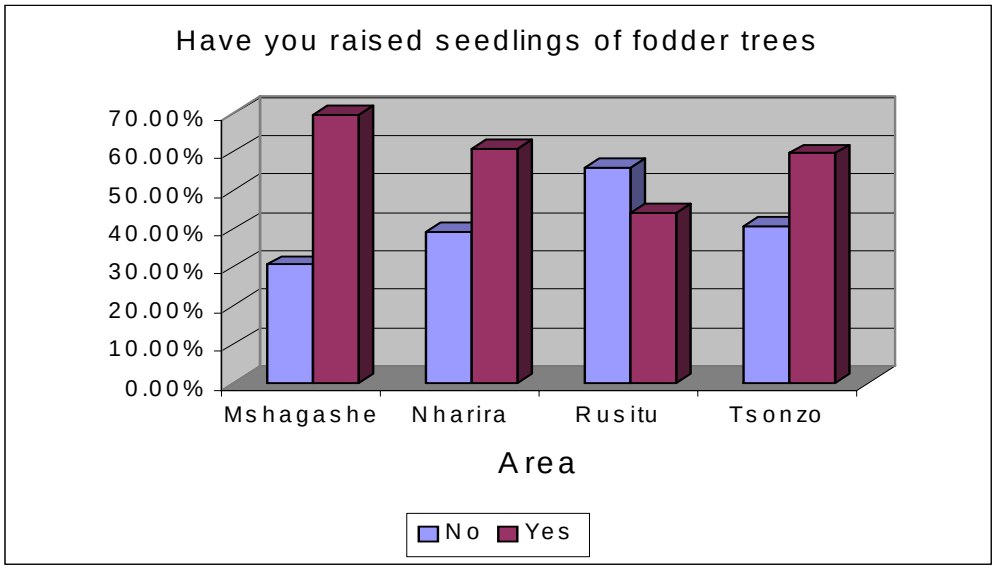
Labor availability is one of the critical issues in smallholder agricultural production. Table 4 presents results of the labour available on the farm

Table 4: Descriptive statistics on household head and members in the four districts

	Rusitu	Tsonzo	Nharira	Mshagashe
Average Age of household head (Years)	51	56	59	61
Members over 15	5	4	4	5
Members under 15	4	2	3	3
Average household size	9	6	7	8
Number of workers	4	6	2	2

The average household size for the areas ranges between 6 in Tsonzo to 9 in Rusitu. However, households also engage workers on their farms.

Figure 1: Average Percentages of farmers who have (yes) and have not (no) raised seedlings for fodder trees in Mshagashe, Nharira, Rusitu and Tsonzo



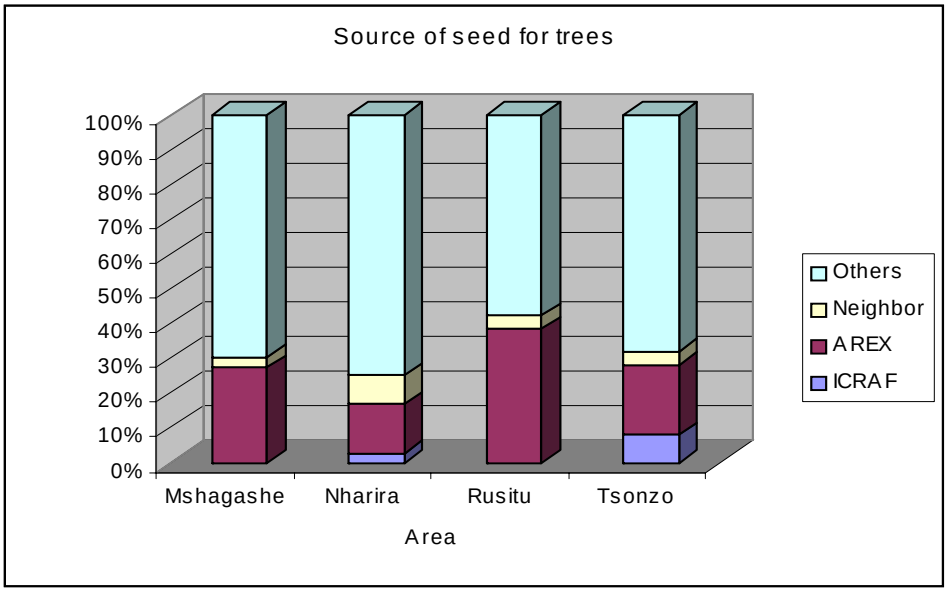
Generally most farmers (about 60%) have raised some agroforestry tree species. Mshagashe, which is very close to Makoholi Research Station, has about 70% of the respondents having raised some agroforestry tree species. It is therefore clear that some of these trees are known and farmers have at one time experimented with the tree species.

Soil Fertility Management for Fodder Tree Species

The respondents were probed on whether they practiced any soil fertility management on their tree species. It is interesting to note that no farmer used any of the soil fertility amendments such as organic and inorganic fertilizers. This has to be expected as such inputs are usually reserved for food and cash crops such as maize, rice, wheat, beans and soybeans, paprika and others.

Figure 2 shows the sources of seed for the agro-forestry tree species. These sources indicate the organizations that are involved with farmers in terms of agro-forestry research as well as other social networks.

Figure 2: Average Percentages showing sources of seed for the agroforestry tree species in Mshagashe, Nharira, Rusitu and Tsonzo small-scale areas



The biggest sources of the seeds in all areas include other sources such as the Forestry Commission of Zimbabwe, Agricultural Rural Development Authority (ARDA) and Non Governmental Organizations. However, the public research and extension system (AREX) is also an important source of seed. ICRAF is also an important source especially in Tsonzo.

Use of innoculants and willingness to grow Calliandra

Results of the innoculant use in the smallholder areas are shown in Table 5. It is clear from Table 5 that there is virtually no use of the inoculants in almost all the areas surveyed. This suggests that farmers do not know of the innoculants especially for tree species. There is therefore a knowledge gap, which the project can fill in terms of testing and evaluating the different species with and without innoculants in the areas.

Table 5: Average percentages of farmers who used (yes) or not (no) used inoculants in Mshagashe, Nharira, Rusitu and Tsonzo small-scale areas.

	Mshagashe	Nharira	Rusitu	Tsonzo
Yes	0.00%	2.70%	0.00%	0.00%
No	100.00%	97.30%	100.00%	100.00%

The one farmer (2.7%) in Nharira (Table 5) mentioned that he inoculated *Leuceana*. The farmer reported that she used a solid innoculant to inoculate her trees. She noted that she got her innoculant from ARDA. However, there is need to verify this as there might be a confusion on

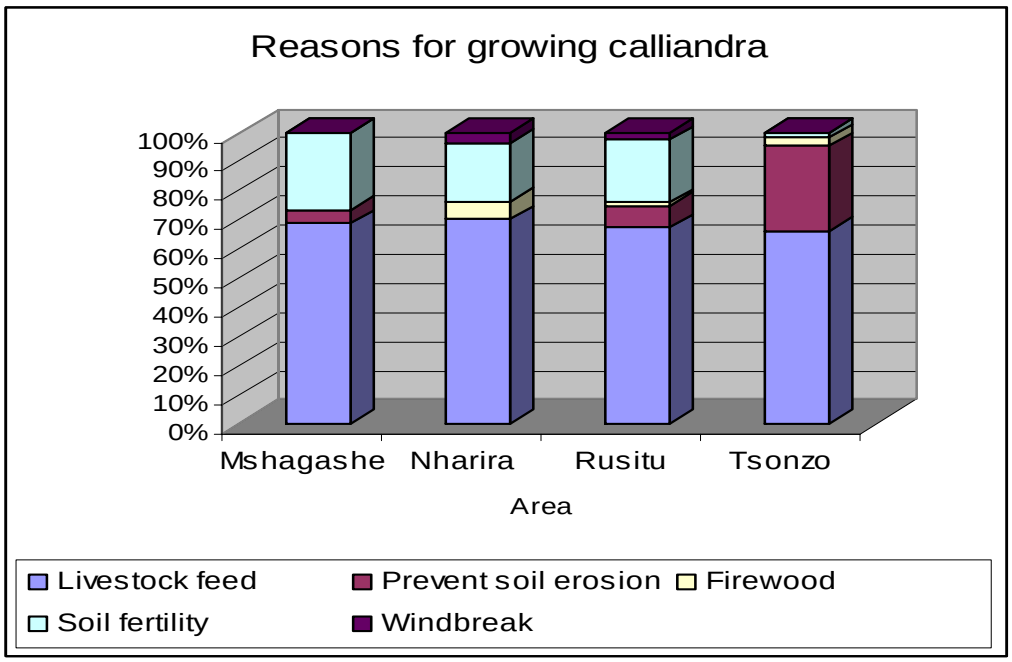
what innoculant was used. She however mentioned that the reason she inoculated was to increase nutrient uptake by her trees. In addition, she reported that she noticed differences between the inoculated and uninnoculated tree species in terms of growth of the trees. It is also important to note that farmers in the surveyed areas do not practice any form of intercropping of the trees and other crops. This again might be a result of lack of awareness of the use of the tree species in soil fertility management. In light of the fact that over 40% of the farmers in all the areas have not grown the fodder tree species before or those that have once grown have abandoned, it is critical to farmers' willingness to grow some of the trees especially calliandra for the first time or once again. Table 6 shows the results of this analysis.

Table 6: Average percentages of farmers who did (yes) or did not (no) show willingness to grow Calliandra in Mshagashe, Nharira, Rusitu and Tsonzo

	Mshagashe	Nharira	Rusitu	Tsonzo
Yes	95.92%	100.00%	98.31%	97.62%
No	4.08%	0.00%	1.69%	2.38%

A majority of the farmers mentioned that they are willing to grow calliandra. Very few farmers (a negligible number) noted that they would not like to grow calliandra. In addition, farmers were also probed on the reasons that they would want to grow calliandra. The results are shown on Figure 3.

Figure 3: Percentages of reasons given by farmers for willingness to grow calliandra in Mshagashe, Nharira, Rusitu and Tsonzo small-scale farming areas.



Almost 70% of the sample size mentioned that they would grow calliandra for livestock feed. Other reasons offered for growing calliandra were; for improving soil fertility, preventing soil erosion, firewood and for providing windbreaks.

It is worth noting that most constraints mentioned by farmers are physical or biotic factors such as the water problems and termites. These can be addressed through technical research into areas such as optimal management techniques that can be developed by research and other organizations. In terms of the socio-economic factors such as lack of fencing and labor issues, there might be a need for demonstrating to farmers the costs and the benefits that are involved in engaging in fodder production especially for those farmers that are involved in dairy production. A simple financial analysis can be developed together with farmers to highlight the economics of fodder production for dairy farming. In this way farmers might realize that benefits might accrue later, which might be worthwhile compared to relying on commercial feeds that might even be beyond the farmers reach. However, there is also a need to encourage farmers to diversify into other short-term and high pay-off enterprises in the period that the trees will be growing so that there is a steady flow of income to the households.

Conclusion

This paper has presented results of a baseline survey on fodder tree species and the use of innoculants in four smallholder areas of Zimbabwe. It also highlighted other descriptive statistics of socio-economic variables and characteristics of farmers in the areas.

In terms of the innoculant use in the smallholder sector, it is clear that these have not been promoted in these areas since only one farmer in the randomly selected sample had ever used the innoculant or knew about the existence of these. This insight proves that there is a big challenge in disseminating the use of these inoculants in the smallholder sector due to the fact that the project is starting from a very low base in terms of farmer knowledge of the innoculants. There is thus a need to have innovative and dissemination pathways that promotes the use of the fodder trees and the innoculants to farmers. This might be achieved through the use of groups of farmers who have either worked with other organizations such as ICRAF, ARDA and others who have an interest in use of fodder trees by farmers. There is also need to develop participatory trials and demonstrations between the research and farmers so that a thorough evaluation of research involving the user of the innoculants is conducted.

It is also important to note that there is a good basis for the identification of farmer experimenters and innovators in the areas surveyed. There have been farmers who have worked with some of the trees before and others who are willing to grow these trees. It is therefore imperative to

closely look at the constraints that farmers mentioned. Some of the problems that the farmers mentioned are water problems, lack of fencing and termites. Inorder for the uptake of these tree species, there is need to address these problems especially in the communal areas where livestock are allowed to move freely especially after the end of harvesting.

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