CALLIANDRA CALOTHYRSUS

Farmers preferences

A study by Mawanda (2004) on the socio-economic impacts of calliandra in the Kabale area, Uganda, shows that farmers' most important perceived benefit from calliandra is animal fodder (Table 1)

Table 1: Most important perceived benefit derived from Calliandra

Primary benefit	Frequency	Percentage
Animal fodder	41	44
Soil erosion control	19	20
Improves soil fertility	19	20
Stakes	10	11
Firewood	3	3
Trees to sell	1	1
Total	93	100

Source: Mawanda 2004

Extent of adoption

A study by Franzel et al (2003) on adoption and dissemination of fodder shrubs in central Kenya, shows that farmers in Embu were adopting calliandra, The research on 45 farmers indicates that over four-fifths of the farmers expanded their calliandra plantings after their first planting (Table 2). Over one-third expanded twice, and 18% three or four times. As farmers expanded, the number of tress planted per expansion increased.

Table 2: Farmers' expansion of Calliandra plantings, Embu, Kenya, 1995 (N=45)

Planting	No. of farmers	Average no. of trees per planting (s.d)
Initial planting	45 (100%)	84 (65)
1st expansion	37 (82%)	85 (54)
2nd expansion	16 (36%)	97 (99)
3rd and 4th expansion	8 (18%)	129 (143)

Source: Franzel et al 2003

The uptake of fodder shrubs has been substantial. By 2006, about 10 years after dissemination began in earnest, 224 organizations were counted across Kenya, Rwanda, northern Tanzania and Uganda promoting fodder shrubs, and about 205,000 farmers had fodder shrubs (Table 3). The estimated figure is derived from data submitted by development organizations involved in promoting fodder shrubs. This data was first validated using follow-up discussions with field experts and some spot visits. Because not all key development organizations submitted information, and expansion had taken place in some new areas, the data received from the organizations was adjusted upwards as appropriate. These adjustments were based on various methods, such as assigning 'average' dissemination and adoption figures to organizations that did not report and taking into account the mandate area and size of the organization (and in some cases building upon past records submitted) (Franzel and Wambugu 2007; Place et al., 2010).

Unfortunately, no data are available for the years after 2006, though numbers of adopters have probably increased substantially. Increased seed sales are one indication of the increase: over an 11 month period between June, 2006 to April, 2007, 25 seed dealers in Kenya sold 3, 804 kg of fodder shrub seed, including 2,356 kg of calliandra, and 549,000 seedlings, sufficient for about 113,000 farmers to plant (Acharya et al., 2010).

Table 3. Farmers planting fodder shrubs in Kenya, Rwanda, northern Tanzania and Uganda by 2005

Country	Number of organizations promoting fodder shrubs	Our record of the number of farmers planting	Rough estimate of additional farmers planting	Total
Kenya	60	51,645	30,000	81,645
Uganda	80	77,369	5,000	82,369
Northern Tanzania	15	17,519	10,000	27,519
Rwanda	69	9,590	4,400	13,990
Total	224	156,123	49,400	205,523

Source: Franzel and Wambugu 2007.

In another study in Kabale District of Uganda carried out in 1999, Gerrits (2000) observed that, out of the 88 surveyed farmers who had planted calliandra 2 years previously, the average number of trees planted per household was 260, ranging from as few as 10 to as many as 2,650. During expansion planting, the average number of trees per household was 168 for the second planting and 136 trees for the 3rd and 4th planting. By the time of the survey, the average number of trees per farm was 321, indicating the expansion of fodder trees on the farms.

Economics of production

Franzel et al (2003) show that in 2001, farmers in central Kenya who planted about 500 calliandra shrubs earned an additional $US98–124 per year from their dairy enterprises, beginning in the second year after planting. The benefits were the result of either using fodder shrubs to increase their milk production or in savings from reducing their purchases of dairy meal. The average household has about 1.7 cows per farm, thus the potential increase in earnings per household is around USD189, an increase of approximately 10% in household income.

The wood of calliandra has a volumetric mass of 510-780 kg/m^3 and a calorific value of about 4,720 kcal/kg (Yantasath *et al.* 1985, Lowry and Macklin 1989). It is therefore a good fuelwood (Palmer et al 1994).

In Indonesia, annual forage yields of calliandra in the order of 7-10 t/ha of dry matter have been recorded over a wide range of edaphic and climatic zones (Ella *et al.* 1989). Kidd and Taogaga

(1984) reported fresh fodder yields of up to 46.2 t/ha/year from Western Samoa (Palmer et al 1994).

A study by Franzel (2002) was carried out to examine the early stages of calliandra adoption among smallholder dairy producers testing calliandra in the highlands of central Kenya. The economic analysis examined partial budgets to show calliandra-use effects on net income under two scenarios: 1) Using calliandra as a supplement to the normal diet and 2) As a substitute for purchased dairy milk.

In the budgets for calliandra as a supplement, in the first year farmers' investment of planting labor and seedlings amounted to USD 6.58. Beginning in the second year after transplanting, harvesting and feeding 2kg dry supplement throughout the lactation period increased milk production by 450 kg per year, an increase of 10% over base milk yields. Net benefits per cow per year after the initial year were USD 120.11(Table 4). Treating the establishment cost as depreciation spread over 5 year period, the annualized net benefit is USD 117.91 per cow per year. The NPV, assuming a 20% discount rate, is USD 258.39.

Table 4: Extra costs and benefits of using *Calliandra* as a supplement for increasing milk production (USD), in Central Kenya

	Extra costs		Extra benefits		Net benefit
Year	Item	USD	Item	USD	USD
1	Shrub seedlings	3.05		0	
	Planting labour	3.53			
	Subtotal	6.58			-6.58
2	Cutting/feeding labour	10.75	450 kg milk	133.07	122.32
Years 3-5 same as year 2					
Net Present Value at 20% discount rate = USD 258.39 per year					
Net benefit per year after year 1 = USD 120.11					
Annualized net benefit treating establishment costs as depreciation = USD 117.91					

Base farm model: the farm has 500 calliandra shrubs and one dairy cow. The cow consumes a basal diet of 80kg napier grass per day and produces 10kg milk per day.
USD1= 59 Ksh.
Source: Franzel et al 2002

By feeding calliandra as a substitute, the farmer saved money he would have spent buying and transporting 730 kg dairy meal during the year. Incremental benefits per year are 14 times higher than incremental costs. Milk production does not increase but the net benefits are slightly higher than in the supplementation case. The net benefits per cow per year after year 1 are USD 141.68. The annualized net benefit is USD 139.48 USD per cow per year. The NPV assuming a 20% discount rate is USD 300.15. Therefore using calliandra increases farmers income by about USD120-142 per cow per year, depending on whether the farmer is supplementing or substituting (Table 5). As average farmer owns 1.7 cows, calliandra increases farmers' income by about USD 204-241 per year, representing an increase of about 10% in total household income. (Muriithi 1998)

Table 5: Extra costs and benefits of using Calliandra as a substitute for dairy meal in milk production (USD) In central Kenya

Year	Extra costs Item	USD	Extra benefits Item	USD	Net benefit USD
1	Shrub seedlings	3.05		0	
	Planting labour	3.53			
	Subtotal	6.58			-6.58
2	Cutting/feeding labour	10.75	Saved dairy meal cost	147.1	
			Saved dairy meal transport	5.32	
			Interest on capital freed up	0.9	
	Subtotal	10.75	Subtotal	152.43	141.68

Years 3-5 same as year 2
Net Present Value at 20% discount rate = USD 300.15 per year
Net benefit per year after year 1 = USD 141.68
Annualized net benefit treating establishment costs as depreciation = USD 139.48

Source: Franzel et al 2002

The study also involved carrying out sensitivity analysis which shows that the net benefits of using calliandra as a supplement or substitute are fairly stable.

A study by Mawanda (2004) on the potential, current socio-economic and farmers' perceived environmental impacts on calliandra in Kabale and Mukono regions of Uganda shows that net benefits of using calliandra as a supplement or substitute are also stable. In Kabale, for calliandra as a supplement, the establishment and maintenance cost is USD 17.43 , the NPV is USD 140.5 and net benefit per year of USD 66.03 (Table 6), while in Mukono the establishment cost is USD 21.72, with an NPV of USD 182.86 and net benefit per year of USD 85.89 (Table 7)

Table 6: Partial Budget: Calliandra use as a supplement in milk production, Kabale, Uganda

Year	Extra Costs Item	US $	Extra Benefits Item	US $	Net Benefits US $
1	Tree seedlings	12	Milk	0	0
	Transportation of seedlings	0.57			
	Planting labour	2			
	Weeding	2.86			
	Subtotal 1	17.43		0	-17.43
2	Weeding	1.33	Milk	91.87	
	Cutting/feeding	18.68			

	Subtotal 2	20.01	91.87	71.86

Year 3-5 are same as year 2
Net Present Value = US $ 140.50
Net benefit per year after year = US $ 66.03
Annualized net benefits treating establishment cost as depreciation = US $ 60.20

Source: Mawanda 2004

Table 7 Partial Budget: Calliandra use as a supplement in milk production, Mukono, Uganda

	Extra Costs		Extra Benefits		Net Benefits
Year	Item	US $	Item	US $	US $
1	Tree seedlings	14.29	Milk	0	0
	Transportation of seedlings	0.86			
	Planting labour	2.57			
	Weeding	4			
	Subtotal 1	21.72		0	-21.72
2	Weeding	1.86	Milk	120.24	
	Cutting/feeding	25.22			
	Subtotal 2	27.09		120.24	93.16

Year 3-5 are same as year 2
Net Present Value =approx. US $182.86
Net benefit per year after year= USD 85.89
Annualised net benefits treating establishment cost as depreciation=USD 78.63

Source: Mawanda 2004

The partial budget analysis for use of calliandra as a substitute shows that in Kabale a higher NPV of USD 206.04 and net benefit per cow per year of USD 102.24 is realized (Table 8. In Mukono the NPV of USD 245.44 and net benefit per year per cow of USD 112.85 is realized (Table 9).

Table 8: Partial Budget: Calliandra use as a substitute for dairy meal in milk production, Kabale, Uganda

	Extra Costs		Extra Benefits		Net Benefits
Year	Item	US $	Item	USD	USD
1	Tree seedlings	12	Milk	0	
	Transportation of seedlings	0.57			
	Planting labour	2			
	Weeding	2.86			
	Subtotal 1	17.43		0	-17.43

2	Weeding	1.33	Dairy meal saved	116.43	
	Cutting/feeding	18.68	Transport of dairy meal	5.82	
			Interest on capital	1.02	
	Subtotal 2	20.01		122.23	102

Year 3-5 are same as year 2

Net Present Value Ug shs 387,562 (US $ 206.04)

Net benefit per year after year 1, Ug shs 192,319 (US $ 102.24)

Annualised net benefits treating establishment cost as depreciation is Ug shs 181,355 (US $ 96.41)

Source: Mawanda 2004

Table 9: Partial Budget: Calliandra as a substitute for dairy meal in milk production, Mukono, Uganda

	Extra Costs		Extra Benefits		Net Benefits
Year	Item	US $	Item	USD	US $
1	Tree seedlings	14.29	Milk	0	
	Transportation of seedlings	0.86			
	Planting labour	2.57			
	Weeding	4			
	Subtotal 1	21.72		0	-21.72
2	Weeding	25.22	Dairy meal saved	128.07	
	Cutting/feeding	1.86	Transport of dairy meal	10.09	
			Interest on capital	1.15	
	Subtotal 2	27.09		138.16	106.75

Year 3-5 are same as year 2

Net Present Value = US $ 245.44

Net benefit per year after year 1 = US $ 112.85

Annualised net benefits treating establishment cost as depreciation = US $ 101.53

Source: Mawanda 2004

Mawanda (2004) argues that a higher NPV could be realized with good management of the shrubs. For example, with good management, farmers could start realizing benefits from the first year.

Further reading

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