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THE 'MODEL FARMER' EXTENSION APPROACH REVISITED: ARE EXPERT FARMERS EFFECTIVE INNOVATORS AND DISSEMINATORS?

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ABSTRACT

Extension programmes often choose 'model farmers', also called 'master', 'lead' or 'expert' farmers, to host demonstrations and train other farmers on improved agricultural practices and innovations. Chosen on the basis of their expertise, model farmers are also assumed to be effective innovators and disseminators. But are they? This study sought to answer this question by examining a sample of 126 adopters of fast-growing leguminous fodder shrubs for feeding dairy cows and goats in Kenya. Criteria were established to rate farmers on their expertise as farmers, disseminators and innovators. Farmers were surveyed, indices were drawn up, and farmers were rated on the three categories. Forty-eight farmers were found to be expert farmers, 46 were expert innovators and 44 were expert disseminators. Forty-eight did not fit into any category. There were no significant differences between disseminators and non-disseminators with respect to age, gender and level of education. Nor were there differences between innovators and non-innovators. These finding are encouraging, as they suggest that there are no important barriers related to these variables preventing farmers from becoming innovators or disseminators. In contrast, expert farmers did tend to be wealthier and have larger land holdings than non-experts. There was some overlap among the expert farmers, innovators and disseminators, with 17 farmers being designated as members of all three categories. A log-linear regression model analysis revealed that farming and dissemination expertise are positively associated, as are innovation and dissemination expertise. However, farming expertise and innovation expertise are not associated. Moreover, 19 (40%) of the 48 expert farmers were not effective disseminators. This finding suggests that extension programmes that choose farmer trainers on the basis of their farming expertise and their dissemination skills will promote

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dissemination more effectively than those that choose trainers on the basis of their farming expertise.

KEY WORDS: *ADOPTERS, GENDER, BARRIERS, LEVEL OF EDUCATION, WEALTHIER FARMERS*

INTRODUCTION AND OBJECTIVES

Three types of farmers have gained importance among researchers and extension specialists interested in promoting farmer-centred research and extension systems: those who are experts in the use of technology, those who innovate (i.e., modify existing or recommended practices) and those who disseminate to others. Farmer experts, also called 'model', 'master' or 'lead' farmers, are sought after so as to demonstrate to other farmers, often on demonstration plots, the use of new technology (Roshetko *et al*., 2005). The second group, innovators, are particularly valued for the experiments they conduct on their own and the new techniques that arise out of such experimentation, which may be appropriate for other farmers (Critchley *et al*., 1999). The third group, farmers who disseminate to others, are sought after as they provide information and new technologies to others (Amudavi *et al*., 2009). With the decline in extension services throughout Africa, farmers who disseminate to others offer possibilities for extending the reach of extension staff by helping other farmers gain access to information and promoting the spread of new technologies.

Extension programmes often choose certain farmers to work with on the basis of their farming expertise, since this attribute is easier to define and more readily observable than are the attributes of an effective disseminator or innovator (Selenar *et al*., 1997). There is then often an implicit assumption that expert farmers are effective disseminators and innovators – but are they?

In fact, little is known about these types of farmers – their personal, farm and household characteristics relative to the general population, how to identify them and what motivates them. Whether people who are experts in using a technology are also effective disseminators, and vice-versa, has not been tested empirically.

The objectives of this paper are to:

- characterise expert farmers, innovators and disseminators in terms of farm and household characteristics
- determine disseminators' and innovators' motivations
- assess the degree of overlap and association among the three types and, in particular, assess the degree to which farmer experts are also effective disseminators and innovators.

This study makes use of a sample of Kenyan adopters of fodder shrubs, fast-growing leguminous shrubs for feeding dairy cows.

A better understanding of who expert farmers, innovators and disseminators are in a community can enable extension and research agencies to mobilise the most appropriate farmers to lead farmer-based extension and research programmes.

Literature review and conceptual framework

There is a dearth of literature on farmer categorisation as experts, innovators and disseminators, and the attributes of each type. A study of tree experts in Rwanda by Den Biggelaar (1996) found that tree experts were farmers who cultivated many trees on their farms, and had more land, animals and manure, better soils and greater wealth.

Grisley (1994) notes that farmer-to-farmer dissemination of technologies is a neglected area of research, even though successful diffusion of many researcher and farmer-developed technologies is dependent upon farmers' private initiatives. Grisley found that farm size and the willingness to experiment were associated with the decision to disseminate to other farmers.

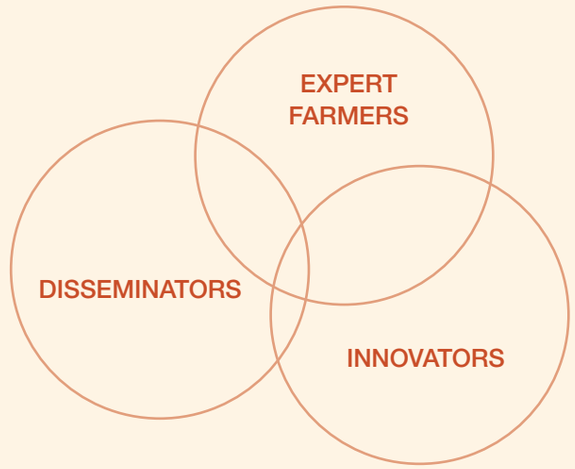
Selenar *et al*. (1997) found that farmer disseminators, who they call 'promoters', are usually individuals with little or no formal education, who – through a process of training, experimentation, learning and practice – increase their knowledge and become capable of sharing with others, in effect functioning as extension workers. Aw-Hassan *et al*. (2008) found that farmer disseminators were similar across a wide range of characteristics to other farmers in the population.

Feder and Savastano (2006) explored the socio-economic status of farmers who were most effective in spreading knowledge. They concluded that opinion leaders who were of higher socio-economic status than their followers, but not excessively so, were more effective in transmitting knowledge; excessive socio-economic distance was shown to reduce the effectiveness of diffusion. People with similar levels of economic and social status tended to interact more than people at different levels.

Kibwana (2001) documented that most innovators' main motivation was to solve day-to-day problems. They were typically middle-aged men, with families, who were inspired by their own ideas and curiosity. Critchley *et al*. (1999) found that farmer innovators were commonly driven by a financial motive as well as by a general concern with production, and that common stimuli to innovation included travel outside the area and access to information from various sources.

This study hypothesises that experts, innovators and disseminators have different characteristics, although there might be some overlap among them, as indicated in Figure 1. Thus, a particular farmer might fall into none, one, two or all three of the categories.

Many extension services make use of 'contact' farmers to enhance farmer-to-farmer dissemination. Contact farmers, also called 'lead' or 'master' farmers, are selected to liaise between the extension staff and the community, in promoting the adoption of a technology or innovation. They are assumed to be experts in the use of new technologies as well as excellent disseminators, but we are not aware of a single case where this has been tested empirically. Gladwell (2002) observes that in the area of consumer products in the USA, experts and disseminators have different personality characteristics that are rarely combined in a single person. Experts in practising a technology, such as farmers with nurseries, may not necessarily be the most active or effective disseminators. Dissemination may not be best promoted by working with expert farmers, but by (a) working with experts and effective disseminators separately, or (b) working with farmer groups, which are likely to have both types of farmers.



Source: Koné (2007).

FIGURE 1: THEORETICAL CHARACTERISATION OF THE OVERLAP AMONG EXPERT FARMERS, INNOVATORS AND DISSEMINATORS

Fodder shrub adoption in East Africa

Shortages of protein-rich feed are a key constraint faced by the 2 million small-scale dairy farmers in the highlands of Eastern Africa. Fodder shrubs, such as *Calliandra calothyrsus*, are easy to grow, are capable of withstanding repeated pruning and provide high levels of protein. Farmers raise seedlings in nurseries and transplant them into their fields, planting them in hedges along boundaries, around the homestead or on bunds along the contour to protect their soil. The plants mature in 9–12 months and are then ready to be cut periodically and fed to cows and goats. Fodder shrubs are attractive to farmers because they require little or no cash. Moreover, they do not require farmers to take land out of use for food or other crops. The only inputs required are the initial seed and small amounts of labour. However, fodder shrubs are relatively knowledge intensive, requiring farmers to learn new management techniques such as nursery establishment, pruning and harvesting. As a result, information about them does not spread as rapidly as other less knowledge-intensive practices (Wambugu *et al*., 2011).

The main alternative protein source is purchased concentrate, which many farmers avoid because of its high cost. Fodder shrubs were first

introduced into Eastern Africa in the early 1990s. Non-governmental organisations (NGOs) led in promoting them and about 200,000 farmers adopted them over the following 15 years (Wambugu *et al*., 2011).

MATERIALS, METHODS AND DATA SOURCES

Information was collected through an informal survey and a structured questionnaire survey. The informal survey was conducted with members of two farmer groups who had worked with research and extension staff in planting fodder shrubs in the late 1990s and early 2000s. The farmers gave their opinions of what constituted expert farmers, innovators and disseminators of fodder-shrub technologies and what their major farm and household characteristics were. This exercise helped in developing questionnaires and in defining indices for characterising farmers into expert farmers, innovators and disseminators. For the structured survey, 12 groups were selected at random from among the 150 farmer groups identified as having planted fodder shrubs. These 12 groups were selected from four districts (Embu, Kirinyaga, Nyeri and Maragua). For the survey, adopters were targeted , i.e., farmers with more than 100 trees. The group members led us to such farmers, both inside and outside the group, who had adopted fodder-shrub technologies.

One hundred and twenty-six farmers were interviewed in the formal survey. Quota sampling was used, aimed at identifying 50 farmers in each of the four categories (expert farmers, innovators, disseminators, and those who did not fit into any of the three categories). It was possible for a particular farmer to be in more than one category. Farmers were interviewed using a semi-structured questionnaire; participant observation was also used. Enumerators observed farmers' innovations and assessed the degree of farmer expertise in planting and using fodder shrubs. The interviews covered variables used to define a farmer as an expert farmer, innovator or disseminator, as well as farm and household variables associated with these characteristics.

The data were analysed using SPSS software to calculate descriptive statistics such as chi-square tests and t-tests. Genstat software was then used to conduct a log-linear model analysis of the three-way contingency table, including the three dichotomous variables: expert farmers, innovators and disseminators.

RESULTS

Indices for farmer experts, innovators and disseminators

Expert index

The criteria used in the farmer expert index were the number of fodder shrubs on the farm, whether the farmer had established a fodder-tree nursery, number of years practising the technology, and the farmer's knowledge about fodder shrubs (Table 1). The criteria were weighted according to their importance in defining an expert farmer. Each was given a score ranging from 0 (low) to 3 (high), which was then multiplied by the weighting factor.

Farmers' knowledge about fodder shrubs was given a higher weighting (3) than the other criteria, which each had a weighting of 1.5. The number of fodder shrubs on the farm was rated low (1) for

TABLE 1: THE EXPERT FARMER INDEX

Criterion	Weighting	Very low 0	Low 1	Medium 2	High 3
1. Number of fodder shrubs on the farm	1.5	—	< 100	100–500	> 500
2. Whether farmer has had a fodder-tree nursery (in the last 3 years)	1.5	Didn't have a nursery	—	—	Had a nursery
3. Number of years practising fodder-tree technology (experience)	1.5	—	≤ 4	5–6	≥ 7
4. Interviewer's assessment of farmer's knowledge of fodder shrubs	3	Poor	Fair	Good	Excellent

farmers with fewer than 100, medium (2) for farmers with 100–500 and high (3) for those with more than 500 fodder shrubs. The rating was multiplied by the weighting to get the total score. The maximum score that a farmer could get was 22.5, and the minimum 3. For ease of calculation, this was transformed into an index ranging from 0 to 1. There were six cases in which the value for the variable 'having had a nursery' was missing. To calculate the index for these cases, the score was divided by the maximum the case could have had without the variable, rather than the maximum the case could have had with the variable.

The minimum criteria for a farmer to be termed an expert farmer were: a good knowledge of fodder shrubs, 5 years experience of growing fodder shrubs, an on-farm nursery, and more than 100 fodder shrubs. Furthermore, he or she had to score 'high' on one of the three criteria (excellent knowledge, more than 7 years' experience or more than 500 fodder trees). The dividing line between an 'expert' and a 'non-expert' score was thus 18 out of 22.5 or an index of 0.80.

The 'master experts' were farmers who scored high in all four criteria. That is, they had more than 500 fodder shrubs, they had had a nursery, they had more than 7 years of fodder-shrub experience and they had an excellent knowledge of fodder shrubs.

Innovator index

The innovator index was developed in a similar manner to the expert farmer index (Table 2). It included the number of experiments or innovations by the farmer; the number of years of practising the innovations; the creativity of the innovation; and the source of the innovation. The creativity of the innovation was assessed in terms of the nature or type of the innovation as well as the originality of the idea.

A farmer had to have at least one innovation or experiment to be called an innovator. The minimum score for a person having one innovation was 7. The 'master innovators' had to have conducted one or more innovations or experiments, practised them for more than 3 years, and made at least one creative innovation from their own ideas. For a master innovator the minimum score was thus 14 out of 21 or index of 0.67.

Disseminator index

The disseminator index was also developed in a similar manner (Table 3). The criteria for the disseminator index were the numbers of farmers given planting materials and information about fodder shrubs, and the dissemination methods used. The methods included proactive ones, such as announcements at public forums and providing training to schools and farmer groups, and passive methods such as giving information to visitors.

The minimum index value to define a farmer as a disseminator is 0.45 (a score of 15 from a possible maximum of 33). A farmer who was a disseminator was one who gave planting material or information about fodder shrubs to more than 10 other farmers (giving a score of 9), and used either public-forum announcements or a

TABLE 2: INNOVATOR INDEX

Criterion	Weighting	Very low 0	Low 1	Medium 2	High 3
1. No. of own experiments/ innovations conducted	3	0	1	2	3+
2. Total number of years practising the innovations	1	—	≤ 2	3–5	≥ 6
3. Creativity of the innovation	1.5	—	Not creative	—	Creative
4. Source of innovation	1.5	—	Learned through a friend/other farmers/from a tour	—	Own idea

combination of other proactive and passive methods (giving a score of 6). Alternatively, a farmer could achieve a score of 15 by giving both planting material and information to at least five farmers and using at least three passive methods of dissemination, such as providing information and seed to people who came and asked for them.

A 'master disseminator' was defined as someone who had (a) given planting material to more than 20 people; (b) given information to more than 20 people; (c) used a public-forum announcement, such as at a church or a village meeting, to promote fodder shrubs; and (d) used passive methods, such as giving information to visitors, at least twice. To be labelled a master disseminator, a farmer had to achieve a score of at least 26 out of 33, or 0.79 on an index of 0 to 1.

Description of expert farmers, innovators and disseminators of fodder-shrub technologies

Expert farmers

The number of expert farmers in the sample was 48 (38%). Experts were similar to non-experts with regard to age, gender, educational level, off-farm employment and leadership positions in the community (Table 4). However, experts tended to be of higher wealth status ($P = 0.04$). The lack of association between expertise and gender, age and education shows that there are few barriers to becoming an expert: men and women, old and young, educated or uneducated were all experts in

TABLE 3: DISSEMINATOR INDEX

Criterion	Weighting	Very low 0	Low 1	Medium 2	High 3
1. Number of farmers given planting materials	3	0	1–4	5–9	10+
2. Number of farmers given information about fodder shrub	3	0	1–4	5–9	10+
Dissemination methods used:					
3. Public-forum announcement	2	No	—	—	Yes
4. Other proactive methods	2	0	1	2	3+
5. Passive methods	1	0	1	2	3+

TABLE 4: COMPARISON OF EXPERT AND NON-EXPERT FARMERS

	Experts	Non-expert	P value
Number	48	78	
Average age in years	57.5	58.4	0.721
Gender of household head			
Male	87%	90%	0.697
Female	13%	10%	
Education			
Without any formal education	2%	5%	0.819
Primary education	36%	33%	
Secondary education	34%	35%	
Tertiary education	28%	23%	
Missing cases	1	3	
With off-farm employment	29%	19%	0.227
Average total farm size in acres	5.4	4.6	0.277
Wealth status			
Below average	6%	20%	0.044
Average	48%	50%	
Above average	46%	30%	
Leadership position in community	61%	54%	0.730

the use of fodder shrubs.

Eight 'master experts' were identified among the 48 experts. They scored high on all four criteria that define an expert: the number of fodder shrubs on the farm, having established a fodder-tree nursery, years practising the fodder technology, and assessment of the farmer's knowledge about fodder shrubs. Six of the master experts were male and two female. All but one of the master experts had leadership positions in the community. All the master experts came from the section of the community with above-average wealth compared to the original sample of 126 where most were of average or below-average wealth. They also had slightly larger farms and were younger than the sample mean.

Innovators

There were 46 innovators in the sample, accounting for 36% of the sample. Innovators had about the same age, gender balance, wealth status and educational level as non-innovators (Table 5). Innovators had more off-farm employment ($P = 0.02$), which may have given them more exposure to innovation in other areas. There was no significant difference between innovators and non-innovators in terms of farm size, leadership positions and wealth level.

There were nine 'master innovators'. All were from the high and average wealth groups; none was from the lowest wealth group, even though 12% of the sample was from this group. Eight of them were male and all had formal education, with six having had at least a secondary school education. Six of the master innovators were full-time farmers. Only one innovator had a score of 21 out of 21, giving the maximum index score of 1. This was a 74-year-old man with primary level education, a wealthy full-time farmer whose former main occupation had been business. He had five innovations or experiments on his farm, of which four were his own ideas. He had a larger than average farm (3.5 ha) and had planted more than 7,000 fodder shrubs. He was also both a master expert and a master disseminator.

TABLE 5: COMPARISON INNOVATORS AND NON-INNOVATORS

	Innovators	Non-innovators	*P* value
Number	46	80	
Average age in years	56.6	58.9	0.319
Gender			
Male	89%	89%	0.948
Female	11%	11%	
Education			
Without any formal education	2%	5%	0.699
Primary education	31%	36%	
Secondary education	38%	33%	
Tertiary education	29%	23%	
Missing cases	1	3	
With off-farm employment	35%	16%	0.021
Average total farm size in acres	4.3	5.3	0.208
Wealth status			
Below average	9%	19%	0.272
Average	50%	49%	
Above average	41%	33%	
Leadership position of household	69%	50%	0.324

Disseminators

The total number of disseminators was 44 (37%). Disseminators and non-disseminators had similar average ages, similar gender proportions, and similar levels of wealth and education (Table 6). There was no significant difference between disseminators and non-disseminators in terms of farm size, leadership positions, wealth level or off-farm employment.

There were 10 'master disseminators' who had disseminated planting materials and information to more than 20 people. Eight of the master disseminators were males. Seven were full-time farmers and their mean age was about the same as that of the rest of the sample. All came from the high- and middle-wealth groups; none of them was poor.

TABLE 6: COMPARISON OF DISSEMINATORS AND NON-DISSEMINATORS

	Disseminators	Non-disseminators	*P* value
Number	44	82	
Average age in years	55.8	59.3	0.140
Gender			
Male	89%	89%	0.947
Female	11%	11%	
Education			
Without any formal education	7%	2%	0.223
Primary education	29%	38%	
Secondary education	44%	29%	
Tertiary education	21%	27%	
Missing cases	1	3	
With off-farm employment	32%	18%	0.100
Average total farm size in acres	4.5	5.1	0.447
Wealth status			
Below average	11%	17%	0.674
Average	50%	49%	
Above average	38%	34%	
Leadership position of household	69%	51%	0.338

TABLE 7: ASSOCIATIONS BASED ON LOG-LINEAR MODELLING

Association	*P* value
Disseminators and Experts	< 0.001
Disseminators and Innovators	< 0.001
Experts and Innovators	0.92
Disseminators, Experts and Innovators	0.82

Overlap and association among the categories

There was some overlap among the three categories, expert farmers, innovators and disseminators (Figure 2). Seventeen (13%) of the interviewed farmers were expert farmers, innovators and disseminators. Twelve were both disseminators and expert farmers (but not innovators), nine were both disseminators and innovators (but not experts) and five were both

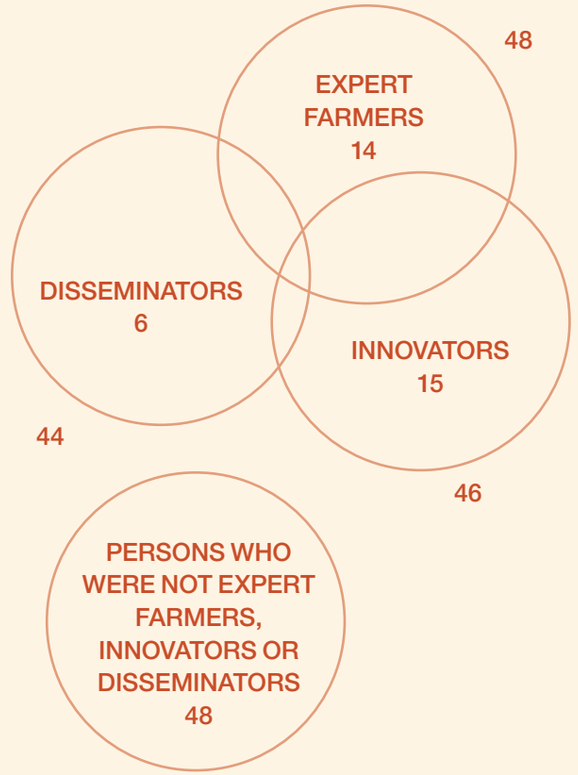


FIGURE 2: OVERLAP BETWEEN EXPERT FARMERS, INNOVATORS AND DISSEMINATORS

TABLE 8: FACTORS THAT MOTIVATE FARMERS TO DISSEMINATE, FOR THE SAMPLE AS A WHOLE AND FOR DISSEMINATORS

Factor	Frequency sample	Frequency disseminators	Percentage of cases (sample)	Percentage of cases (disseminators)
Desire to help others to benefit	85	36	79	90
Social benefits	23	13	21	33
Monetary benefits	15	5	14	13
Interest or enquiry by another farmer	6	2	6	5
Not sure	4	1	4	3
Other factors	5	3	5	8

TABLE 9: FACTORS THAT MOTIVATE FARMERS TO INNOVATE

Factor	Frequency	Percentage of innovators who responded
Interest in experimenting	8	44
Observation	3	17
Lack of sufficient feed during dry season	2	11
High labour demand for nursery establishment	2	11
Saving on cost	2	22
Aging trees	1	6
To prevent theft (use trees for fence)	1	6
Near homestead	1	6
Transplants susceptible to weather changes	1	6
Seeking better farming methods	1	6
Aesthetics	1	6

Note: Only innovators were asked about the factors that motivate farmers to innovate; only 18 of the 28 innovators were able to give factors that motivate them to innovate.

experts and innovators (but not disseminators). The farmers who were only experts, innovators or disseminators were 14, 15 and 6, respectively. A further 48 (38%) were not classified as experts, innovators or disseminators.

Interestingly, 19 (40%) of the 48 expert farmers were not effective disseminators. Also, 24 (52%) of the 46 expert farmers were not innovators.

The degree of association among the farmers is also of interest here. A log-linear regression model analysis revealed that farming and dissemination expertise were positively associated, as were dissemination expertise and innovation expertise (Table 7). However, farming expertise and innovation expertise were not associated.

Factors motivating farmers to be disseminators and innovators

According to the survey, the main factor motivating farmers to become disseminators was the desire to benefit others; this was mentioned by 79% of farmers (Table 8). Other factors included social benefits, monetary benefits and interest/because other farmers had asked them (mentioned by 21%, 14% and 6% of the sample, respectively). An additional 4% of the farmers were not sure why they disseminated. Social benefits of distributing information and planting materials included enhancement of respect and authority in the community. Such farmers tended to be leaders in the community. Farmers gained monetary benefits through the sale of seedlings and seeds to other farmers or groups. Other less-mentioned reasons included ‘desire to tell people what I know’, ‘because I got planting materials free’, ‘I have a teaching background’ and ‘I am chairman of another group’. Many also said they wanted to prevent others from feeling jealous of the gains they received through use of a new technology. This view

TABLE 10: THE ASSOCIATION BETWEEN BEING AN EXPERT FARMER OR AN INNOVATOR AND CONTACTS WITH EXTENSION

Variable	Category	Mean	t value	*P* value
Number of information sources	Experts	6.0	2.70	0.008
	Non-experts	4.5		
	Innovators	5.7	1.76	0.135
	Non-innovators	4.7		
Number of visits by extension staff in past year	Experts	12.3	2.14	0.038
	Non-experts	3.0		
	Innovators	10.85	1.76	0.081
	Non-innovators	4.03		

is important as the early adopters of innovations feel more secure when their neighbours also adopt them. In fact, one of the reasons why people share planting materials and information freely is to reduce the chances of their livestock and crops being damaged by envious neighbours.

While farmers could discuss their motivations for disseminating, they had difficulty describing their reasons for innovating. Twenty-eight of the 46 farmer innovators were unable to give any reasons for their actions. Eight mentioned their interest in experimenting, not just in fodder shrubs, but in agricultural practices in general (Table 9). Several were motivated by specific problems they encountered, such as lack of sufficient feed during the dry season or lack of labour for managing a nursery. A major reason for innovating was an attempt to reduce production costs. Main types of innovations with fodder shrubs included seed pretreatment, propagation, spacing and configuration, management and feed preparation.

The degree to which expert farmers and innovators interacted with extension staff was also investigated (Table 10). Expert farmers had significantly more sources of information about fodder shrubs and more contact with extension staff than non-experts. This is to be expected and can be interpreted in two ways: experts seek more information than non-experts and the contacts they make contribute to their expertise. In contrast, innovators did not have significantly more sources of information than did non-innovators and their numbers of contacts with extension were not significantly higher ($P = 0.08$).

DISCUSSION AND CONCLUSIONS

The characterisation of expert farmers revealed them to be generally of higher wealth status than non-experts, confirming Den Biggelaar's (1996) finding. Expert farmers may have high wealth status either because being experts makes them wealthy or because wealthy farmers have the resources to become expert farmers. Our results did not reveal any significant differences between experts and non-experts in terms of gender, age and education. These findings are encouraging as they suggest that there are no important constraints concerning these variables that limit individuals from becoming expert farmers.

Innovators were found to have about the same age, gender balance, wealth status and educational level as non-innovators. This suggests that these variables do not limit farmers from innovating. Innovators had more off-farm employment, which may have given them more exposure to innovation in other areas. This is in line with Critchley *et al.*'s (1999) observation that innovation is associated with travel outside one's area.

Farmers develop innovations mainly by experimenting and by observing other farmers. Although they could discuss their motivations for disseminating, respondents had more difficulty describing their reasons for innovating. Eight farmers mentioned their interest in experimenting; trying to reduce production costs (particularly the high cost of propagation) was another major reason for innovating. This supports Critchley *et al.*'s (1999) findings that motives for innovation are often financial.

Disseminators and non-disseminators had similar average ages, gender proportions and

levels of wealth, off-farm employment and education. As Aw-Hassan *et al*. (2008) observed in Syria, there were no important socio-economic barriers to becoming a disseminator. The factors that motivated farmers to be disseminators were the desire to benefit other farmers, social benefits and monetary benefits.

There was some overlap among expert farmers, innovators and disseminators. Of the 78 farmers who belonged to at least one of the categories, 17 belonged to all three (i.e., they were farmer experts, innovators and disseminators), and a further 26 fell into two of the three categories.

While there were few barriers to becoming an expert farmer, innovator or disseminator, there were barriers keeping individuals from becoming master experts, master innovators and master disseminators. All farmers in the master categories came from the high and middle-wealth groups; none of the poor were represented. Female-headed households were not under-represented among the group of 'masters'.

The findings showed that farmer experts had strong contacts with extension providers, while farmer innovators had fewer contacts. Similarly, farming expertise was not associated with innovation. These findings are consistent with Saad (2002), who found that extension staff and expert farmers with whom they work tend to disregard and stifle innovations, preferring to promote and apply fixed technology packages.

Finally, the study shows the weakness of a common extension approach which chose expert farmers to host demonstrations and assumed that these farmers were expert disseminators. In our sample, 19 (40%) of 48 expert farmers were not effective disseminators. This finding suggests that extension programmes that choose farmer trainers on the basis of their farming expertise will not promote dissemination as effectively as those that also choose trainers on the basis of their dissemination skills.

More research is needed in three areas. These findings should be verified at other sites and in other cultural settings, as characteristics of expert farmers, innovators and disseminators may vary. The findings may also vary by agricultural technology, particularly because fodder shrubs are a relatively new and knowledge-intensive innovation. Research is needed on how to identify effective disseminators and innovators. Nevertheless, the findings confirm the importance of farmer-to-farmer dissemination and farmer innovation; improving the effectiveness of these can help increase the effectiveness of research and extension programmes.

LITERATURE CITED

Amudavi, D.M., Khan, Z.R, Wanyama, J.M., Midega, C.A.O., Pittchar, J. and Nyangau, I.M. 2009. 'Assessment of technical efficiency of farmer teachers in the uptake and dissemination of push–pull technology in western Kenya'. *Crop Protection* 28: 987–996.

Aw-Hassan, A., Mazid, A. and Salahieh, H. 2008. 'The role of informal farmer-to-farmer seed distribution in diffusion of new barley varieties in Syria'. *Experimental Agriculture* 44: 413–431.

Critchley, W., Cooke, R., Jallow, T., Lafleur, S., Laman, M., Njoroge, J., Nyagah, V. and Obas, E. 1999. *Promoting Farmer Innovation: Harnessing Local Environmental Knowledge in East Africa*. *RELMA Workshop Report Series* No. 2. Regional Land Management Unit, Nairobi, Kenya.

Den Biggelaar, C. 1996. *Farmer Experimentation and Innovation: A Case Study of Knowledge Innovation Processes in Agroforestry Systems in Rwanda. Community Forestry Case Study Series* 12. Food and Agriculture Organization of the United Nations, Rome, Italy.

Feder, G. and Savastano, S. 2006. *The Role of Opinion Leaders in the Diffusion of New Knowledge: The Case of Integrated Pest Management. World Bank Policy Research Working Paper* 3916. World Bank, Washington, DC, USA.

Gladwell, M. 2002. *The Tipping Point: How Little Things Can Make a Big Difference*. Back Bay Books, Boston, MA, USA.

Grisley, W. 1994. 'Farmer-to-farmer transfers of new crop varieties: An empirical analysis on small farms in Uganda.' *Agricultural Economics* 11 (1): 43–49.

Kibwana, O.T. 2001. 'Forging partnership between farmers, extension and research in Tanzania'. *In Reij, C. and Waters-Bayer, A. (eds) Farmer Innovation in Africa: A Source of Inspiration for Agricultural Development. Earthscan, London, UK.*

Roshetko, J.M., Purnomosidi, P. and Mulawarman. 2005. 'Farmer demonstration trials: promoting tree planting and farmer innovation in Indonesia'. pp. 32–39. *In* Gonsalves, J., Becker, T., Braun, A., Campilan, D., De Chavez, H., Fajber, E., Kapiriri, M., Rivaca-Caminade, J. and Vernooy, R. (eds) *Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook*, Vol. 1: *Understanding Participatory Research and Development. International Potato Center (CIP) – Users' Perspectives With Agricultural Research and Development*, Manila, The Philippines and International Development Research Centre, Ottawa, Canada.

Saad, N. 2002. *Farmer Processes of Experimentation and Innovation: A Review of Literature. Working Document* No. 21. CGIAR Systemwide Program on Participatory Research and Gender Analysis, Cali, Colombia.

Selenar, D., Chenier, J. and Zelaya, R. 1997. *Farmer to Farmer Extension: Lessons from the Field*. International Institute for Rural Reconstruction, New York, USA.

Wambugu, C., Place, F. and Franzel, S. 2011. 'Research, development and scaling up the adoption of fodder shrub innovations in East Africa'. *International Journal of Agricultural Sustainability* 9 (1): 100–109.