THE BLENDING OF PARTICIPATORY RESEARCH AND QUANTITATIVE METHODS: WEALTH STATUS, GENDER AND THE ADOPTION OF IMPROVED FALLOWS IN ZAMBIA

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ABSTRACT

Although there is increasing emphasis on targeting of improved technology towards poor and female farmers, few adoption studies assess the uptake of new practices by these groups in a comprehensive manner. In this study, community members used the wealth ranking method to identify the different wealth groups in their communities, to determine each household's wealth status, and to assess the association of wealth and different types of households with the planting of improved tree fallows, a practice for improving crop yields. There were no significant differences between the proportions of women and men planting improved fallows nor were there differences between single women and female heads of households who were married. There was some evidence of association between planting improved fallows and wealth. That 22% of the 'poor' group and 16% of the' very poor' group were planting them suggests that there are no barriers preventing low-income households from doing so. Moreover, the proportion of females, poor, and very poor people planting improved fallows varied considerably among villages, suggesting that opportunities exist for increasing their use of the technology. Whereas the use of mineral fertilizer is strongly associated with high-income, male farmers, improved fallows appear to be a gender-neutral and wealth-neutral technology. Poor farmers appreciate improved fallows because they permit them to substitute small amounts of land and labour for cash, their most scarce resource. Finally, the high degree of consistency among different key informants in classifying households among wealth groups confirmed the effectiveness and accuracy of the wealth ranking exercise.

Keywords: Adoption, Agroforestry, Participatory research, *Sesbania sesban*,

INTRODUCTION

Policy makers in Africa place great emphasis on the development and dissemination of new agricultural technologies for improving the wellbeing of the rural poor and enhancing national food security. In recent years, governments and donor agencies have sought to target two previously neglected groups, the poor and female farmers (CGIAR, 1998). Poor farmers are likely to have different needs, problems, and resources than better-off farmers and less ability to adopt new technologies (Grandin, 1988). Female-headed households are poorer than male-headed households and have the additional problem that most research and extension systems are biased towards male farmers (Gladwin et al., 1997).

Farmer surveys documenting the adoption of new technology are fairly common, but most have three important weaknesses. First, they rarely assess the association of wealth with adoption, mainly because assessing the income of rural households is difficult (CIMMYT Economics Program, 1993).

Where wealth groups are defined, the indicators and groupings are often arbitrary as when researchers use proxies based on their own definitions of wealth and wealth groups or group farmers into terciles. Second, while many researchers examine gender, they usually treat female-headed households as a homogenous group, failing to differentiate between single women and married women whose husbands live away (Bonnard and Scherr, 1994). Third, most adoption surveys involve farmers only in a passive. manner, as respondents to questionnaires. In contrast, participatory research methods, such as those used in this study, emphasize helping communities to conduct such assessments themselves, so that they can learn about the needs and differences among different types of households.

This study uses wealth ranking, a participatory research method, in which community members define wealth criteria and classify themselves according to the criteria (Grandin, 1988). Community members then assess which households are using a new practice, improved tree fallows, and the association between use of the practice and differing wealth and gender categories.

The objectives of the study were to:
- identify the different wealth groups perceived by farmers and the local indicators for wealth
- determine the wealth group of each household in the village as assessed by local key informants
- assess the quality of information by comparing the opinions of key informants
- assess the association among gender, wealth status, and the planting of improved fallows

BACKGROUND AND METHODS

Study area

The plateau area of eastern Zambia is characterized by a flat to gently rolling landscape and altitudes ranging from 900 m to 1200 m. The main soil types are loamy-sand or sand Alfisols, interspersed with clay and loam Luvisols. Rainfall averages about 1,000 mm per year with about 85% falling in four months, December through March. (Ngugi, 1988; Raussen et al., 1995).

Population density varies between 25 to 40 persons km^{-2}. About half of the farmers practice ox cultivation, the others cultivate by hand-hoe. Average cropped land ranges from 1.1-1.6 ha for hoe cultivators to 2.3-4.3 ha for ox cultivators. The two groups grow similar crops, though ox cultivators tend to use more purchased inputs. Maize is the most important crop accounting for about 60% of total cultivated area. Other crops include sunflower, groundnuts, and cotton. Average numbers of cattle per household range from 1.5 to 3, depending on the district, and goats are also common. The main ethnic groups are the Chewa and the Ngoni. Rural households are concentrated in village settlements of up to 100 homesteads, a legacy of government-sponsored village regrouping programs (Ngugi, 1988; Jha and Hojjati, 1993; Peterson et al., 1999).

Farmer surveys have identified declining soil fertility as one of farmers' main perceived problems (Ngugi, 1988; ARPT, 1991). Nitrogen deficiency was judged to be the most important problem responsible for low maize yields. Increased pressure on land has reduced fallow periods, farmers' main method for maintaining soil fertility, to one to three years. Many farmers practice continuous cropping because brief, natural fallows do not result in an increase in yields (Ngugi, 1988). Fertilizer use on maize was common during the 1980's but the removal of subsidies caused most farmers to drastically reduce or abandon the technology.

Improved tree fallows

Short–duration improved fallows utilizing fast-growing, nitrogen-fixing leguminous trees are a promising alternative to natural fallows for increasing the fertility of nitrogen-depleted soil. In 1987, the Zambia/ICRAF Agroforestry Research Project began experimentation at Msekera Research Station, Chipata, Zambia, on improved tree fallows. In on-station trials, improved fallows using *Sesbania sesban* seedlings transplanted from nurseries greatly increased maize yields (Kwesiga and Coe, 1994; Kwesiga et al., 1999). Species that could be established directly from seed, such as *Tephrosia vogelii* and *Cajanus cajan*, were also tested on station with encouraging results (Kwesiga et al., 1999). Farmer experimentation began in 1992/93 and the number planting improved fallows rapidly increased, to 204 in 1994/95, and then to over 10,000 by 2000 (Franzel et al., 2002). No material incentives were provided to the farmers except for the supply of tree seed.

Wealth ranking
Wealth ranking is a method for categorizing farm households based on differences in wealth. Community members define the criteria and classify themselves according to these (Grandin, 1988). Crowley (1997) summarizes the method, as follows. Farmers define the different wealth groups in the community, usually creating 3 or 4 groups. They identify attributes that distinguish each group and then place each household into a group. Farmers may use beans, pebbles, or cards with household names to facilitate the task. The method is widely used in participatory research and many modifications have been made. For example, Sharrock et al. (1993) used key informants rather than the entire community. In some cases, individual scores of wealth are computed and averaged (Grandin, 1988) whereas in other cases, the wealth group of each household is arrived at by means of a consensus (Guinand, 1996).

In most cases, wealth ranking is used as part of a diagnostic exercise to help a community to characterize itself and to define its problems. In a review of 17 articles on wealth ranking, we did not find any which assessed the use of a new technology by different wealth groups. Two articles (Sarch, 1992 and Guinand, 1996) examined the participation of different wealth groups in on-farm trials; both found that the proportion of wealthier farmers in the trials was much higher than their proportion in the population.

Methods
The sample for this study was all 218 households in four villages. The villages were selected based on their accessibility, contrasting biophysical and socioeconomic characteristics, and the relatively high availability of seeds and information about planting improved fallows that was available to farmers.

For the wealth ranking method, a group of 6-9 key informants were assembled in each village to define wealth groups and determine each household's wealth group. Efforts were made to ensure that different types of farmers, e.g., female heads of households, were represented among the key informants. The research team met the key informants, explained the purpose of the wealth ranking exercise and asked them to determine the number of different groupings based on wealth endowment that existed in the village. After discussing amongst themselves, the informants arrived at the number of wealth groups in the village.

Next, the informants were asked, individually, to describe the differences between the groups. They then met in plenary and drew up a final list of indicators. Informants then were divided into four groups. Each group was given a set of cards (each card had the name of a household head on it) and asked to identify the wealth category of each household. Then the informants met in plenary to compare their findings. The final assessment of each household's wealth status was arrived at by consensus.

The quality of information was assessed in two ways. First, the assessments of the four groups were compared; a high degree of consistency among groups suggests that the exercise was accurate. Second, the number of errors that each group made was calculated, that is, the number of times that an individual group's assessment was different than that of the consensus. If a single group never erred, this would suggest that the group was more knowledgeable than other groups or, possibly, was of higher status and that the other groups were reluctant to challenge its views.

The influence of wealth status, gender, and village on the planting of improved fallows was assessed using a linear-logistic model for ordered category response data (Collet, 1991).

RESULTS

Gender and wealth groups
Village size ranged from 33 to 81 households. The percentage of households that were female-headed averaged 36% and ranged from 28% to 42% among the villages (Table 1). Single women, that is, women who were divorced, widowed, or never married, accounted for 65% of the female household heads. The remaining were married women whose husbands were living away from the village.

Table 1. The proportion of male-headed, female-headed (married), and female-headed (single) households in the sample villages (Percentages are in brackets).

Village	Male headed households	Married female-headed households	Single female-headed households	Total number of households
Mshaba	33 (72)	4(9)	9(19)	46 (100)
Kasauka	23 (70)	3(9)	7(21)	33 (100)
Chivungwe	36 (62)	4(7)	18(31)	58 (100)
Fisi	47 (58)	17(21)	17(21)	81 (100)
Total	139(64)	28(13)	51(23)	218 (100)

In all the villages the informants identified four major groupings: well off, fairly well off, (referred to as fair), poor, and very poor. The main indicators for wealth and well being of households common to all of the villages were the amount of land cultivated (except Fisi), the number of cattle owned, the type of roofing material used, ownership of a bicycle (except Fisi), amount of maize harvested per year (except Mshaba), ownership of ox-drawn implements, wether the household hired labour, ablity to send children to school, and onership of a bottomland (dimba) (except Fisi)

Some indicators, such as house type and ownership of ox-drawn implements, bicycles, shops, or hammer mill were useful for distinguishing between the well-off and fair groups. Others such as ownership of goats, pigs and chickens were useful for differentiating between the very poor and the other categories.

Table 2. Number of households in different wealth groups in the sample villages (Percentages for each village are in brackets).

	Well-off	Fairly well off	Poor	Very poor	Total
Mshaba	9 (20)	21 (46)	8 (17)	8 (17)	46 (100)
Kasauka	2 (6)	13 (40)	9 (27)	9(27)	33 (100)
Chivungwe	3 (5)	23 (40)	25 (43)	7(12)	58 (100)
Fisi	3 (4)	11 (13)	48 (59)	19(23)	81 (100)
Total	17 (8)	68(31)	90 (41)	43 (20)	218 (100)

The wealth indicators were fairly similar across villages. There was some variation in the levels of certain indicators among villages; for example a household with five head of cattle would be considered 'well-off' in Mshaba but only 'fair' in the other villages. But the commonality of most indicators and levels across villages permitted the analysis of data across village.

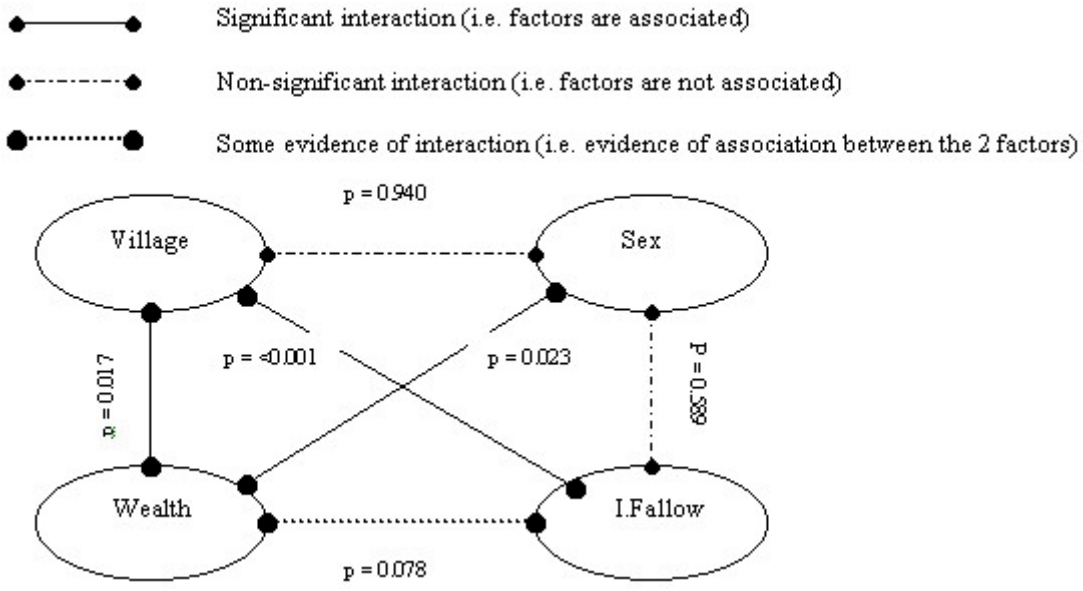

Figure 1. Results of the significance of association among variables using the linear logistic model

The proportion of households in different wealth groups varied considerably among the villages (p=0.017, log-linear model (Table 2; Figure 1). Overall, the two middle groups, the fair and the poor, accounted for 72% of all households. The poor were the largest group in Fisi, the fair were the largest in Mshaba and Kasauka, and the two groups were about equal in size in Chivungwe. The poor and very poor represented a majority of households in all but Mshaba, where people have higher incomes from trade and casual labour in nearby Chipata town. Fisi is poorer than other villages, probably because of an epidemic of East Cost Fever, which killed most of its cattle in 1989.

Accuracy of the exercise

The responses of key informants concerning the wealth group of each household were highly consistent (Table 3). In two-thirds of the cases, either the four groups of informants all had the same response or three out of the four were in agreement. In only 10% of the cases were more than two different wealth groups suggested for a single household. Differences among key informants were greatest in Fisi, the most populous village, perhaps because informants were less able to know each individual household intimately in such a big village.

Table 3. Consistency of responses of key informants on the wealth group of individual households (Percentages for each village are in parentheses).

	Complete agreement	Three of four agreed	Split-decision[a]	Disagreement	Total
Mshaba	15 (33)	14 (30)	12(26)	5 (11)	46 (100)
Kasauka	8 (24)	16 (48)	7 (21)	2 (6)	33(100)
Chivungwe	20 (34)	23 (40)	13 (22)	2 (3)	58 (100)
Fisi	16 (20)	35 (43)	17 (21)	13 (16)	81 (100)
Total	59 (27)	88 (40)	49 (22)	22 (10)	218 (100)

[a]two informants believe household is in one wealth group and two believe it is in another.
[b]informants are undecided as to which of three different wealth groups the household belongs to.

There was much variation in the numbers of errors made by the groups in assessing the wealth categories of households, that is, the number of times a group's assessment differed from the consensus (Table 4). A low number of errors by a single group may indicate that that group was very knowledgeable or that the group was very influential, perhaps because of the high status of a member(s). For example, group 3 in Chivungwe made only four errors and may have dominated the other groups in arriving at a consensus; the other groups made 10, 14, and 25 errors respectively. Groups in other villages appear to have been more equal in status and knowledge as there was less variation in the number of errors among groups.

Table 4. Number of errors[a] made by groups in assessing the wealth category of households.

	Mshaba		Kasauka		Chivungwe		Fisi	
	No. errors	No. large errors	No. errors	No. large errors	No. errors	No. large errors	No. errors	No. large errors
Group 1	14	1	13	0	25	0	29	3
Group 2	10	1	4	0	10	1	17	1
Group 3	8	0	5	0	4	0	14	1
Group 4	20	1	13	1	14	0	46	2
Total no. of households ranked	46	46	33	33	58	58	81	81

[a]An error is defined as a difference between the group's assessment and the consensus among groups. A large error involves mistaking the wealth group of a household by more than one category away from the consensus, for example, mistaking a well-off household for a poor household

Only 5% of the errors were large, that is, involved mistaking the wealth group of a household by more than one category away from the consensus, for example, mistaking a well-off household for a poor household. The groups appeared to have greater difficulty classifying the very poor households than other groups. For example, the proportion of households where the groups were in complete agreement about the wealth ranking was lowest for the very poor (p=.07, Chi square test).

Association among gender and wealth and use of improved fallows

Female-headed households are poorer than male-headed households throughout sub-Saharan Africa (Quisumbing, et al., 1995). In our sample, the association between gender and wealth was strong; 50% of male-headed households were well-off or fair as compared to 21% of female-headed households (Table 5; figure 1) (p= 0.02, log linear model). There was no significant difference between the proportions of males and females in the lowest category, that is, the very poor households (Chi square test, p= 0.23). Also, surprisingly, there was no significant difference between the wealth status of single and married female heads of households (log-linear model, p= 0.98)

Table 5. Proportion of households in different wealth groups by gender (percentages are in brackets).

Wealth group	Mshaba		Kasauka		Chivungwe		Fisi		Total	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Well off	7 (21)	2 (15)	1 (4)	1 (10)	3(8)	0	3(6)	0	14(10)	3 (4)
Fair	18 (55)	3 (23)	9 (39)	4(40)	17(47)	6(27)	11(24)	0	55 (40)	13 (17)
Poor	4 (12)	4 (31)	7(31)	2(20)	9(25)	16(73)	26(55)	22(65)	46 (33)	44(55)
Very poor	4 (12)	4 (31)	6(26)	3(30)	7(20)	0	7(15)	12(35)	24(17)	19(24)
Total	33(100)	13 (100)	23 (100)	10(100)	36 (100)	22 (100)	47(100)	34(100)	139 (100)	79 (100)

The analysis across villages obscures the considerable variation in the association between gender and wealth among villages. In Kasauka, females were better off than males; 5 of 10 females were fair or well off while only 10 of 23 males were (Table 6). In Chivungwe, 7 of 36 male-headed households were very poor whereas none of the 22 female-headed households fell in that category. At the other extreme, in Fisi, all 23 of the female-headed households were poor or very poor while only 33 of 47 males households were.

Table 6. Association between gender and the planting of improved fallows (Percentages are in brackets).

	Males			Females			Total		
	Planting	Not planting	Total	Planting	Not planting	Total	Planting	Not planting	Total
Mshaba	16(48)	17(52)	33(100)	8(61)	5(39)	13(100)	24 (52)	22 (48)	46(100)
Kasauka	15(65)	8(35)	23(100)	3(30)	7(70)	10 (100)	18 (54)	15 (46)	33(100)
Chivun-gwe	8(22)	28(78)	36(100)	4(18)	18(82)	22(100)	12 (21)	46 (79)	58(100)
Fisi	6(13)	41(87)	47(100)	3 (9)	31(91)	34(100)	9 (11)	72 (89)	81(100)
Total	45(32)	94(68)	139 (100)	18(23)	61(77)	79(100)	63 (29)	155 (71)	218 (100)

The proportion of farmers who had planted improved fallows ranged from 11% in Fisi to 54% in Kasauka and averaged 29% across the sample (Table 7). The higher rate of planting in Kasauka and Mshaba was probably associated with greater exposure to the technology, in terms of farmer training centers, on-farm trials, and farmer visits to the research stations.

Overall, 32% of males and 23% of females had planted improved fallows, but the difference between the two proportions was not significant (p=0.71). There was considerable variation among villages; for example, in Mshaba, the proportion of females planting was larger than that of the males. The high proportion of female planters in Mshaba may be attributed to the presence of an active womens' group. Across the sample, 25% of

single women and 18% of married female household heads planted improved fallows. However, the difference between these two proportions was not significant (p=0.68, log-linear model).

Table 7. Association between wealth category and planting of improved fallows (percentages are in brackets).

	Well-off		Fairly well -off		Poor		Very poor		Village total	
Village	Planting	Not Planting	Planting	Not planting	Planting	Not planting	Planting	Not Planting	Planting	Not Planting
Mshaba	7(78)	2(22)	10(48)	11(52)	6(75)	2(25)	1(13)	7(87)	24(52)	22(48)
Kasauka	1(50)	1(50)	7(54)	6(46)	6(67)	3(33)	4(46)	5(56)	18(54)	15(46)
Chivungwe	1(33)	2(67)	7(30)	16(70)	4(16)	21(84)	0(0)	7(100)	12(21)	46(79)
Fisi	0(0)	3(100)	3(27)	8(73)	4(8)	44(92)	2(11)	17(90)	9(11)	72(89)
Total for all villages	9(53)	8(47)	27(40)	41(60)	20(22)	70(78)	`7(16)	36(84)	63 (29)	155(71)

As wealth declined, the proportion of farmers planting improved fallows tended to declined. Whereas 53% of the well off farmers had improved fallows, only 22% of the poor and 16% of the very poor group had them (Table 7). The association between wealth and planting was somewhat significant (figure 1)(p=0.078, log-linear model). There was considerable variation among the villages in the percentage of poor and very poor planting improved fallows. In Fisi and Chivungwe, the percentage of the poor and very poor who planted improved fallows was 9% and 14% respectively. In Kasauka and Mshaba, 55% and 44%, respectively, of the poor and very poor planted. Kasauka was the only village where the proportion of the poor and very poor groups planting improved fallows was greater than the proportion of well off and fairly well off that did so.

CONCLUSION

While male farmers and high-income farmers tend to have high adoption rates for new agricultural practices, this study found no evidence of an association between either wealth or gender and the planting of improved fallows. That 22% of the poor and 16% of the very poor plant improved fallows is probably related to the low capital and labour requirements of the practice. Peterson (1999) found that the constraints to planting improved fallows varied by gender; women are constrained more by lack of land and strength; men by lack of time and opportunity cost of land. Moreover, among female-headed households, there were no significant differences in our study between the proportions of single and married women planting the fallows. This finding conflicts with those of Muturi and Franzel (1992) and Bonnard and Scherr (1994), who found that married women in Kenya tended to plant more trees than single women. Peterson (1999) found that because single women in eastern Zambia do not have to consult a male for permission, they are able to plant improved fallows more often than married women.

The findings from this study have several implications. First, whereas mineral fertilizer is strongly associated with high-income, male farmers (Place et al., 2002), improved fallows appear to be a gender-neutral and wealth-neutral technology. Policy makers can thus promote them as practices that will benefit the poor and female farmers as well as the better off and male farmers. Second, the considerable variation among villages in the relative proportion of poor and females planting suggests that there are important opportunities for increasing the participation of these groups in the planting of improved fallows. For example, the hypothesis that the existence of farmer groups and their effectiveness have a positive association with the proportion of the poor and females planting the technology needs to be investigated. Many of the farmers planting improved fallows are still experimenting with them; a follow up study is needed to assess whether poor and female farmers are expanding their use of improved fallows.

Finally, the findings confirm the effectiveness of wealth ranking for determining the wealth groups of households. The responses of key informants were fairly consistent, demonstrating their accuracy in classifying households. But some bias appeared to be a problem in 1 of the 4 villages where a single group was highly, and probably overly, influential in determining the outcome.

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