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### FARMERS' KNOWLEDGE OF AGRONOMIC AND ABIOTIC CONSTRAINTS IN THE COFFEE-BANANA AGROFORESTRY SYSTEMS OF SOUTH-WESTERN UGANDA

Lilian Nakibuule<sup>1</sup>, Godfrey H. Kagezi<sup>\*1</sup>, P. Kucel<sup>1</sup>, J. Kobusinge<sup>1</sup>, W. W. Wagoire<sup>1</sup>, G. Kisolo<sup>2</sup>, Perfecto I<sup>3</sup>

<sup>1</sup>National Coffee Research Institute (NaCORI), National Agricultural Research Organisation (NARO), P.O. Box 185 Mukono, Uganda.

<sup>2</sup>Uganda Martyrs University, P.O. Box 5498 Kampala, Uganda.

<sup>3</sup>School of Natural Resources and Environment, University of Michigan, Ann Arbor, Mi 48109.

#### ABSTRACT

Productivity of coffee and bananas in Uganda remains below attainable yields despite the importance of these crops to the smallholder farmers. This is due to agronomic and abiotic constraints among other factors. We therefore determined farmers' knowledge of agronomic and abiotic factors limiting coffee and banana production in coffee-banana agro forestry systems of southwestern Uganda. Nine districts were randomly sampled and a questionnaire administered to 10 randomly selected households per district. Farmers had knowledge and mentioned five constraints - with the majority (96%) of them reporting broad-leaved weeds. However, their knowledge was neither dependent ( $p \geq 0.05$ ) on sex, age nor education, implying that all constraints are considered important. Most farmers (78%) were using hoes for managing weeds, organic manures (63%) for declining soil fertility, trenches (49%) for soil erosion and mulching (39%) for drought. Knowledge generated forms a basis for informing policy and research agenda aimed at managing these constraints.

#### KEYWORDS

Abiotic, Agronomic, Banana, Coffee, Constraints and Farmers' -knowledge.

#### Author for Correspondence:

Godfrey H. Kagezi,  
National Coffee Research Institute (NaCORI),  
National Agricultural Research Organisation,  
P.O. Box 185 Mukono, Uganda.

**Email:** [gkagezi@gmail.com](mailto:gkagezi@gmail.com)

#### INTRODUCTION

Coffee and bananas constitute the food and income base for many smallholder farmers in Uganda<sup>1,2</sup>. According to the Government of Uganda Vision 40, coffee is one of the major commodities to drive the 68% of the population to the middle class income by the year 2025. Coffee is the main cash crop harvested once or twice a year, while banana is a primary food and cash crop produced throughout the

year<sup>3,4</sup>. These crops are often grown as sole crops, although there is a tendency of intercropping the two, predominately in densely populated areas<sup>4</sup>. Traditionally, many smallholder farmers in Uganda inter-plant these crops with trees, leading to sustainable production<sup>5-8</sup>. Agroforestry system is a low-cost and environmentally-friendly approach currently being promoted by research and extension for sustainable production of both crops<sup>7,8</sup>.

Despite all these efforts by the stakeholders, the current coffee and banana production averaging about 500 kg ha<sup>-1</sup> for Robusta coffee and 5-20 Mg ha<sup>-1</sup> yr<sup>-1</sup> FW for cooking bananas, are three to four times below the attainable yields of 2.2 t ha<sup>-1</sup> and 100 Mg ha<sup>-1</sup> FW, respectively<sup>4,9</sup>. This is attributed to a number of constraints of which agronomic and abiotic factors are paramount<sup>10</sup>. In addition, limited appreciation of farmers' knowledge and their perceptions on these constraints has been an impediment to identifying appropriate intervention strategies, leading to low adoption of recommended technologies<sup>11</sup>. Thus, modern research and development call for incorporation of farmers' knowledge and experience in research agenda<sup>12</sup>. This forms a basis for constructive collaboration between farmers, scientists, extension and policy makers in term of priorities definition and setting<sup>13,14</sup>.

This study therefore aimed at answering the following research questions: - (i) do farmers know the agronomic and abiotic constraints limiting production of coffee and bananas in the coffee-banana agroforestry systems of southwestern Uganda?, (ii) how do farmers cope up with these constraints?, and, (iii) is this knowledge dependent on age, sex or educational level?. The information generated would be used to inform policy and research agenda to set priorities and formulate development policies aimed at increasing coffee and banana productivity in Uganda.

## **MATERIAL AND METHODS**

The study was conducted in nine (9) districts randomly selected in southwestern Uganda in 2014. These districts were: - Ibanda, Isingiro, Mitooma, Rubirizi, Kanungu, Ntungamo, Bundibugyo, Kibaale and Kabarole. In each district, 10 farmers practicing

the coffee-banana agroforestry systems were purposively selected and a questionnaire eliciting their perception on the agronomic and abiotic constraints and the coping mechanisms administered to them. Data were summarized using descriptive statistics including means and percentages. In addition, the percentage of farmers mentioning the different agronomic and abiotic constraints limiting coffee and banana production was compared using a chi-square analysis. We also used a simple logistic regression analysis to define the relationship between farmers' perception of the agronomic and abiotic factors as well as their coping options and the socio-demographic characteristics (sex, education and age). All the analysis was done in SAS v. 9.1 for Windows<sup>15</sup>.

## **RESULTS AND DISCUSSION**

This study established farmers' knowledge of the agronomic and abiotic constraints limiting coffee and banana production in the coffee-banana agroforestry systems of southwestern Uganda and how they cope up with them. It also determined whether sex, age and educational status of farmers were determinants of this knowledge. This knowledge is vital for informing research and other agendas to set priorities and formulate development policies aimed at increasing coffee and banana productivity in Uganda.

Results revealed that, the respondents had knowledge of the agronomic and abiotic factors limiting production of coffee and bananas. More than 70% of the respondents mentioned five constraints, namely: broad-leaved and grassy weeds, declining soil fertility, soil erosion and drought affecting their coffee and bananas (Figure No.1). Our finding agrees with reports by<sup>16-18</sup> in the same region. Similarly, on-station and on-farm research studies have also reported these factors to be limiting both coffee and banana production in Uganda<sup>19-21</sup>. This therefore calls for research and policy to develop appropriate technologies to properly address these constraints<sup>18</sup>.

Chi-square analysis revealed no significant ( $p=0.3153$ ) difference among the percentage of farmers mentioning the various factors. Similarly, a

simple logistic analysis showed that farmers' knowledge of the agronomic and abiotic factors limiting coffee and banana production was neither dependent ( $p>0.05$ ) on sex, age nor education level of the respondent (Table No.1). This implies that farmers consider all these constraints equally important in limiting production of both coffee and bananas in the region<sup>10,18</sup>. However, most (96%) of the farmers recognized broad-leaved weeds as the most important constraint limiting production of both coffee and bananas (Figure No.1). Similarly<sup>17,22</sup>, observed that weeds were the most prominent agronomic problem mentioned by coffee and banana farmers in southwestern and central Uganda respectively. Weeds are disadvantageous because they compete with coffee and bananas for water, nutrients and direct sunlight, causing qualitative and quantitative losses<sup>23-25</sup>. In addition to yield losses, weeds are known to harbor harmful pests and diseases for both crops<sup>24,26,27</sup>.

Farmers had knowledge on how to manage these agronomic and abiotic factors limiting their coffee and banana production in the region (Figure No.2). They mentioned several ways of coping with them, depending on the constraint.

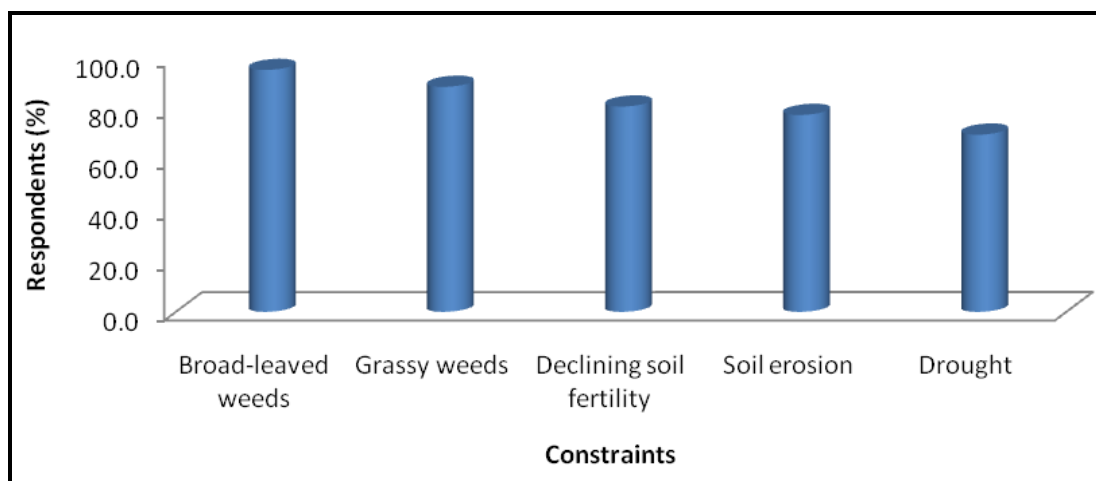
This finding corroborates with observation by<sup>16-18</sup> in this region. The study further showed that most farmers (>70%) were using hoe weeding for managing both broad-leaved and grassy weeds, as reported. In addition, most farmers (63%) were using organic manures to address the declining soil fertility. This result is in line farmers' responses in surveys conducted by<sup>28-30</sup> in central Uganda as well as<sup>31</sup> in eastern Uganda. On the other hand, most farmers (49%) were using trenches to manage soil erosion, supporting survey findings of<sup>32</sup>. Also, most farmers (39%) were mulching their coffee and banana fields to adapt to drought as reported by<sup>33</sup>. However, a simple logistic analysis showed that the number of coping options for the agronomic and abiotic factors limiting coffee and banana production mentioned by the farmer was neither dependent ( $p>0.05$ ) on sex, age nor education level of the respondent (Table No.2). This implies that all farmers irrespective of the category had knowledge on the management options of the agronomic and abiotic constraints - emphasizing the importance farmers attach to these factors.

**Table No.1: Sex, age and education level as determinants of respondent's knowledge of the factors limiting coffee and banana production in coffee-banana agroforestry systems of southwestern Uganda**

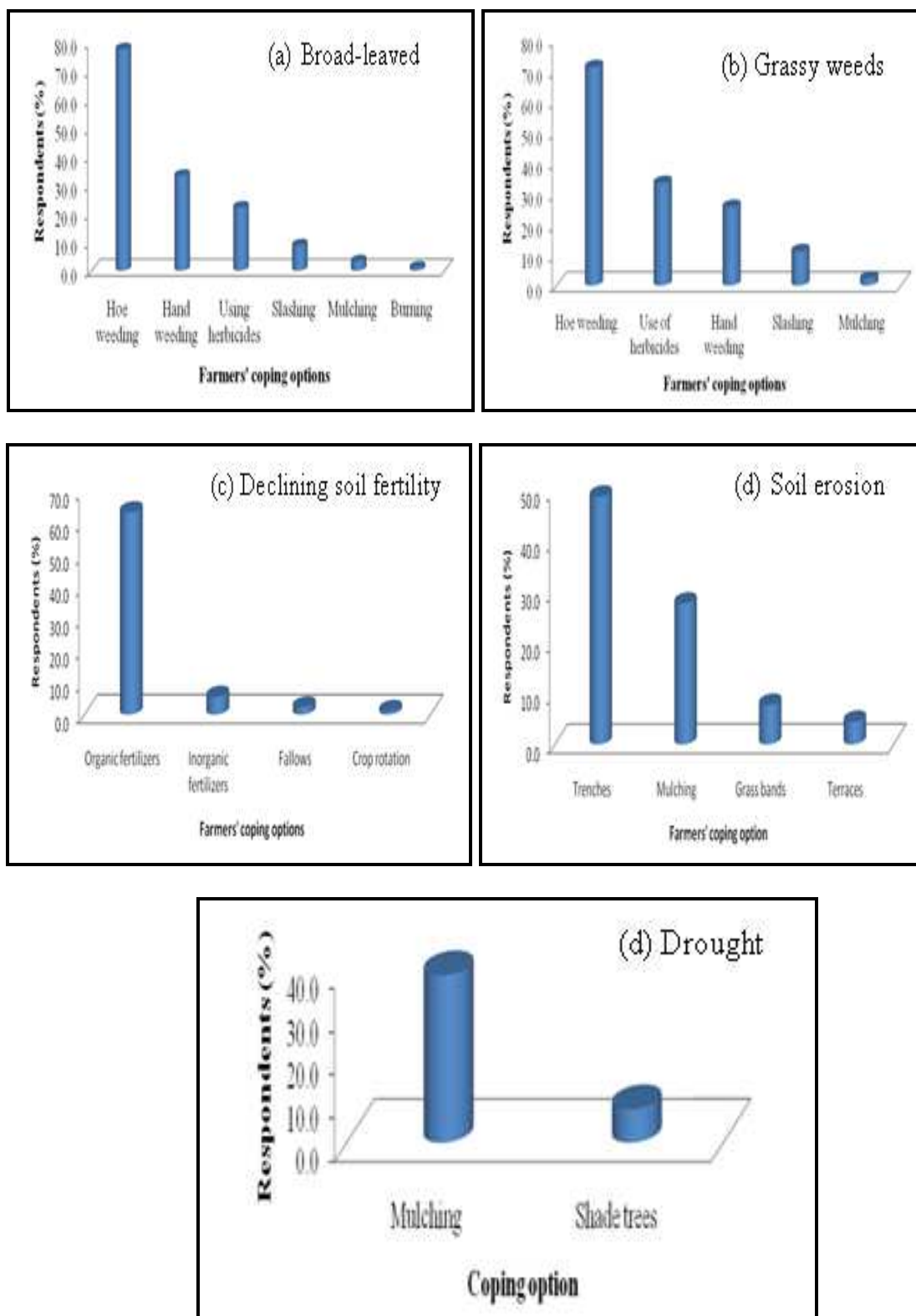
S.No	Constraint	Parameter	DF	Estimate	Standard Error	Wald Chi-Square	P value
1	Broad-leaved weeds	Intercept	1	11.7196	185.7	0.0040	0.9497
		Sex	1	-11.9419	185.7	0.0041	0.9487
		Age	1	-0.0181	0.0372	0.2380	0.6257
		Education	1	-1.3116	0.8092	2.6274	0.1050
2	Grassy weeds	Intercept	1	-1.3148	2.0618	0.4067	0.5237
		Sex	1	-0.7770	0.8756	0.7874	0.3749
		Age	1	0.00739	0.0225	0.1084	0.7420
		Education	1	-0.1095	0.4071	0.0723	0.7880
3	Declining soil fertility	Intercept	1	-1.3678	1.6570	0.6814	0.4091
		Sex	1	-0.5113	0.6657	0.5901	0.4424
		Age	1	0.0113	0.0181	0.3853	0.5348
		Education	1	0.0105	0.3253	0.0010	0.974
4	Soil erosion	Intercept	1	-2.5843	1.5790	2.6788	0.1017
		Sex	1	0.6161	0.5852	1.1085	0.2924
		Age	1	0.00364	0.0172	0.0445	0.8330
		Education	1	0.4646	0.3151	2.1743	0.1403
5	Drought	Intercept	1	-0.8706	1.3870	0.3940	0.5302
		Sex	1	-0.00151	0.5276	0.0000	0.9977
		Age	1	0.000911	0.0153	0.0035	0.9526
		Education	1	-0.0140	0.2790	0.0025	0.9600

**Table No.2: Sex, age and education level as determinants of respondent's knowledge of the number of coping options for the abiotic and agronomic constraints in coffee-banana agroforestry systems of southwestern Uganda**

S.No	Parameter	Df	Parameter Estimate	Standard Error	t Value	Pr >  t
<i>Broad-leaved weeds</i>						
1	Intercept	1	1.21883	0.43988	2.77	0.0069
2	Sex	1	0.09451	0.16745	0.56	0.5739
3	Age	1	0.00424	0.00487	0.87	0.3860
4	Education level	1	-0.06205	0.08851	-0.70	0.4851
<i>Grassy weeds</i>						
5	Intercept	1	0.85505	0.46769	1.83	0.0710
6	Sex	1	0.23526	0.17803	1.32	0.1899
7	Age	1	0.00538	0.00517	1.04	0.3009
8	Education level	1	0.00295	0.09410	0.03	0.9751
<i>Declining soil fertility</i>						
9	Intercept	1	1.08244	0.36925	2.93	0.0043
10	Sex	1	-0.02701	0.14056	-0.19	0.8481
11	Age	1	-0.00656	0.00408	-1.61	0.1120
12	Education level	1	-0.00500	0.07430	-0.07	0.9465
<i>Soil erosion</i>						
13	Intercept	1	1.34983	0.50458	2.68	0.0089
14	Sex	1	-0.13311	0.19208	-0.69	0.4902
15	Age	1	-0.00479	0.00558	-0.86	0.3927
16	Education level	1	-0.03819	0.10153	-0.38	0.7077
<i>Drought</i>						
17	Intercept	1	0.58134	0.36239	1.60	0.1123
18	Sex	1	0.00850	0.13795	0.06	0.9510
19	Age	1	-0.00056109	0.00401	-0.14	0.8890
20	Education level	1	-0.07352	0.07292	-1.01	0.3162



**Figure No.1: Percentage of farmers mentioning the various agronomic and abiotic factors limiting coffee and banana production in the coffee-banana agroforestry systems of southwestern Uganda**



**Figure No.2: Percentage of respondents mentioning the various methods of managing of the major agronomic and abiotic factors limiting production of coffee and bananas in the coffee-banana agroforestry systems of southwestern Uganda**

## CONCLUSION

Farmers had knowledge of the agronomic and abiotic factors limiting coffee and banana production in their region - with most of them mentioned weeds. However, farmers' knowledge of the constraints was neither dependent on age, sex nor educational level, implying that farmers consider all the constraints important. Similarly, farmers had knowledge on managing these factors. They were using hoes for addressing weeds, organic manures for declining soil fertility, trenches for soil erosion and mulches for drought. Farmers' knowledge of managing these constraints was also neither dependent on age, sex nor educational level. The knowledge generated forms a basis for informing policy and any subsequent research agenda aimed at managing agronomic and abiotic stresses in the coffee-banana agro forestry systems of Uganda.

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## CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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