

Table S1. Description of variables used to cluster smallholders in Northern Uganda.

Variable	Description	Unit
Household-related characteristics		
Age	Age of respondent	years
Family size	Number of people living under the same roof	Number
Education level	Number of years in school for household head	years
Farming experience	Farming experience (respondent)	years
Household farm assets		
Average monthly income	Average monthly income, both farm and off-farm	USD
Total land owned	Total land owned by the household	Hectares
Value of farm assets	Monetary value of farm assets owned for 2019	USD
Proportion of land: crop production	Proportion of the total land allocated to crop production	percentage
Proportion of land: livestock production	Proportion of the total land allocated to livestock production	percentage
TLUs	Total livestock units (TLUs)	Units
Livestock value	Monetary value of livestock as at October 2019	USD
Pigeon pea related attributes		
Proportion of pigeon pea sold	Proportion of pigeon pea sold for 2019	percentage
Pigeon pea acreage	Total land used for pigeon pea production	Hectares
Quantity of Pigeon pea produced	Quantity of pigeon pea produced (2019 harvest)	Kilogram
Intercropped pigeon pea	Whether farmer intercropped pigeon pea or otherwise	Dummy; 1=intercropped, 0=otherwise
Number of years growing pigeon pea	Number of years for growing pigeon pea in the household	Years

Note: Tropical Livestock Unit (TLU) conversion: cattle=1, goats, sheep and pigs=0.1, donkeys=0.5, Oxen=1.42, chicken, turkeys, ducks and guinea fowls=0.01, rabbits=0.02 (Jahnke, 1982). USD is United States dollars.

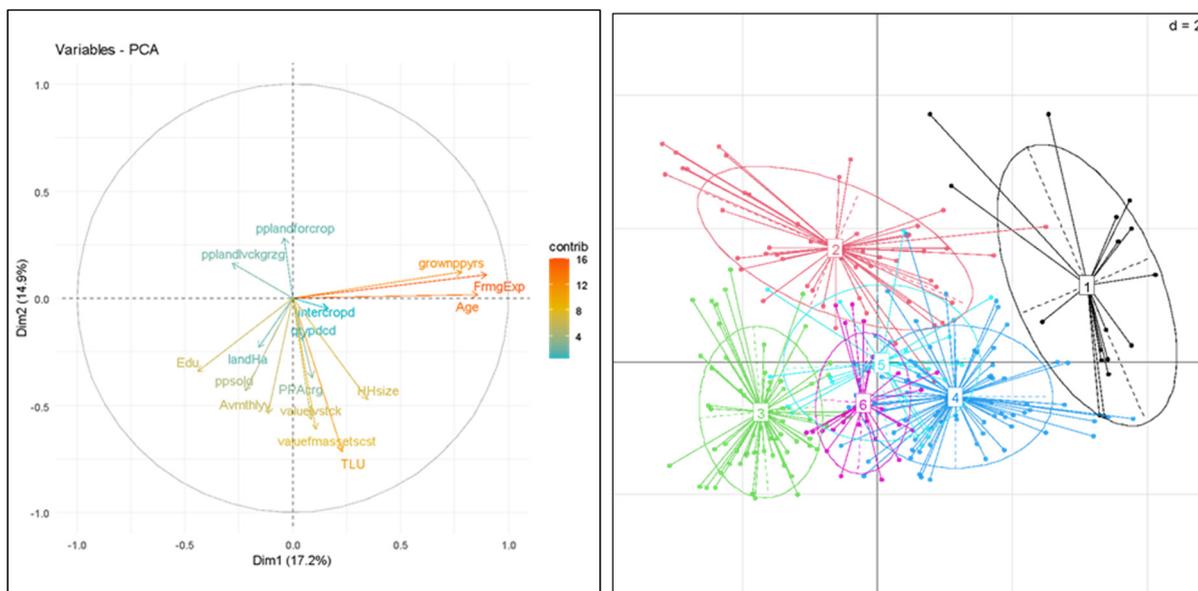


Figure S1. PCA and CA output (PC1-PC2), correlation circles and scatter plot along the first two principal components. The directions and lengths of arrows within the circles show the strengths of correlations between variables and PCs. Each household is connected to its individual cluster mean with a line.

Table S2: Selected principal components, loadings, Eigenvalues and variance from PCA.

Variables	Correlations between each variable and the principal components					
	PC1	PC2	PC3	PC4	PC5	PC6
Age	0.86	0.02	-0.12	-0.19	0.01	0.06
Family size	0.35	-0.47	0.19	0.27	0	-0.01
Education level	-0.44	-0.34	0.09	-0.42	-0.11	0.04
Farming experience	0.9	0.11	-0.14	-0.15	-0.01	-0.02
Average monthly income	-0.15	-0.54	0.11	-0.27	0.02	-0.14
Total land owned	-0.18	-0.23	-0.74	0.1	0.27	-0.17
Value of farm assets	0.07	-0.61	-0.08	-0.09	-0.37	-0.06
Proportion of land: crop production	-0.02	0.28	0.67	-0.13	-0.19	-0.15
Proportion of land: livestock production	-0.27	0.16	-0.62	0.04	-0.39	-0.03
Livestock value	0.09	-0.57	-0.03	0.29	-0.29	0.14
TLUs	0.23	-0.72	0.05	0.06	-0.26	0.01
Pigeon pea acreage	0.06	-0.37	-0.12	-0.09	0.63	-0.09
Proportion of pigeon pea sold	-0.25	-0.43	0.19	-0.27	0.34	0.44
Quantity of Pigeon pea produced	0.04	-0.19	0.22	0.12	0.12	-0.82
Intercropped pigeon pea	0.16	-0.05	0.24	0.69	0.18	0.23
Numbers of years growing pigeon pea	0.79	0.12	-0.05	-0.24	-0.02	0.03
Eigen value	2.75	2.39	1.64	1.14	1.10	1.02
Variance explained (%)	17.2	14.9	10.3	7.1	6.9	6.4
Cumulative variance (%)	17.2	32.1	42.4	49.5	56.4	62.8

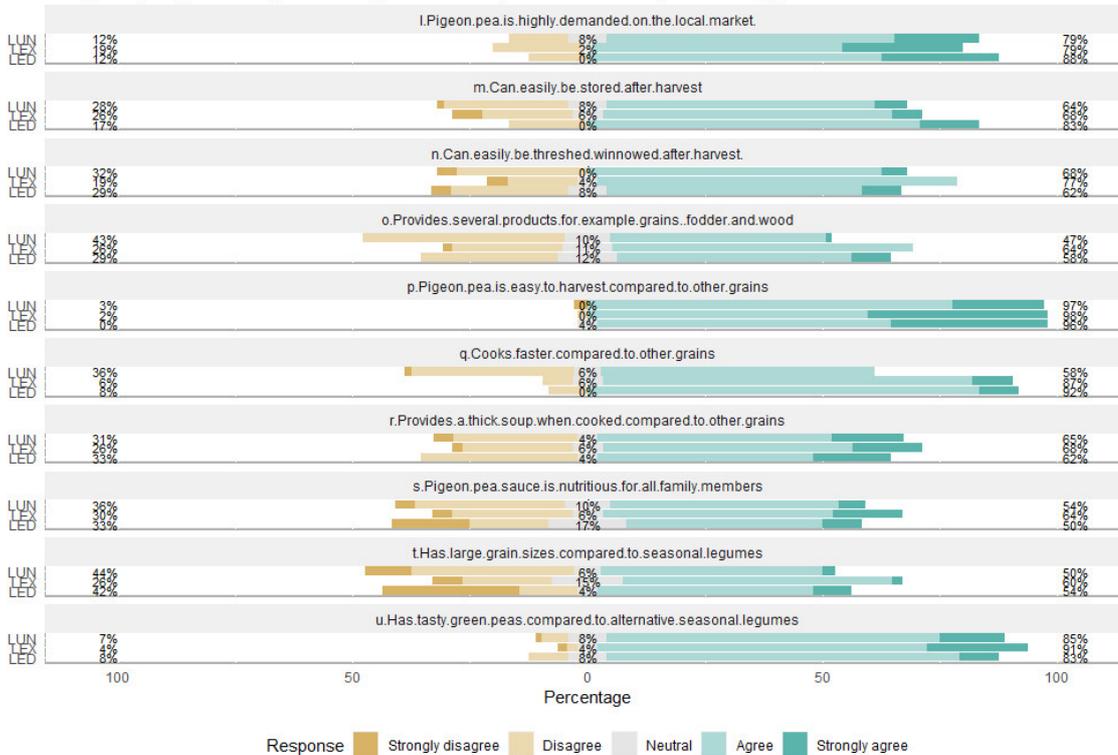
Source: survey data 2019. Factor loadings of > 0.400 show high correlations between selected variables and PCs.

Table S3. Variable mean that characterize the partitioning of the six different farmer types.

Resource category	Low	High	Low	Medium	High	Low	p- value
Variables	LEX	HEX	LED	MEX	HED	LUN	
Age	57.88 ^a	38.53 ^d	29.55 ^d	48.26 ^b	42.75 ^c	38.22 ^c	0.001
Family size	5.24 ^a	6.75 ^b	5.27 ^b	7.97 ^a	10.05 ^a	6.89 ^a	0.001
Education level	3.53 ^c	5.53 ^{ab}	7.69 ^{ab}	4.04 ^{bc}	6.8 ^a	3.1 ^c	0.001
Farming experience	44.47 ^a	18.73 ^{de}	8.68 ^e	29.62 ^b	18.1 ^{cd}	16.61 ^c	0.001
Average monthly income♦	11.18 ^b	21.76 ^b	26.56 ^{ab}	21.03 ^{ab}	32.77 ^a	10.98 ^b	0.001
Land owned	2.92 ^b	6.36 ^a	1.59 ^b	1.34 ^a	2.38 ^b	1.12 ^b	0.001
Value of farm assets	18.43 ^b	33.27 ^{bc}	22.24 ^c	34.64 ^{ab}	49.34 ^a	15.22 ^{bc}	0.001
Proportion of land: crop production	54.86 ^a	43.96 ^b	74.28 ^a	71.11 ^b	49.11 ^b	72.96 ^a	0.001
Proportion of land: livestock grazing	11.83 ^b	20.52 ^a	9.88 ^b	5.86 ^b	8.3 ^b	10.86 ^b	0.001
TLUs	2.54 ^b	3.34 ^{bc}	2.19 ^c	3.69 ^b	10.22 ^a	1.13 ^{bc}	0.001
Livestock value	23.77 ^b	77.05 ^b	35.35 ^b	37.98 ^b	324.03 ^a	10.72 ^b	0.001
Pigeon pea acreage	0.64 ^{bc}	0.75 ^c	0.42 ^c	0.58 ^a	0.83 ^{ab}	0.36 ^c	0.001
Quantity of Pigeon pea produced per Ha	355.9 ^b	374.7 ^b	364.3 ^b	401.6 ^b	475.9 ^{ab}	327.2 ^a	0.001
Proportion of pigeon pea sold	13.29 ^d	26.79 ^{cd}	39.62 ^{ab}	24.64 ^{bc}	54.31 ^a	11.64 ^d	0.001
Number of years growing pigeon pea	38.76 ^a	9.78 ^c	5.48 ^c	18.35 ^b	10.2 ^{bc}	7.89 ^{bc}	0.001

Survey results- 2019: Means followed by the same superscript letter in the same row are not significant different by the HSD-test at the 5% level of significance. HSD = Tukey's honestly significant difference test. LEX, LED and LUN refer to Low Resource endowed and experienced, educated and unexperienced, whereas MEX refers to Medium Resourced and Experienced, HED and HEX refer to High Resource endowed and educated or experienced. ♦ The total monthly income indicator was calculated as the sum of off- farm income and on-farm income generated from crop and livestock sales. Farm product sales were calculated from local prices, retrieved at the time of the survey.

A. Pigeon pea processing, marketing and consumption attributes by resource type: LUN, LEX & LED



C. Pigeon pea processing, marketing and consumption attributes by resource type: MEX, HEX & HED

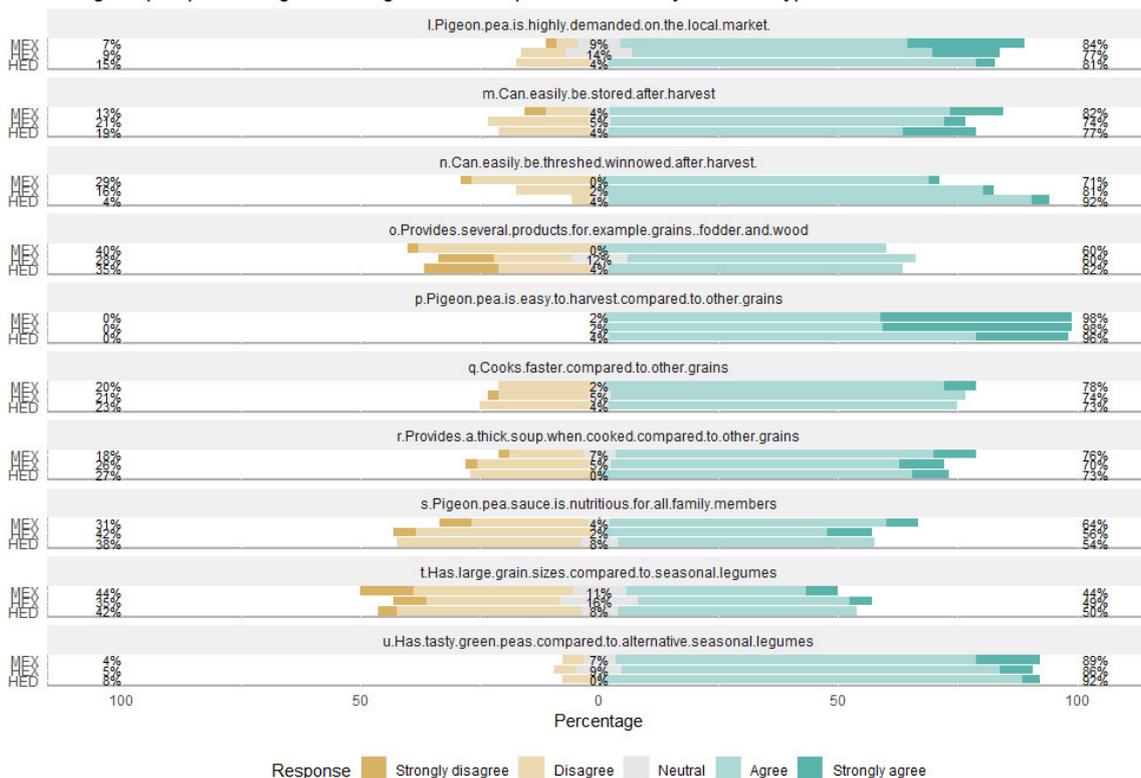
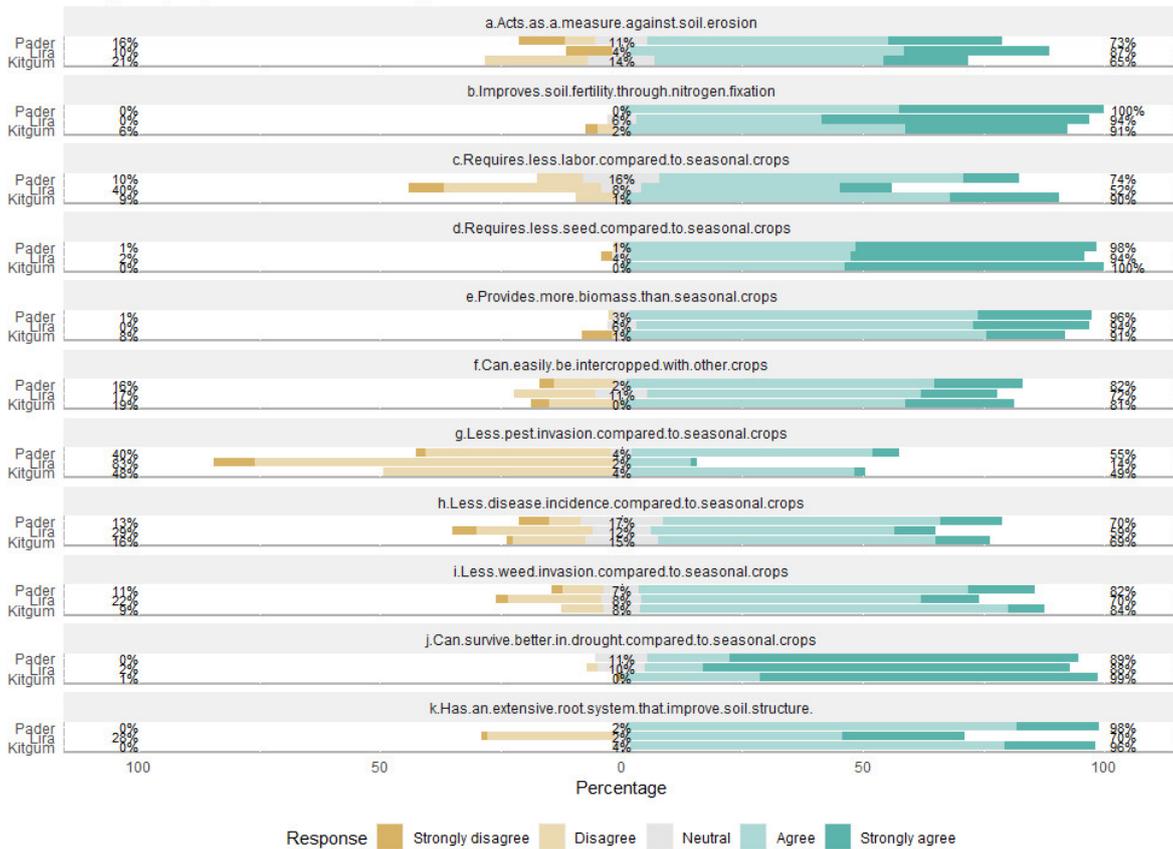
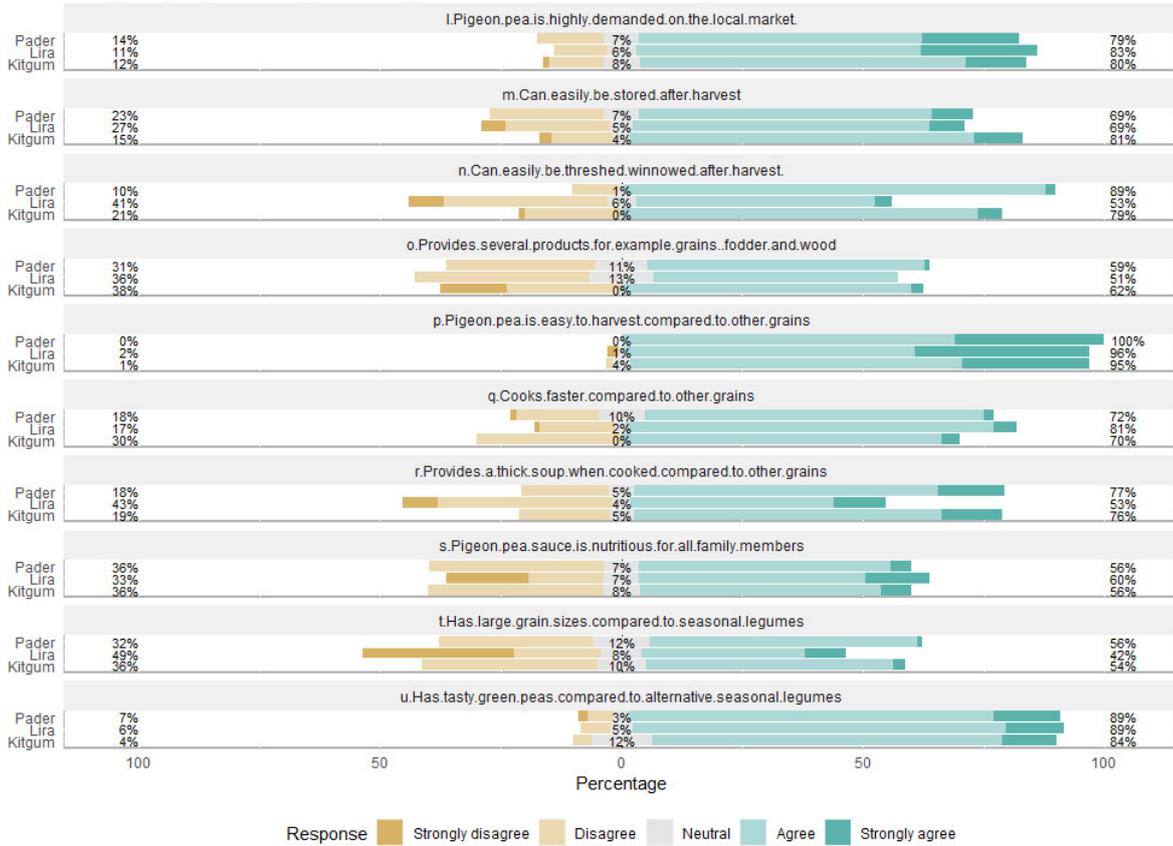


Figure S2. (A,C): Smallholders' perceptions of pigeon pea by resource type (the sample size was 257). Likert type rate; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The percentage on the left side indicate the share of respondents answering with 1 or 2 on the Likert scale. The percentage in the middle indicate the share of respondents answering with 3 (neutral) on the Likert scale. The percentages on the right side indicate the share of respondents answering with 4 or 5 (agreement) on the Likert scale. Pigeon pea production, processing, marketing and consumption attributes by farm type.

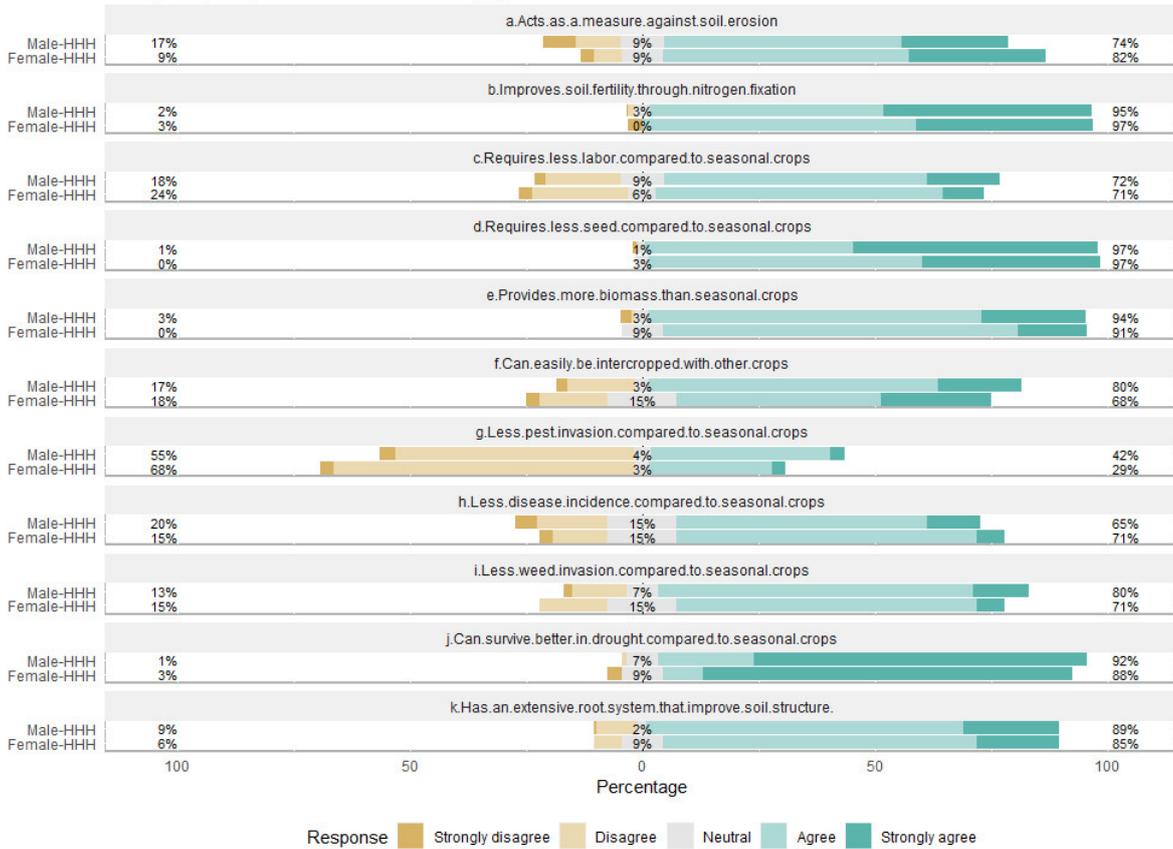
A. Pigeon pea production attributes by District



B. Pigeon pea processing, marketing and consumption attributes by District



C. Pigeon pea production attributes by gender of the household head



D. Pigeon pea processing, marketing and consumption attributes by gender of the household head

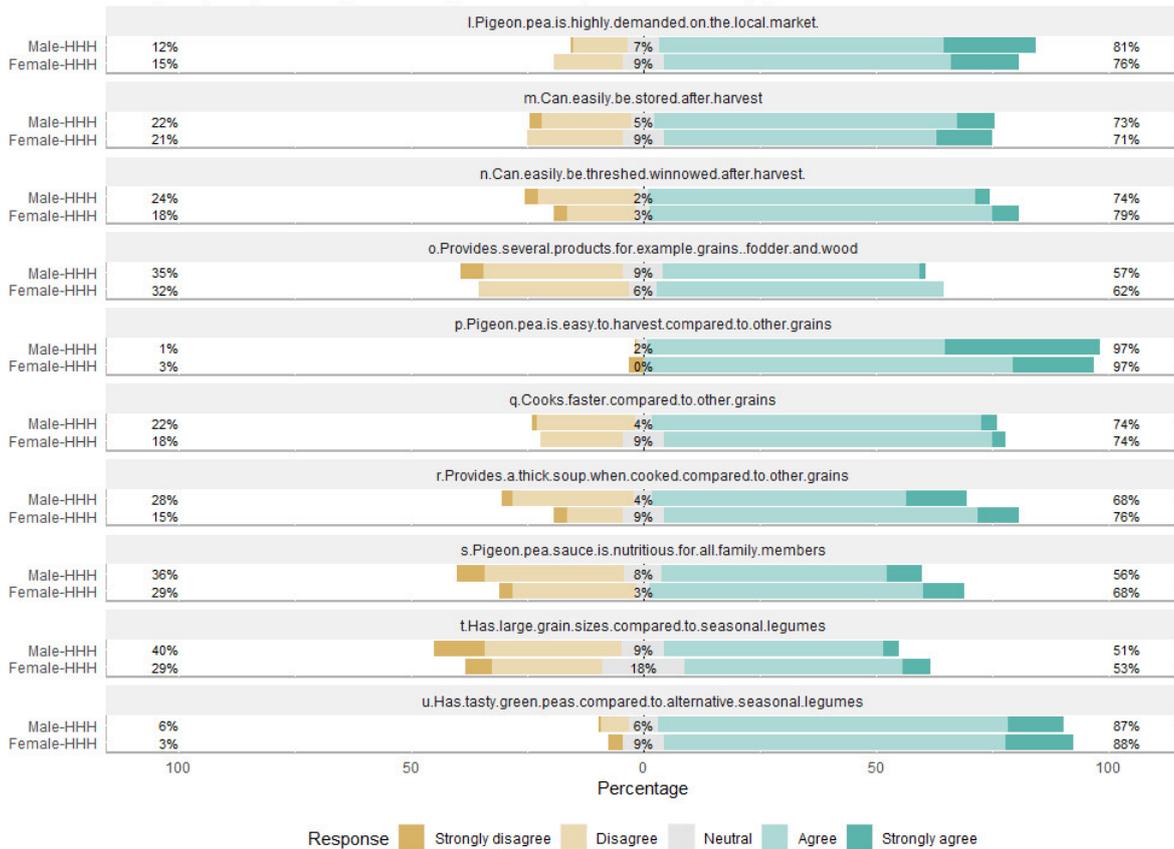


Figure S3. (A–D): Smallholders’ perceptions of pigeon pea (the sample size was 257). Likert type rate; 1=strongly disagree, 2=disagree, 3=neutral, 4=agree and 5=strongly agree. The percentage on the left side indicate the share of respondents answering with 1 or 2 on the Likert scale. The percentage in the middle indicate the share of respondents answering with 3 (neutral) on the Likert scale. The percentages on the right side indicate the share of respondents answering with 4 or 5 (agreement) on the Likert scale. Pigeon pea production, processing, marketing and consumption attributes by district and gender of household head.