

Adoption of Climate-Resilient Groundnut Varieties Increases Agricultural Production, Consumption, and Smallholder Commercialization in West Africa

Supplementary Tables

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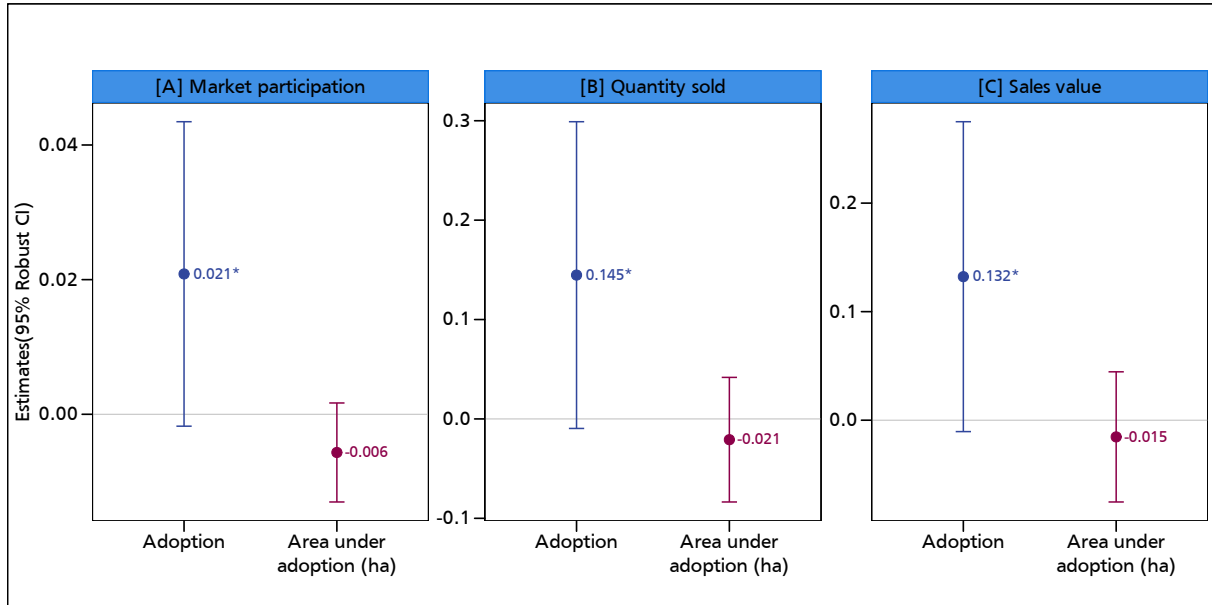
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1 Supplementary Tables

1.1 Supplementary Note

We present the results of the estimation using the pooled FE-OLS model. Figure S1 presents the results of the relationship between the adoption of climate-resilient groundnut varieties and commercialization where we employ the linear probability model for binary outcomes. We present results when we consider adoption as a dummy and the extent of adoption of climate-resilient groundnut varieties. Considering adoption as a dummy, we establish a positive association with the commercialization outcomes; market participation, quantity of groundnut sold, and sales. Considering the area under adoption, we obtain negative estimates that are not statistically significant. However, this result could mean that increasing the area of cultivation of improved climate-resilient groundnut varieties is negatively correlated with market participation, quantity sold and the associated sales value. This negative relationship although not statistically significant could be due to diminishing returns when we consider the area under adoption. Otherwise, these negative results could be due to endogeneity issues which could lead to biased estimates. Given that we control for these endogeneity issues using the 2SLS and both household fixed effects and the correlated random effects model, we only use these results for comparison with the main estimation results.

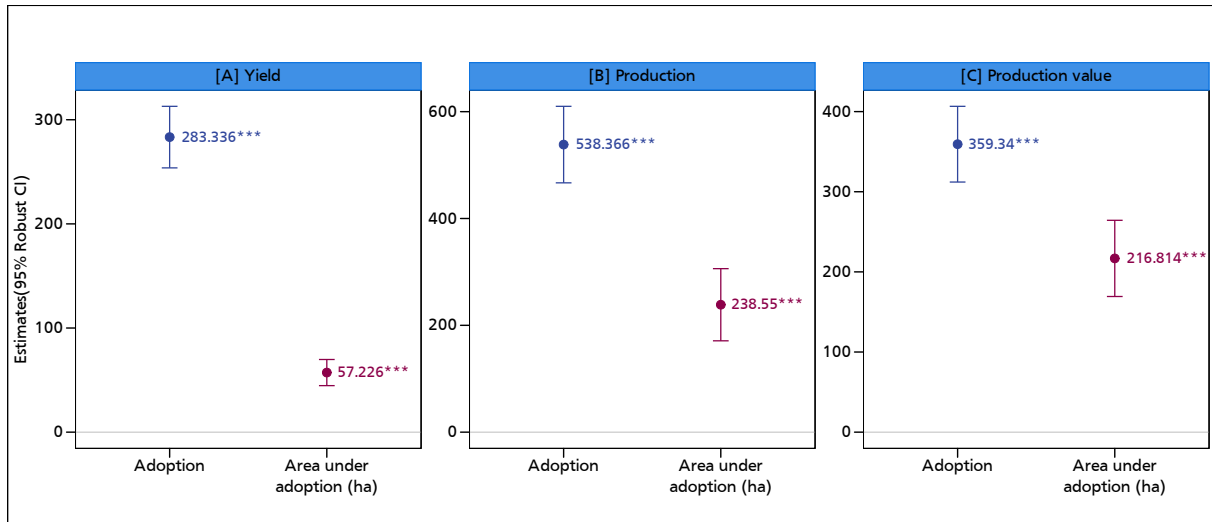
Figure S1: OLS estimates of the relationship between adoption and commercialization



Note: The graph displays coefficients along with their corresponding 95% confidence intervals as error bars. The coefficients are estimated using OLS with $n=8604$ observation. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). Statistical tests are two-sided t-tests. Full models are reported in S2 & S3 with Robust standard errors in parentheses and P-values in square brackets. Additional controls include age and educational level of the household head, dependency ratio, whether the household head is male, household size, cooperative membership, training, access to public and private extension, access to credits both in cash and kind, distance to nearest urban and village market, crop rotation, mixed cropping, labour, market price, input costs, area of cultivation, off-farm income and soil type.

Estimating the relationship between adoption of improved groundnuts, production, production value and land productivity using the FE-OLS model (Figure S2), we obtain positive coefficients for all outcomes. When we consider adoption as a dummy, we observe production and productivity increases of about 540Kg and 285Kg/ha respectively. Considering the scale of adoption, we observe that adoption of improved climate-smart groundnut varieties increases groundnut production by 240Kg and land productivity by approximately 60Kg/ha. The magnitudes here are positive indicating that adoption both when considered as a dummy as well as extent increases yield, production, and production value. The smaller magnitudes here might be indicative of diminishing returns as early highlighted. The positive and significant estimates of the area under adoption variable aligns with the tenets of the non-separable agricultural household model where the production, consumption and ultimately commercialization decisions of households are non-separable. This suggests that households would only participate in markets to the extent that the household food production and consumption needs are met.

Figure S2: OLS estimates of the relationship between adoption and commercialization



Note: The graph displays coefficients along with their corresponding 95% confidence intervals as error bars. The coefficients are estimated using OLS with n=8604 observation. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** p<0.01, ** p<0.05, * p<0.1). Statistical tests are two-sided t-tests. Full models are reported in S4 & S5 with Robust standard errors in parentheses and P-values in square brackets. Additional controls include age and educational level of the household head, dependency ratio, whether the household head is male, household size, cooperative membership, training, access to public and private extension, access to credits both in cash and kind, distance to nearest urban and village market, crop rotation, mixed cropping, labour, market price, input costs, area of cultivation, off-farm income and soil type.

1.2 Descriptive statistics

Table S1: Descriptive statistics by year and adoption status

Characteristic	2017, N = 2868			2018, N = 2868			2019, N = 2868		
	Non-adopter, N = 1,809	Adopter, N = 1,059	p-value	Non-adopter, N = 1,770	Adopter, N = 1,098	p-value	Non-adopter, N = 1,670	Adopter, N = 1,198	p-value
Country			<0.001			<0.001			<0.001
Ghana	327 (18%)	171 (16%)		353 (20%)	145 (13%)		340 (20%)	158 (13%)	
Mali	697 (39%)	143 (14%)		693 (39%)	147 (13%)		642 (38%)	198 (17%)	
Nigeria	785 (43%)	745 (70%)		724 (41%)	806 (73%)		688 (41%)	842 (70%)	
Age of household head (years)	48 (13)	47 (11)	0.073	49 (13)	47 (11)	<0.001	50 (12)	49 (12)	0.14
Sex of household head (dummy, male=1)	1,681 (93%)	1,004 (95%)	0.047	1,629 (92%)	1,056 (96%)	<0.001	1,546 (93%)	1,139 (95%)	0.007
Education level (Number of years)	2.5 (3.8)	3.4 (4.4)	<0.001	2.4 (3.8)	3.6 (4.4)	<0.001	2.1 (3.3)	3.9 (4.8)	<0.001
Household size (number of persons)	12 (7)	10 (6)	<0.001	12 (7)	10 (6)	<0.001	13 (10)	10 (7)	<0.001
Dependency ratio	1.59 (1.10)	1.77 (1.38)	0.029	1.64 (1.15)	1.69 (1.30)	0.8	1.74 (1.32)	1.95 (1.63)	0.015
Farmers group membership (dummy)	757 (42%)	551 (52%)	<0.001	771 (44%)	537 (49%)	0.005	696 (42%)	518 (43%)	0.4
Training on agriculture (dummy)	591 (33%)	473 (45%)	<0.001	557 (31%)	507 (46%)	<0.001	530 (32%)	565 (47%)	<0.001
Training on groundnut farming(dummy)	1,020 (56%)	587 (55%)	0.6	1,001 (57%)	606 (55%)	0.5	629 (38%)	766 (64%)	<0.001
Public agricultural extension service (number of visits)	1.21 (1.66)	3.32 (3.30)	<0.001	1.40 (1.84)	2.94 (3.29)	<0.001	1.71 (1.90)	2.47 (2.12)	<0.001
Private agricultural extension service (number of visits)	0.58 (0.90)	1.54 (1.89)	<0.001	0.62 (0.94)	1.44 (1.88)	<0.001	1.11 (1.33)	1.38 (1.57)	<0.001
Cash credit for groundnut farming (dummy)	32 (1.8%)	24 (2.3%)	0.4	30 (1.7%)	26 (2.4%)	0.2	49 (2.9%)	76 (6.3%)	<0.001
Credit in kind for groundnut farming (dummy)	62 (3.4%)	129 (12%)	<0.001	54 (3.1%)	137 (12%)	<0.001	87 (5.2%)	150 (13%)	<0.001
Distance to the nearest urban market (km)	15 (18)	11 (11)	<0.001	15 (19)	11 (11)	<0.001	13 (14)	12 (14)	<0.001
Distance the nearest village market (km)	3.8 (5.3)	3.5 (3.7)	0.004	3.9 (5.4)	3.4 (3.6)	0.003	4.8 (5.0)	3.6 (4.5)	<0.001
Crop rotation (dummy)	889 (49%)	397 (37%)	<0.001	905 (51%)	381 (35%)	<0.001	921 (55%)	393 (33%)	<0.001
Mixed Crops (dummy)	657 (36%)	448 (42%)	0.001	681 (38%)	424 (39%)	>0.9	725 (43%)	542 (45%)	0.3
Labor force (man.day)	3.9 (5.1)	6.5 (7.4)	<0.001	4.4 (5.5)	5.6 (7.1)	<0.001	7 (9)	7 (6)	<0.001
Unit selling price (USD/kg)	0.53 (0.07)	0.71 (0.08)	<0.001	0.53 (0.07)	0.72 (0.08)	<0.001	0.53 (0.07)	0.71 (0.09)	<0.001
Seed cost (USD/ha)	8 (16)	27 (19)	<0.001	8 (17)	25 (20)	<0.001	20 (21)	23 (19)	<0.001
Fertilizer cost (USD/ha)	17 (29)	53 (39)	<0.001	18 (30)	49 (40)	<0.001	19 (28)	49 (39)	<0.001
Pesticide cost (USD/ha)	4 (8)	14 (14)	<0.001	4 (8)	13 (14)	<0.001	6 (13)	11 (11)	<0.001
Labor cost (USD/ha)	21 (33)	49 (41)	<0.001	24 (34)	43 (41)	<0.001	50 (49)	50 (41)	0.031
Groundnut area (ha)	1.44 (1.47)	1.81 (1.62)	<0.001	1.49 (1.46)	1.72 (1.64)	<0.001	1.60 (1.47)	1.72 (1.32)	<0.001
Off-farm income (dummy)	80 (4.4%)	190 (18%)	<0.001	85 (4.8%)	185 (17%)	<0.001	142 (8.5%)	199 (17%)	<0.001
Clay soil (dummy)	279 (15%)	164 (15%)	>0.9	271 (15%)	172 (16%)	0.8	282 (17%)	207 (17%)	0.8
Sandy-clay soil (dummy)	987 (55%)	595 (56%)	0.4	977 (55%)	605 (55%)	>0.9	740 (44%)	516 (43%)	0.5
Silty soil (dummy)	281 (16%)	162 (15%)	0.9	278 (16%)	165 (15%)	0.6	306 (18%)	200 (17%)	0.3

¹ n (%); Mean (SD)² Pearson's Chi-squared test; Wilcoxon rank sum test

Note: The table below presents a comparison between adopters and non-adopters over time. Two-sided t-tests were used for statistical testing, and the corresponding p-values are presented in the last column. The tests performed are Pearsons Chi-squared test for categorical variables and the Wilcoxon rank sum test for continuous variables.

1.3 Pooled OLS Regressions

Table S2: Full OLS estimates of the relationship between adoption and commercialization(Adoption)

variables	(1)	(2)	(3)
	Market participation	Quantity Sold	Sales value
Adoption dummy	0.021* (0.012) [0.071]	0.145* (0.079) [0.066]	0.132* (0.073) [0.069]
Age of household head (years)	-0.001** (0.000) [0.026]	-0.006** (0.002) [0.011]	-0.005*** (0.002) [0.010]
Sex of household head (dummy, male=1)	-0.012 (0.020) [0.554]	0.105 (0.129) [0.416]	0.112 (0.118) [0.341]
Education level (Number of years)	0.001 (0.001) [0.530]	-0.005 (0.006) [0.393]	-0.005 (0.005) [0.308]
Household size (number of persons)	0.000 (0.001) [0.642]	0.015*** (0.005) [0.001]	0.015*** (0.004) [0.001]
Farmers group membership (dummy)	0.022*** (0.004) [0.000]	0.132*** (0.029) [0.000]	0.120*** (0.027) [0.000]
Training on agriculture (dummy)	-0.057*** (0.011) [0.000]	-0.320*** (0.074) [0.000]	-0.282*** (0.068) [0.000]
Training on groundnut farming (dummy)	-0.021*** (0.004) [0.000]	-0.154*** (0.025) [0.000]	-0.143*** (0.023) [0.000]
Public agricultural extension service (number of visits)	0.001 (0.002) [0.644]	-0.017 (0.014) [0.222]	-0.018 (0.013) [0.168]
Private agricultural extension service (number of visits)	0.007** (0.003) [0.022]	0.034* (0.020) [0.092]	0.027 (0.019) [0.159]
Cash credit for groundnut farming (dummy)	0.011 (0.020) [0.591]	0.034 (0.140) [0.806]	0.026 (0.130) [0.842]
Credit in kind for groundnut farming (dummy)	-0.008 (0.012) [0.520]	0.039 (0.088) [0.654]	0.043 (0.082) [0.604]
Distance to the nearest urban market (km)	-0.002*** (0.000) [0.000]	-0.015*** (0.002) [0.000]	-0.014*** (0.002) [0.000]
Distance the nearest village market (km)	-0.004*** (0.001) [0.000]	-0.021*** (0.007) [0.004]	-0.019*** (0.007) [0.005]
Crop rotation (dummy)	0.010 (0.010) [0.313]	0.085 (0.063) [0.177]	0.078 (0.057) [0.173]
Mixed Crops (dummy)	0.003 (0.008) [0.661]	-0.095* (0.051) [0.064]	-0.097** (0.047) [0.038]
Labor force (man.day)	0.002*** (0.001) [0.000]	0.024*** (0.004) [0.000]	0.023*** (0.004) [0.000]
Unit selling price (USDkg)	0.068 (0.042) [0.109]	0.579** (0.286) [0.043]	2.001*** (0.264) [0.000]
Seed cost (USDha)	0.001*** (0.000) [0.000]	0.010*** (0.002) [0.000]	0.009*** (0.002) [0.000]
Fertilizer cost (USDha)	0.000 (0.000) [0.417]	0.001* (0.001) [0.052]	0.001* (0.001) [0.052]
Pesticide cost (USDha)	-0.000 (0.000)	0.003 (0.002)	0.003 (0.002)

Table S2: Full OLS estimates of the relationship between adoption and commercialization(Adoption)
(continued)

variables	Market participation	Quantity Sold	Sales value
	[0.160]	[0.212]	[0.129]
Labor cost (USDha)	0.000***	0.002***	0.002***
	(0.000)	(0.001)	(0.001)
	[0.000]	[0.002]	[0.002]
Groundnut area (ha)	0.019***	0.347***	0.335***
	(0.003)	(0.022)	(0.021)
	[0.000]	[0.000]	[0.000]
Off-farm income (dummy)	-0.033***	-0.151**	-0.135**
	(0.010)	(0.074)	(0.069)
	[0.002]	[0.040]	[0.049]
Dependency ratio	0.001	-0.002	-0.003
	(0.003)	(0.019)	(0.017)
	[0.820]	[0.894]	[0.869]
Clay soil (dummy)	-0.008	-0.097	-0.095
	(0.011)	(0.077)	(0.071)
	[0.463]	[0.212]	[0.182]
Sandy-clay soil (dummy)	0.007	0.035	0.031
	(0.009)	(0.061)	(0.056)
	[0.446]	[0.565]	[0.582]
Silty soil (dummy)	0.008	0.052	0.046
	(0.011)	(0.076)	(0.070)
	[0.471]	[0.494]	[0.516]
Observations	8,604	8,604	8,604
R-squared	0.274	0.421	0.451
F test	13.95	30.48	37.56

Note: The table presents the results of OLS regressions between adoption decision ('Adoption dummy') and market participation(1), quantity sold(2) and Sales value(3). with robust standard errors, where the standard errors are clustered. The statistical tests conducted are two-sided t-tests. P-values are denoted in square brackets. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). All regressions include a comprehensive set of district fixed effects to control for potential unobserved heterogeneity.

Table S3: Full OLS estimates of the relationship between adoption and commercialization (Area under Adoption)

variables	(1)	(2)	(3)
	Market participation	Quantity Sold	Sales value
Area under adoption (ha)	-0.006 (0.004) [0.130]	-0.021 (0.032) [0.514]	-0.015 (0.031) [0.615]
Age of household head (years)	-0.001** (0.000) [0.026]	-0.006** (0.002) [0.011]	-0.005*** (0.002) [0.010]
Sex of household head (dummy, male=1)	-0.011 (0.020) [0.580]	0.110 (0.129) [0.396]	0.116 (0.118) [0.325]
Education level (Number of years)	0.001 (0.001) [0.555]	-0.005 (0.006) [0.386]	-0.006 (0.005) [0.305]
Household size (number of persons)	0.000 (0.001) [0.710]	0.014*** (0.005) [0.002]	0.014*** (0.004) [0.001]
Farmers group membership (dummy)	0.022*** (0.004) [0.000]	0.132*** (0.029) [0.000]	0.120*** (0.027) [0.000]
Training on agriculture (dummy)	-0.056*** (0.011) [0.000]	-0.319*** (0.074) [0.000]	-0.282*** (0.068) [0.000]
Training on groundnut farming (dummy)	-0.021*** (0.004) [0.000]	-0.155*** (0.025) [0.000]	-0.144*** (0.023) [0.000]
Public agricultural extension service (number of visits)	0.001 (0.002) [0.523]	-0.015 (0.014) [0.290]	-0.016 (0.013) [0.222]
Private agricultural extension service (number of visits)	0.008*** (0.003) [0.007]	0.042** (0.020) [0.038]	0.033* (0.019) [0.075]
Cash credit for groundnut farming (dummy)	0.011 (0.020) [0.575]	0.038 (0.140) [0.784]	0.030 (0.131) [0.819]
Credit in kind for groundnut farming (dummy)	-0.006 (0.012) [0.655]	0.052 (0.087) [0.552]	0.053 (0.082) [0.515]
Distance to the nearest urban market (km)	-0.002*** (0.000) [0.000]	-0.015*** (0.002) [0.000]	-0.014*** (0.002) [0.000]
Distance the nearest village market (km)	-0.004*** (0.001) [0.000]	-0.021*** (0.007) [0.004]	-0.019*** (0.007) [0.005]
Crop rotation (dummy)	0.009 (0.010) [0.359]	0.080 (0.063) [0.201]	0.074 (0.058) [0.195]
Mixed Crops (dummy)	0.002 (0.008) [0.742]	-0.100* (0.051) [0.051]	-0.102** (0.047) [0.030]
Labor force (man.day)	0.002*** (0.001) [0.000]	0.023*** (0.004) [0.000]	0.022*** (0.004) [0.000]
Unit selling price (USDkg)	0.134*** (0.034) [0.000]	0.982*** (0.235) [0.000]	2.357*** (0.218) [0.000]
Seed cost (USDha)	0.001*** (0.000) [0.000]	0.010*** (0.002) [0.000]	0.009*** (0.002) [0.000]
Fertilizer cost (USDha)	0.000 (0.000) [0.292]	0.002** (0.001) [0.031]	0.002** (0.001) [0.032]
Pesticide cost (USDha)	-0.000 (0.000) [0.264]	0.004 (0.002) [0.139]	0.004* (0.002) [0.083]

Table S3: Full OLS estimates of the relationship between adoption and commercialization (Area under Adoption) (*continued*)

variables	Market participation	Quantity Sold	Sales value
Labor cost (USDha)	0.000*** (0.000) [0.000]	0.002*** (0.001) [0.002]	0.002*** (0.001) [0.002]
Groundnut area (ha)	0.022*** (0.003) [0.000]	0.355*** (0.022) [0.000]	0.342*** (0.021) [0.000]
Off-farm income (dummy)	-0.033*** (0.010) [0.002]	-0.150** (0.074) [0.041]	-0.134* (0.069) [0.051]
Dependency ratio	0.001 (0.003) [0.839]	-0.003 (0.019) [0.885]	-0.003 (0.017) [0.863]
Clay soil (dummy)	-0.009 (0.011) [0.408]	-0.101 (0.077) [0.189]	-0.099 (0.071) [0.163]
Sandy-clay soil (dummy)	0.006 (0.009) [0.487]	0.032 (0.060) [0.593]	0.028 (0.055) [0.607]
Silty soil (dummy)	0.008 (0.011) [0.468]	0.053 (0.076) [0.489]	0.046 (0.070) [0.510]
Observations	8,604	8,604	8,604
R-squared	0.273	0.421	0.451
F test	14.32	31.28	38.78

Note: The table presents the results of OLS regressions between area under adoption in ha ('Area under adoption') and market participation(1), quantity sold(2) and Sales value(3). Robust standard errors are in brackets. The statistical tests conducted are two-sided t-tests. P-values, denoted in square brackets. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** p<0.01, ** p<0.05, * p<0.1). All regressions include a comprehensive set of district fixed effects to control for potential unobserved heterogeneity.

Table S4: Full OLS estimates of the relationship between adoption, production yields and consumption(Adoption)

variables	(1)	(2)	(3)	(4)
	Production	Production value	Yield	Consumption
Adoption dummy	538.366*** (36.536) 0.000	359.340*** (24.099) [0.000]	283.336*** (15.075) [0.000]	48.891 (40.829) [0.231]
Age of household head (years)	0.226 (0.882) 0.798	0.246 (0.625) [0.694]	-0.023 (0.374) [0.952]	2.086** (1.048) [0.047]
Sex of household head (dummy, male=1)	-17.450 (31.798) 0.583	-20.938 (23.338) [0.370]	-24.355 (17.706) [0.169]	-23.960 (31.806) [0.451]
Education level (Number of years)	0.573 (2.929) 0.845	-0.462 (2.113) [0.827]	1.681 (1.329) [0.206]	11.339*** (3.409) [0.001]
Household size (number of persons)	-2.087 (1.918) 0.277	-3.346** (1.312) [0.011]	0.531 (0.633) [0.401]	-9.443*** (2.320) [0.000]
Farmers group membership (dummy)	27.503* (14.436) 0.057	23.696** (10.143) [0.020]	1.717 (5.305) [0.746]	32.920** (16.310) [0.044]
Training on agriculture (dummy)	20.058 (28.123) 0.476	10.166 (19.713) [0.606]	12.945 (11.464) [0.259]	17.410 (32.155) [0.588]
Training on groundnut farming (dummy)	-2.803 (9.558) 0.769	-3.008 (6.533) [0.645]	-2.129 (4.027) [0.597]	17.571 (10.709) [0.101]
Public agricultural extension service (number of visits)	-10.965 (7.583) 0.148	-9.267* (5.383) [0.085]	-7.113** (2.889) [0.014]	21.836** (8.703) [0.012]
Private agricultural extension service (number of visits)	-20.005** (9.408) 0.034	-13.667** (6.454) [0.034]	-3.053 (3.826) [0.425]	-12.012 (9.947) [0.227]
Cash credit for groundnut farming (dummy)	-116.583* (62.411) 0.062	-96.283** (42.370) [0.023]	-3.990 (27.589) [0.885]	-39.613 (68.001) [0.560]
Credit in kind for groundnut farming (dummy)	19.798 (52.308) 0.705	39.725 (37.817) [0.294]	-8.167 (19.779) [0.680]	-40.616 (54.772) [0.458]
Distance to the nearest urban market (km)	-0.254 (0.828) 0.759	-0.150 (0.553) [0.787]	0.039 (0.353) [0.912]	3.065*** (0.900) [0.001]
Distance the nearest village market (km)	-3.361* (1.840) 0.068	-2.097* (1.198) [0.080]	-1.617** (0.795) [0.042]	0.650 (2.005) [0.746]
Crop rotation (dummy)	-54.106* (27.676) 0.051	-50.565** (19.779) [0.011]	1.007 (11.600) [0.931]	3.006 (29.979) [0.920]
Mixed Crops (dummy)	40.551* (21.514) 0.059	32.475** (15.265) [0.033]	-1.605 (9.425) [0.865]	135.895*** (22.840) [0.000]
Labor force (man.day)	-4.390 (2.721) 0.107	-3.713** (1.808) [0.040]	-1.619** (0.788) [0.040]	-8.452*** (2.579) [0.001]
Unit selling price (USDkg)	36.726 (128.183) 0.774	1,208.590*** (90.647) [0.000]	93.809* (55.544) [0.091]	60.809 (141.705) [0.668]
Seed cost (USDha)	-0.542 (0.569) 0.341	-0.338 (0.402) [0.400]	-0.371 (0.257) [0.150]	-1.834*** (0.615) [0.003]
Fertilizer cost (USDha)	-1.346*** (0.440) 0.002	-1.273*** (0.322) [0.000]	-0.004 (0.199) [0.983]	-2.452*** (0.481) [0.000]
Pesticide cost (USDha)	2.260* (1.289) 0.080	2.177** (0.999) [0.029]	0.024 (0.531) [0.964]	-2.370** (1.139) [0.037]

Table S4: Full OLS estimates of the relationship between adoption, production yields and consumption(Adoption) (*continued*)

variables	Production	Production value	Yield	Consumption
Labor cost (USDha)	0.075 (0.265)	0.043 (0.191)	-0.082 (0.131)	-0.841*** (0.244)
	0.777 (20.072)	[0.821] (13.993)	[0.529] (3.300)	[0.001] (24.390)
Groundnut area (ha)	698.176***	436.072***	1.376 (3.300)	339.550*** (24.390)
	0.000 (39.174)	[0.000] (29.191)	[0.677] (18.076)	[0.000] (38.588)
Off-farm income (dummy)	-15.131 (39.174)	-9.056 (29.191)	-21.645 (18.076)	-70.211* (38.588)
	0.699 (7.625)	[0.756] (5.439)	[0.231] (3.538)	[0.069] (8.883)
Dependency ratio	-10.922 (7.625)	-9.494* (5.439)	-1.563 (3.538)	-3.289 (8.883)
	0.152 (29.406)	[0.081] (20.300)	[0.659] (13.795)	[0.711] (33.239)
Clay soil (dummy)	6.092 (29.406)	0.292 (20.300)	3.708 (13.795)	-32.831 (33.239)
	0.836 (25.243)	[0.989] (17.693)	[0.788] (11.221)	[0.323] (28.923)
Sandy-clay soil (dummy)	28.195 (25.243)	20.606 (17.693)	-1.381 (11.221)	-46.923 (28.923)
	0.264 (30.870)	[0.244] (21.598)	[0.902] (13.986)	[0.105] (35.069)
Silty soil (dummy)	20.218 (30.870)	14.880 (21.598)	12.882 (13.986)	-31.084 (35.069)
	0.513 (8,604)	[0.491] (8,604)	[0.357] (8,604)	[0.375] (8,604)
Observations	8,604	8,604	8,604	8,604
R-squared	0.616	0.594	0.181	0.248
F test	69.22	73.12	26.48	14.71

Note: The table presents the results of OLS regressions between area under adoption in ha ('Adoption dummy') and Production(1), production value(2), Yield(3) and Consumption(4). Robust standard errors are in brackets. The statistical tests conducted are two-sided t-tests. P-values are denoted in square brackets. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** p<0.01, ** p<0.05, * p<0.1). All regressions include a comprehensive set of district fixed effects to control for potential unobserved heterogeneity.

Table S5: OLS estimates of the relationship between adoption, production , yields and consumption(Area under Adoption)

variables	(1)	(2)	(3)	(4)
	Production	Production value	Yield	Consumption
Area under adoption (ha)	238.550*** (34.459) [0.000]	216.814*** (24.253) [0.000]	57.226*** (6.403) [0.000]	20.643 (38.366) [0.591]
Age of household head (years)	0.377 (0.875) [0.667]	0.374 (0.611) [0.541]	0.025 (0.380) [0.948]	2.099** (1.045) [0.045]
Sex of household head (dummy, male=1)	-17.307 (29.621) [0.559]	-23.796 (20.843) [0.254]	-20.776 (17.751) [0.242]	-23.894 (31.850) [0.453]
Education level (Number of years)	2.728 (2.916) [0.350]	1.428 (2.076) [0.492]	2.280* (1.354) [0.092]	11.527*** (3.402) [0.001]
Household size (number of persons)	0.104 (1.852) [0.955]	-1.326 (1.243) [0.286]	1.023 (0.641) [0.110]	-9.254*** (2.271) [0.000]
Farmers group membership (dummy)	23.024 (14.530) [0.113]	19.604* (10.143) [0.053]	0.668 (5.411) [0.902]	32.533** (16.393) [0.047]
Training on agriculture (dummy)	19.017 (28.199) [0.500]	8.794 (19.422) [0.651]	13.199 (11.653) [0.257]	17.327 (32.241) [0.591]
Training on groundnut farming (dummy)	-6.485 (9.625) [0.500]	-5.155 (6.519) [0.429]	-4.435 (4.090) [0.278]	17.231 (10.707) [0.108]
Public agricultural extension service (number of visits)	-5.811 (7.401) [0.432]	-6.431 (5.123) [0.209]	-3.685 (2.924) [0.208]	22.315** (8.721) [0.011]
Private agricultural extension service (number of visits)	-10.123 (9.116) [0.267]	-10.434* (6.215) [0.093]	6.138 (3.799) [0.106]	-11.055 (9.781) [0.258]
Cash credit for groundnut farming (dummy)	-87.350 (63.173) [0.167]	-74.251* (42.902) [0.084]	8.406 (28.328) [0.767]	-37.003 (67.864) [0.586]
Credit in kind for groundnut farming (dummy)	-8.897 (50.662) [0.861]	6.830 (35.263) [0.846]	-6.967 (20.115) [0.729]	-42.978 (53.109) [0.418]
Distance to the nearest urban market (km)	-0.735 (0.826) [0.374]	-0.486 (0.541) [0.369]	-0.196 (0.363) [0.590]	3.022*** (0.897) [0.001]
Distance the nearest village market (km)	-3.326* (1.806) [0.066]	-2.099* (1.139) [0.066]	-1.568** (0.794) [0.048]	0.653 (2.005) [0.745]
Crop rotation (dummy)	-42.921 (26.863) [0.110]	-38.056** (18.900) [0.044]	0.911 (11.740) [0.938]	3.933 (29.791) [0.895]
Mixed Crops (dummy)	34.291 (21.331) [0.108]	30.585** (14.868) [0.040]	-7.613 (9.562) [0.426]	135.286*** (22.649) [0.000]
Labor force (man.day)	-4.084 (2.927) [0.163]	-3.021 (1.994) [0.130]	-2.037** (0.808) [0.012]	-8.433*** (2.576) [0.001]
Unit selling price (USDkg)	512.083*** (133.797) [0.000]	1,339.478*** (96.971) [0.000]	565.109*** (49.594) [0.000]	107.283 (147.220) [0.466]
Seed cost (USDha)	0.128 (0.546) [0.815]	0.059 (0.370) [0.873]	0.042 (0.259) [0.872]	-1.772*** (0.607) [0.004]
Fertilizer cost (USDha)	-0.846** (0.431) [0.050]	-0.963*** (0.312) [0.002]	0.288 (0.201) [0.153]	-2.406*** (0.473) [0.000]
Pesticide cost (USDha)	2.188* (1.325) [0.099]	1.732* (1.024) [0.091]	0.456 (0.540) [0.398]	-2.369** (1.163) [0.042]

Table S5: OLS estimates of the relationship between adoption, production , yields and consumption(Area under Adoption) (*continued*)

variables	Production	Production value	Yield	Consumption
Labor cost (USDha)	0.010 (0.257) [0.968]	-0.006 (0.179) [0.974]	-0.110 (0.133) [0.410]	-0.846*** (0.245) [0.001]
Groundnut area (ha)	634.557*** (20.141) [0.000]	376.027*** (13.418) [0.000]	-11.249*** (3.596) [0.002]	334.084*** (25.656) [0.000]
Off-farm income (dummy)	-3.625 (38.674) [0.925]	0.179 (28.513) [0.995]	-17.434 (18.365) [0.342]	-69.193* (38.584) [0.073]
Dependency ratio	-7.874 (7.614) [0.301]	-6.761 (5.353) [0.207]	-0.786 (3.592) [0.827]	-3.025 (8.851) [0.733]
Clay soil (dummy)	28.503 (29.032) [0.326]	22.644 (19.653) [0.249]	6.733 (14.049) [0.632]	-30.927 (32.761) [0.345]
Sandy-clay soil (dummy)	45.222* (24.917) [0.070]	36.851** (17.077) [0.031]	1.791 (11.460) [0.876]	-45.463 (28.606) [0.112]
Silty soil (dummy)	26.747 (30.838) [0.386]	20.009 (21.038) [0.342]	15.403 (14.258) [0.280]	-30.505 (34.996) [0.383]
Observations	8,604	8,604	8,604	8,604
R-squared	0.622	0.613	0.156	0.248
F test	64.51	71.32	16.55	14.65

Note: The table presents the results of OLS regressions between area under adoption in ha ('Area under adoption') and Production(1), production value(2) , Yield(3) and Consumption(4). Robust standard errors are in brackets. The statistical tests conducted are two-sided t-tests. P-values are denoted in square brackets. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** p<0.01, ** p<0.05, * p<0.1). All regressions include a comprehensive set of district fixed effects to control for potential unobserved heterogeneity.

1.4 Panel Regression

Table S6: Full 2SLS estimates of the relationship between adoption , commercialization, yield and consumption(Area under Adoption)

variables	(1) Production	(2) Production value	(3) Yield	(4) Consumption
Area under adoption (ha)	238.550*** (34.459) [0.000]	216.814*** (24.253) [0.000]	57.226*** (6.403) [0.000]	20.643 (38.366) [0.591]
Age of household head (years)	0.377 (0.875) [0.667]	0.374 (0.611) [0.541]	0.025 (0.380) [0.948]	2.099** (1.045) [0.045]
Sex of household head (dummy, male=1)	-17.307 (29.621) [0.559]	-23.796 (20.843) [0.254]	-20.776 (17.751) [0.242]	-23.894 (31.850) [0.453]
Education level (Number of years)	2.728 (2.916) [0.350]	1.428 (2.076) [0.492]	2.280* (1.354) [0.092]	11.527*** (3.402) [0.001]
Household size (number of persons)	0.104 (1.852) [0.955]	-1.326 (1.243) [0.286]	1.023 (0.641) [0.110]	-9.254*** (2.271) [0.000]
Farmers group membership (dummy)	23.024 (14.530) [0.113]	19.604* (10.143) [0.053]	0.668 (5.411) [0.902]	32.533** (16.393) [0.047]
Training on agriculture (dummy)	19.017 (28.199) [0.500]	8.794 (19.422) [0.651]	13.199 (11.653) [0.257]	17.327 (32.241) [0.591]
Training on groundnut farming (dummy)	-6.485 (9.625) [0.500]	-5.155 (6.519) [0.429]	-4.435 (4.090) [0.278]	17.231 (10.707) [0.108]
Public agricultural extension service (number of visits)	-5.811 (7.401) [0.432]	-6.431 (5.123) [0.209]	-3.685 (2.924) [0.208]	22.315** (8.721) [0.011]
Private agricultural extension service (number of visits)	-10.123 (9.116) [0.267]	-10.434* (6.215) [0.093]	6.138 (3.799) [0.106]	-11.055 (9.781) [0.258]
Cash credit for groundnut farming (dummy)	-87.350 (63.173) [0.167]	-74.251* (42.902) [0.084]	8.406 (28.328) [0.767]	-37.003 (67.864) [0.586]
Credit in kind for groundnut farming (dummy)	-8.897 (50.662) [0.861]	6.830 (35.263) [0.846]	-6.967 (20.115) [0.729]	-42.978 (53.109) [0.418]
Distance to the nearest urban market (km)	-0.735 (0.826) [0.374]	-0.486 (0.541) [0.369]	-0.196 (0.363) [0.590]	3.022*** (0.897) [0.001]
Distance the nearest village market (km)	-3.326* (1.806) [0.066]	-2.099* (1.139) [0.066]	-1.568** (0.794) [0.048]	0.653 (2.005) [0.745]
Crop rotation (dummy)	-42.921 (26.863) [0.110]	-38.056** (18.900) [0.044]	0.911 (11.740) [0.938]	3.933 (29.791) [0.895]
Mixed Crops (dummy)	34.291 (21.331) [0.108]	30.585** (14.868) [0.040]	-7.613 (9.562) [0.426]	135.286*** (22.649) [0.000]
Labor force (man.day)	-4.084 (2.927) [0.163]	-3.021 (1.994) [0.130]	-2.037** (0.808) [0.012]	-8.433*** (2.576) [0.001]
Unit selling price (USDkg)	512.083*** (133.797) [0.000]	1,339.478*** (96.971) [0.000]	565.109*** (49.594) [0.000]	107.283 (147.220) [0.466]
Seed cost (USDha)	0.128 (0.546) [0.815]	0.059 (0.370) [0.873]	0.042 (0.259) [0.872]	-1.772*** (0.607) [0.004]
Fertilizer cost (USDha)	-0.846** (0.431) [0.050]	-0.963*** (0.312) [0.002]	0.288 (0.201) [0.153]	-2.406*** (0.473) [0.000]
Pesticide cost (USDha)	2.188* (0.431) [0.050]	1.732* (0.312) [0.002]	0.456 (0.201) [0.153]	-2.369** (0.473) [0.000]

Table S6: Full 2SLS estimates of the relationship between adoption , commercialization, yield and consumption(Area under Adoption) (*continued*)

variables	Production	Production value	Yield	Consumption
	(1.325)	(1.024)	(0.540)	(1.163)
	[0.099]	[0.091]	[0.398]	[0.042]
Labor cost (USDha)	0.010	-0.006	-0.110	-0.846***
	(0.257)	(0.179)	(0.133)	(0.245)
	[0.968]	[0.974]	[0.410]	[0.001]
Groundnut area (ha)	634.557***	376.027***	-11.249***	334.084***
	(20.141)	(13.418)	(3.596)	(25.656)
	[0.000]	[0.000]	[0.002]	[0.000]
Off-farm income (dummy)	-3.625	0.179	-17.434	-69.193*
	(38.674)	(28.513)	(18.365)	(38.584)
	[0.925]	[0.995]	[0.342]	[0.073]
Dependency ratio	-7.874	-6.761	-0.786	-3.025
	(7.614)	(5.353)	(3.592)	(8.851)
	[0.301]	[0.207]	[0.827]	[0.733]
Clay soil (dummy)	28.503	22.644	6.733	-30.927
	(29.032)	(19.653)	(14.049)	(32.761)
	[0.326]	[0.249]	[0.632]	[0.345]
Sandy-clay soil (dummy)	45.222*	36.851**	1.791	-45.463
	(24.917)	(17.077)	(11.460)	(28.606)
	[0.070]	[0.031]	[0.876]	[0.112]
Silty soil (dummy)	26.747	20.009	15.403	-30.505
	(30.838)	(21.038)	(14.258)	(34.996)
	[0.386]	[0.342]	[0.280]	[0.383]
Observations	8,604	8,604	8,604	8,604
R-squared	0.622	0.613	0.156	0.248
F test	64.51	71.32	16.55	14.65

Note: The table presents the results of 2SLS regressions between area under adoption in ha ('Area under adoption') and Production (1), production value (2), Yield (3) and Consumption (4). Robust standard errors are in brackets. The statistical tests conducted are two-sided t-tests. P-values are denoted in square brackets. The presence of an asterisk (*) above a coefficient indicates that the coefficient is statistically different from zero at a predetermined level of significance (*** p<0.01, ** p<0.05, * p<0.1). All regressions include a comprehensive set of district fixed effects to control for potential unobserved heterogeneity.

Table S7: Full 2SLS estimates of the relationship between adoption and commercialization

variables	(1)		(2)		(3)	
	Market participation		Quantity sold		Sales value	
	FE	RE	FE	RE	FE	RE
Adoption dummy	0.064*** (0.020) [0.001]	0.053*** (0.018) [0.002]	0.594*** (0.134) [0.000]	0.544*** (0.120) [0.000]	0.570*** (0.124) [0.000]	0.526*** (0.110) [0.000]
Age of household head (years)	0.002 (0.003) [0.545]	-0.001* (0.000) [0.066]	-0.011 (0.024) [0.649]	-0.006** (0.003) [0.043]	-0.013 (0.022) [0.554]	-0.005** (0.003) [0.040]
Sex of household head (dummy, male=1)		-0.011 (0.020) [0.572]		0.115 (0.137) [0.401]		0.121 (0.126) [0.335]
Education level (Number of years)		0.001 (0.001) [0.676]		-0.005 (0.009) [0.563]		-0.006 (0.008) [0.487]
Household size (number of persons)	0.002*** (0.001) [0.004]	0.001* (0.001) [0.082]	0.027*** (0.005) [0.000]	0.020*** (0.004) [0.000]	0.026*** (0.004) [0.000]	0.019*** (0.004) [0.000]
Farmers group membership (dummy)	0.022*** (0.005) [0.000]	0.023*** (0.004) [0.000]	0.124*** (0.035) [0.000]	0.132*** (0.028) [0.000]	0.111*** (0.032) [0.000]	0.119*** (0.026) [0.000]
Training on agriculture (dummy)	-0.043*** (0.011) [0.000]	-0.052*** (0.009) [0.000]	-0.314*** (0.078) [0.000]	-0.318*** (0.065) [0.000]	-0.287*** (0.072) [0.000]	-0.285*** (0.059) [0.000]
Training on groundnut farming (dummy)	-0.025*** (0.003) [0.000]	-0.023*** (0.003) [0.000]	-0.176*** (0.023) [0.000]	-0.166*** (0.021) [0.000]	-0.162*** (0.021) [0.000]	-0.153*** (0.019) [0.000]
Public agricultural extension service (number of visits)	0.002 (0.002) [0.354]	0.002 (0.002) [0.355]	-0.024 (0.016) [0.149]	-0.020 (0.014) [0.162]	-0.025 (0.015) [0.104]	-0.021 (0.013) [0.106]
Private agricultural extension service (number of visits)	0.003 (0.003) [0.318]	0.004 (0.003) [0.153]	0.045* (0.024) [0.059]	0.026 (0.020) [0.199]	0.042* (0.022) [0.055]	0.021 (0.019) [0.266]
Cash credit for groundnut farming (dummy)	-0.010 (0.023) [0.663]	0.000 (0.020) [0.995]	-0.186 (0.156) [0.234]	-0.076 (0.136) [0.573]	-0.193 (0.144) [0.180]	-0.083 (0.125) [0.505]
Credit in kind for groundnut farming (dummy)	-0.044*** (0.016) [0.007]	-0.026* (0.014) [0.060]	-0.046 (0.109) [0.674]	-0.019 (0.094) [0.835]	-0.022 (0.100) [0.827]	-0.006 (0.086) [0.946]
Distance to the nearest urban market (km)	-0.000 (0.000) [0.154]	-0.001*** (0.000) [0.000]	-0.003 (0.002) [0.101]	-0.009*** (0.002) [0.000]	-0.003 (0.002) [0.100]	-0.008*** (0.002) [0.000]
Distance the nearest village market (km)	-0.003*** (0.001) [0.003]	-0.003*** (0.001) [0.000]	-0.013** (0.006) [0.046]	-0.017*** (0.005) [0.002]	-0.011* (0.006) [0.056]	-0.015*** (0.005) [0.003]
Crop rotation (dummy)	-0.023** (0.011) [0.030]	-0.005 (0.009) [0.544]	-0.144** (0.072) [0.046]	-0.016 (0.061) [0.790]	-0.135** (0.066) [0.043]	-0.014 (0.056) [0.798]
Mixed Crops (dummy)	0.004 (0.009) [0.678]	0.003 (0.007) [0.718]	-0.063 (0.061) [0.298]	-0.079 (0.050) [0.119]	-0.066 (0.056) [0.238]	-0.080* (0.046) [0.082]
Labor force (man.day)	0.002*** (0.001) [0.003]	0.002*** (0.001) [0.000]	0.027*** (0.005) [0.000]	0.026*** (0.004) [0.000]	0.026*** (0.004) [0.000]	0.025*** (0.004) [0.000]
Unit selling price (USDkg)	0.009 (0.054) [0.873]	0.012 (0.050) [0.803]	-0.134 (0.365) [0.714]	-0.180 (0.338) [0.596]	1.301*** (0.336) [0.000]	1.249*** (0.311) [0.000]
Seed cost (USDha)	0.002*** (0.000) [0.000]	0.002*** (0.000) [0.000]	0.011*** (0.002) [0.000]	0.010*** (0.001) [0.000]	0.010*** (0.001) [0.000]	0.009*** (0.001) [0.000]
Fertilizer cost (USDha)	0.000 (0.000) [0.726]	0.000 (0.000) [0.590]	0.001 (0.001) [0.210]	0.001 (0.001) [0.145]	0.001 (0.001) [0.223]	0.001 (0.001) [0.152]
Pesticide cost (USDha)	-0.001*** (0.000) [0.004]	-0.001** (0.000) [0.015]	-0.005 (0.003) [0.107]	-0.002 (0.003) [0.514]	-0.004 (0.003) [0.136]	-0.001 (0.002) [0.641]

Table S7: Full 2SLS estimates of the relationship between adoption and commercialization (*continued*)

variables	FE	RE	FE	RE	FE	RE
Labor cost (USDha)	0.000*** (0.000) [0.001]	0.000*** (0.000) [0.000]	0.002*** (0.001) [0.004]	0.002*** (0.001) [0.001]	0.002*** (0.001) [0.004]	0.002*** (0.001) [0.001]
Groundnut area (ha)	0.003 (0.003) [0.410]	0.013*** (0.003) [0.000]	0.198*** (0.023) [0.000]	0.282*** (0.019) [0.000]	0.195*** (0.021) [0.000]	0.274*** (0.017) [0.000]
Off-farm income (dummy)	-0.020 (0.014) [0.174]	-0.027** (0.012) [0.026]	-0.035 (0.098) [0.722]	-0.101 (0.083) [0.219]	-0.024 (0.090) [0.793]	-0.088 (0.076) [0.247]
Dependency ratio	0.002 (0.003) [0.608]	0.001 (0.003) [0.722]	0.013 (0.022) [0.557]	0.003 (0.018) [0.854]	0.012 (0.020) [0.551]	0.003 (0.016) [0.867]
Clay soil (dummy)	-0.016 (0.013) [0.200]	-0.012 (0.011) [0.272]	-0.161* (0.087) [0.064]	-0.120 (0.073) [0.103]	-0.155* (0.080) [0.053]	-0.116* (0.068) [0.086]
Sandy-clay soil (dummy)	0.006 (0.010) [0.525]	0.006 (0.009) [0.485]	0.052 (0.068) [0.448]	0.036 (0.059) [0.541]	0.048 (0.063) [0.449]	0.032 (0.054) [0.552]
Silty soil (dummy)	-0.004 (0.013) [0.732]	0.002 (0.011) [0.864]	-0.032 (0.087) [0.708]	0.010 (0.073) [0.893]	-0.033 (0.080) [0.676]	0.007 (0.067) [0.922]
Constant	0.455** (0.191) [0.017]	0.987*** (0.053) [0.000]	4.382*** (1.295) [0.001]	7.194*** (0.361) [0.000]	3.379*** (1.191) [0.005]	5.831*** (0.331) [0.000]
Observations	8,604	8,604	8,604	8,604	8,604	8,604
Number of id	2,868	2,868	2,868	2,868	2,868	2,868
District FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Standard errors in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Note: The table provides the results of 2SLS regressions examining the relationship between adoption decision ('Adoption dummy') and various factors related to Market participation (1), Quantity sold (2), and Sales value (3). The regressions were estimated using both Random Effect (RE) and Fixed Effect (FE) specifications, with robust standard errors shown in brackets. The statistical tests conducted were two-sided t-tests, and p-values are denoted in square brackets. Coefficients marked with an asterisk (*) indicate statistical significance at predetermined levels of significance (*** p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.

Table S8: Full 2SLS estimates of the relationship between adoption (Area), production and yields

variables	(1)		(2)		(3)	
	Market participation		Quantity sold		Sales value	
	FE	RE	FE	RE	FE	RE
Area under adoption (ha)	0.044*** (0.014) [0.001]	0.036*** (0.013) [0.005]	0.414*** (0.094) [0.000]	0.370*** (0.086) [0.000]	0.397*** (0.087) [0.000]	0.358*** (0.079) [0.000]
Age of household head (years)	0.002 (0.004) [0.639]	0.001 (0.004) [0.792]	-0.015 (0.024) [0.529]	-0.021 (0.024) [0.390]	-0.017 (0.022) [0.440]	-0.022 (0.022) [0.316]
Sex of household head (dummy, male=1)		-0.015 (0.020) [0.465]		0.065 (0.140) [0.643]		0.073 (0.128) [0.566]
Education level (Number of years)		0.001 (0.001) [0.454]		-0.002 (0.009) [0.865]		-0.002 (0.008) [0.800]
Household size (number of persons)	0.002*** (0.001) [0.001]	0.002*** (0.001) [0.002]	0.030*** (0.005) [0.000]	0.030*** (0.005) [0.000]	0.029*** (0.005) [0.000]	0.029*** (0.005) [0.000]
Farmers group membership (dummy)	0.022*** (0.005) [0.000]	0.022*** (0.005) [0.000]	0.119*** (0.035) [0.001]	0.120*** (0.035) [0.001]	0.106*** (0.032) [0.001]	0.107*** (0.032) [0.001]
Training on agriculture (dummy)	-0.043*** (0.012) [0.000]	-0.041*** (0.012) [0.000]	-0.312*** (0.078) [0.000]	-0.296*** (0.079) [0.000]	-0.285*** (0.072) [0.000]	-0.270*** (0.072) [0.000]
Training on groundnut farming (dummy)	-0.025*** (0.003) [0.000]	-0.025*** (0.003) [0.000]	-0.178*** (0.023) [0.000]	-0.181*** (0.023) [0.000]	-0.165*** (0.021) [0.000]	-0.167*** (0.021) [0.000]
Public agricultural extension service (number of visits)	0.002 (0.002) [0.387]	0.003 (0.002) [0.206]	-0.025 (0.017) [0.133]	-0.019 (0.017) [0.247]	-0.026* (0.015) [0.091]	-0.021 (0.015) [0.176]
Private agricultural extension service (number of visits)	0.004 (0.003) [0.298]	0.003 (0.003) [0.320]	0.046* (0.024) [0.053]	0.043* (0.024) [0.066]	0.043** (0.022) [0.049]	0.041* (0.022) [0.061]
Cash credit for groundnut farming (dummy)	-0.006 (0.023) [0.811]	-0.005 (0.023) [0.845]	-0.144 (0.157) [0.359]	-0.139 (0.157) [0.376]	-0.152 (0.145) [0.293]	-0.148 (0.145) [0.307]
Credit in kind for groundnut farming (dummy)	-0.048*** (0.016) [0.003]	-0.047*** (0.016) [0.004]	-0.090 (0.111) [0.418]	-0.080 (0.111) [0.470]	-0.064 (0.102) [0.529]	-0.056 (0.103) [0.587]
Distance to the nearest urban market (km)	-0.000 (0.000) [0.182]	-0.001*** (0.000) [0.000]	-0.003 (0.002) [0.131]	-0.009*** (0.002) [0.000]	-0.003 (0.002) [0.131]	-0.008*** (0.002) [0.000]
Distance the nearest village market (km)	-0.003*** (0.001) [0.004]	-0.003*** (0.001) [0.000]	-0.012* (0.006) [0.065]	-0.016*** (0.005) [0.002]	-0.010* (0.006) [0.078]	-0.015*** (0.005) [0.003]
Crop rotation (dummy)	-0.020* (0.001) [0.000]	-0.019* (0.001) [0.000]	-0.114 (0.006) [0.065]	-0.101 (0.005) [0.002]	-0.106 (0.006) [0.078]	-0.093 (0.005) [0.003]

Table S8: Full 2SLS estimates of the relationship between adoption (Area), production and yields (*continued*)

variables	FE	RE	FE	RE	FE	RE
	(0.011)	(0.011)	(0.074)	(0.074)	(0.068)	(0.068)
	[0.068]	[0.080]	[0.123]	[0.171]	[0.122]	[0.170]
Mixed Crops (dummy)	0.005	0.002	-0.049	-0.068	-0.052	-0.069
	(0.009)	(0.009)	(0.061)	(0.061)	(0.056)	(0.056)
	[0.563]	[0.837]	[0.422]	[0.268]	[0.352]	[0.219]
Labor force (man.day)	0.002***	0.002***	0.028***	0.028***	0.027***	0.027***
	(0.001)	(0.001)	(0.005)	(0.005)	(0.004)	(0.004)
	[0.002]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]
Unit selling price (USDkg)	0.017	0.037	-0.055	0.045	1.376***	1.469***
	(0.052)	(0.050)	(0.355)	(0.337)	(0.326)	(0.310)
	[0.744]	[0.449]	[0.876]	[0.895]	[0.000]	[0.000]
Seed cost (USDha)	0.002***	0.002***	0.011***	0.011***	0.010***	0.010***
	(0.000)	(0.000)	(0.002)	(0.002)	(0.001)	(0.001)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Fertilizer cost (USDha)	0.000	0.000	0.002*	0.002*	0.002*	0.002*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	[0.437]	[0.365]	[0.067]	[0.061]	[0.068]	[0.063]
Pesticide cost (USDha)	-0.001***	-0.001***	-0.006**	-0.007**	-0.006**	-0.006**
	(0.000)	(0.000)	(0.003)	(0.003)	(0.003)	(0.003)
	[0.002]	[0.001]	[0.038]	[0.018]	[0.047]	[0.023]
Labor cost (USDha)	0.000***	0.000***	0.002***	0.003***	0.002***	0.002***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
	[0.000]	[0.000]	[0.002]	[0.001]	[0.002]	[0.001]
Groundnut area (ha)	-0.009*	-0.006	0.085**	0.103***	0.087***	0.103***
	(0.005)	(0.005)	(0.035)	(0.034)	(0.033)	(0.031)
	[0.073]	[0.221]	[0.016]	[0.002]	[0.008]	[0.001]
Off-farm income (dummy)	-0.019	-0.021	-0.031	-0.043	-0.020	-0.031
	(0.015)	(0.015)	(0.099)	(0.099)	(0.091)	(0.091)
	[0.186]	[0.143]	[0.755]	[0.661]	[0.827]	[0.730]
Dependency ratio	0.002	0.002	0.017	0.020	0.016	0.019
	(0.003)	(0.003)	(0.022)	(0.022)	(0.020)	(0.020)
	[0.509]	[0.457]	[0.430]	[0.365]	[0.420]	[0.355]
Clay soil (dummy)	-0.015	-0.010	-0.143	-0.102	-0.138*	-0.098
	(0.013)	(0.011)	(0.088)	(0.074)	(0.081)	(0.068)
	[0.260]	[0.345]	[0.103]	[0.171]	[0.088]	[0.151]
Sandy-clay soil (dummy)	0.008	0.008	0.068	0.060	0.063	0.056
	(0.010)	(0.009)	(0.069)	(0.059)	(0.064)	(0.055)
	[0.422]	[0.354]	[0.324]	[0.310]	[0.320]	[0.305]
Silty soil (dummy)	-0.005	0.002	-0.034	0.012	-0.035	0.009
	(0.013)	(0.011)	(0.087)	(0.074)	(0.080)	(0.068)
	[0.723]	[0.882]	[0.696]	[0.872]	[0.665]	[0.894]
Constant	0.817***	1.032***	7.214***	7.482***	5.972***	6.123***
	(0.183)	(0.078)	(1.248)	(0.534)	(1.148)	(0.490)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Observations	8,604	8,604	8,604	8,604	8,604	8,604
Number of id	2,868	2,868	2,868	2,868	2,868	2,868

Table S8: Full 2SLS estimates of the relationship between adoption (Area), production and yields (*continued*)

variables	FE	RE	FE	RE	FE	RE
District FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Standard errors in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Note: The table provides the results of 2SLS regressions examining the relationship between area of adoption in ha ('Area under adoption') and various factors related to Market participation (1), Quantity sold (2), and Sales value (3). The regressions were estimated using both Random Effect (RE) and Fixed Effect (FE) specifications, with robust standard errors shown in brackets. The statistical tests conducted were two-sided t-tests, and p-values are denoted in square brackets. Coefficients marked with an asterisk (*) indicate statistical significance at predetermined levels of significance (*** p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.

Table S9: Full 2SLS estimates of the relationship between adoption, production , consumption and yields

variables	(1)			(2)		
	FE			RE		FE
	Yield	Production value	Consumption	Yield	Production value	Consumption
Area under adoption				247.985*** (18.310) [0.000]	338.019*** (26.640) [0.000]	148.786*** (51.027) 0.004
Adoption dummy	344.491*** (31.119) [0.000]	476.159*** (48.846) [0.000]	213.525*** (73.166) [0.004]			
Age of household head	-1.764 (5.487) [0.748]	-0.649 (8.612) [0.940]	24.046* (12.900) [0.062]	0.103 (0.460) [0.823]	0.419 (0.659) [0.525]	22.497* (12.954) 0.082
Sex of household head				-31.423 (22.602) [0.164]	-31.003 (32.367) [0.338]	
Education level				3.787*** (1.439) [0.008]	2.378 (2.061) [0.249]	
Household size	1.631 (1.119) [0.145]	-1.605 (1.756) [0.361]	-9.816*** (2.630) [0.000]	2.966*** (0.829) [0.000]	-0.090 (1.202) [0.940]	-8.588*** (2.674) 0.001
Farmers group membership	-4.339 (7.999) [0.587]	17.512 (12.556) [0.163]	36.037* (18.808) [0.055]	-3.610 (5.849) [0.537]	17.237** (8.476) [0.042]	34.260* (18.857) 0.069
Training on agriculture	27.801 (18.021) [0.123]	12.633 (28.286) [0.655]	63.381 (42.370) [0.135]	12.921 (13.267) [0.330]	7.400 (19.225) [0.700]	64.148 (42.400) 0.130
Training on groundnut farming	1.255 (5.354) [0.815]	6.025 (8.404) [0.473]	48.752*** (12.588) [0.000]	-2.858 (4.512) [0.526]	-3.802 (6.566) [0.563]	47.725*** (12.579) 0.000
Public agricultural extension service	-2.771 (3.800) [0.466]	-4.887 (5.964) [0.413]	31.133*** (8.934) [0.000]	-5.376* (2.956) [0.069]	-7.300* (4.290) [0.089]	30.692*** (8.956) 0.001
Private agricultural extension service	-4.178 (5.470) [0.445]	-11.633 (8.586) [0.175]	-25.896** (12.862) [0.044]	-4.700 (4.229) [0.266]	-17.314*** (6.137) [0.005]	-25.374** (12.839) 0.048
Cash credit for groundnut farming	-34.959 (36.180) [0.334]	-100.824* (56.789) [0.076]	68.337 (85.065) [0.422]	15.063 (28.780) [0.601]	-69.078* (41.794) [0.098]	83.395 (85.023) 0.327
Credit in kind for groundnut farming	-11.792 (25.272) [0.641]	32.827 (39.667) [0.408]	-16.957 (59.418) [0.775]	-50.645** (20.016) [0.011]	-20.044 (29.052) [0.490]	-32.844 (60.113) 0.585
Distance to the nearest urban market	0.277 (0.458) [0.546]	-0.795 (0.720) [0.270]	1.917* (1.078) [0.075]	-0.152 (0.410) [0.711]	-0.517 (0.598) [0.388]	1.997* (1.081) 0.065
Distance the nearest village market	-0.900	-3.282	-1.691	-1.495	-2.226	-1.387

Table S9: Full 2SLS estimates of the relationship between adoption, production , consumption and yields (*continued*)

variables	Yield	Production value	Consumption	Yield	Production value	Consumption
	(1.483)	(2.328)	(3.487)	(1.107)	(1.605)	(3.488)
	[0.544]	[0.159]	[0.628]	[0.177]	[0.166]	0.691
Crop rotation	0.657	-57.944**	95.764**	17.593	-27.657	106.643***
	(16.734)	(26.266)	(39.344)	(12.801)	(18.561)	(40.029)
	[0.969]	[0.027]	[0.015]	[0.169]	[0.136]	0.008
Mixed Crops	-3.981	-0.791	121.324***	0.592	33.105**	126.313***
	(14.033)	(22.026)	(32.993)	(10.421)	(15.107)	(33.096)
	[0.777]	[0.971]	[0.000]	[0.955]	[0.028]	0.000
Labor force	-1.834*	-3.726**	-6.969***	-0.455	-2.104*	-6.407**
	(1.086)	(1.705)	(2.553)	(0.860)	(1.248)	(2.579)
	[0.091]	[0.029]	[0.006]	[0.596]	[0.092]	0.013
Unit selling price	-4.303	944.429***	-291.865	-43.089	950.849***	-263.742
	(84.567)	(132.740)	(198.831)	(74.277)	(108.314)	(191.606)
	[0.959]	[0.000]	[0.142]	[0.562]	[0.000]	0.169
Seed cost	-0.316	-0.706	-3.200***	-0.094	-0.089	-2.952***
	(0.362)	(0.569)	(0.852)	(0.298)	(0.433)	(0.845)
	[0.382]	[0.215]	[0.000]	[0.752]	[0.838]	0.000
Fertilizer cost	-0.326	-1.623***	-4.888***	0.182	-1.026***	-4.662***
	(0.248)	(0.389)	(0.583)	(0.192)	(0.279)	(0.581)
	[0.188]	[0.000]	[0.000]	[0.345]	[0.000]	0.000
Pesticide cost	0.479	2.361**	0.046	-0.843	0.947	-0.545
	(0.683)	(1.072)	(1.606)	(0.552)	(0.802)	(1.665)
	[0.483]	[0.028]	[0.977]	[0.127]	[0.238]	0.743
Labor cost	-0.132	-0.216	-0.937**	-0.098	-0.036	-0.845**
	(0.180)	(0.282)	(0.423)	(0.141)	(0.205)	(0.426)
	[0.464]	[0.444]	[0.027]	[0.487]	[0.861]	0.047
Groundnut area	4.688	442.704***	362.297***	-68.906***	339.828***	321.825***
	(5.273)	(8.277)	(12.398)	(6.704)	(9.747)	(19.151)
	[0.374]	[0.000]	[0.000]	[0.000]	[0.000]	0.000
Off-farm income	-32.969	-30.255	-96.324*	-14.460	-0.281	-94.894*
	(22.728)	(35.674)	(53.437)	(17.175)	(24.906)	(53.479)
	[0.147]	[0.396]	[0.071]	[0.400]	[0.991]	0.076
Dependency ratio	-2.550	-8.979	-1.541	1.543	-5.448	0.102
	(5.046)	(7.920)	(11.863)	(3.689)	(5.345)	(11.902)
	[0.613]	[0.257]	[0.897]	[0.676]	[0.308]	0.993
Clay soil	-8.783	-4.912	-89.820*	27.891*	36.250	-83.404*
	(20.148)	(31.625)	(47.372)	(15.434)	(22.388)	(47.514)
	[0.663]	[0.877]	[0.058]	[0.071]	[0.105]	0.079
Sandy-clay soil	-6.730	23.207	-70.619*	16.071	47.385***	-64.812*
	(15.832)	(24.851)	(37.225)	(12.392)	(17.985)	(37.307)
	[0.671]	[0.350]	[0.058]	[0.195]	[0.008]	0.082
Silty soil	18.191	38.862	-15.868	17.476	23.171	-16.460
	(20.049)	(31.470)	(47.139)	(15.291)	(22.176)	(47.184)
	[0.364]	[0.217]	[0.736]	[0.253]	[0.296]	0.727
	(299.869)	(470.689)	(705.045)	(69.209)	(100.096)	(674.252)
	[0.016]	[0.331]	[0.094]	[0.000]	[0.000]	0.052

Table S9: Full 2SLS estimates of the relationship between adoption, production , consumption and yields (*continued*)

variables	Yield	Production value	Consumption	Yield	Production value	Consumption
Observations	8,604	8,604	8,604	8,604	8,604	8,604
Number of id	2,868	2,868	2,868	2,868	2,868	2,868
District FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Standard errors in brackets						
*** p<0.01, ** p<0.05, * p<0.1						

Note: The table provides the results of 2SLS regressions examining the relationship between adoption decision ('Adoption dummy') and area of adoption in ha ('Area under adoption') and various factors related to Yield, production and Consumption. The regressions were estimated using both Random Effect (RE) and Fixed Effect (FE) specifications, with robust standard errors shown in brackets. The statistical tests conducted were two-sided t-tests, and p-values are denoted in square brackets. Coefficients marked with an asterisk (*) indicate statistical significance at predetermined levels of significance (***) p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.

Table S10: Full 2SLS estimates of the relationship between continuous adoption, quantity sold, consumption and yields

variable	(1)	(2)	(3)
	Yield	Consumption	Quantity sold
Three years continuous adoption	1,241.558*** (109.207) [0.000]	442.096* (232.261) [0.057]	3.459*** (0.843) [0.000]
Age of household head	3.043 (6.770) [0.653]	29.136** (12.811) [0.023]	-0.010 (0.025) [0.696]
Sex of household head	-5.704 (26.148) [0.827]	2.115 (53.072) [0.968]	0.100 (0.148) [0.498]
Education level	1.786 (1.659) [0.282]	11.093*** (3.367) [0.001]	-0.005 (0.009) [0.629]
Household size	1.422 (1.386) [0.305]	-9.907*** (2.621) [0.000]	0.026*** (0.005) [0.000]
Farmers group membership	-1.115 (9.920) [0.910]	35.620* (18.766) [0.058]	0.130*** (0.037) [0.000]
Training on agriculture	34.339 (22.390) [0.125]	64.568 (42.357) [0.127]	-0.291*** (0.083) [0.000]
Training on groundnut farming	-2.045 (6.615) [0.757]	46.483*** (12.517) [0.000]	-0.184*** (0.025) [0.000]
Public agricultural extension service	1.450 (4.706) [0.758]	33.164*** (8.902) [0.000]	-0.012 (0.017) [0.484]
Private agricultural extension service	9.044 (6.622) [0.172]	-18.473 (12.533) [0.141]	0.062** (0.025) [0.012]
Cash credit for groundnut farming	-1.744 (44.669) [0.969]	94.178 (84.507) [0.265]	-0.128 (0.165) [0.438]
Credit in kind for groundnut farming	13.682 (31.369) [0.663]	-1.986 (59.343) [0.973]	-0.004 (0.116) [0.970]
Distance to the nearest urban market	0.111 (0.490) [0.821]	3.014*** (0.944) [0.001]	-0.009*** (0.002) [0.000]
Distance the nearest village market	-3.430*** (1.319) [0.009]	-0.960 (2.580) [0.710]	-0.019*** (0.006) [0.001]
Crop rotation	-28.885 (20.471)	71.025* (38.744)	-0.170** (0.076)

Table S10: Full 2SLS estimates of the relationship between continuous adoption, quantity sold, consumption and yields (*continued*)

variable	Yield	Consumption	Quantity sold
	[0.158]	[0.067]	[0.025]
Mixed Crops	-9.799	120.908***	-0.089
	(17.415)	(32.947)	(0.064)
	[0.574]	[0.000]	[0.170]
Labor force	-3.194**	-7.905***	0.025***
	(1.345)	(2.545)	(0.005)
	[0.018]	[0.002]	[0.000]
Unit selling price	716.738***	151.924	1.093***
	(66.187)	(125.209)	(0.245)
	[0.000]	[0.225]	[0.000]
Seed cost	0.142	-2.860***	0.011***
	(0.446)	(0.843)	(0.002)
	[0.750]	[0.001]	[0.000]
Fertilizer cost	-0.087	-4.674***	0.002
	(0.306)	(0.579)	(0.001)
	[0.777]	[0.000]	[0.105]
Pesticide cost	2.303***	1.387	-0.003
	(0.825)	(1.561)	(0.003)
	[0.005]	[0.374]	[0.344]
Labor cost	-0.120	-1.002**	0.002***
	(0.222)	(0.420)	(0.001)
	[0.589]	[0.017]	[0.005]
Groundnut area	8.132	362.101***	0.209***
	(6.546)	(12.384)	(0.024)
	[0.214]	[0.000]	[0.000]
Off-farm income	-29.912	-90.212*	-0.041
	(28.166)	(53.284)	(0.104)
	[0.288]	[0.090]	[0.697]
Dependency ratio	-4.058	-3.783	0.013
	(6.265)	(11.852)	(0.023)
	[0.517]	[0.750]	[0.566]
Clay soil	-8.107	-38.002	-0.149*
	(17.912)	(35.025)	(0.078)
	[0.651]	[0.278]	[0.057]
Sandy-clay soil	4.858	-41.520	0.053
	(14.477)	(28.260)	(0.062)
	[0.737]	[0.142]	[0.392]
Silty soil	7.944	-28.525	0.004
	(17.914)	(35.019)	(0.078)
	[0.657]	[0.415]	[0.963]
Constant	2,586.162***	434.444	12.715***
	(214.256)	(451.470)	(1.574)
	[0.000]	[0.336]	[0.000]
Observations	8,604	8,604	8,604
Number of id	2,868	2,868	2,868
District FE	YES	YES	YES

Table S10: Full 2SLS estimates of the relationship between continuous adoption, quantity sold, consumption and yields (*continued*)

variable	Yield	Consumption	Quantity sold
Year FE	YES	YES	YES
Standard errors in brackets			
*** p<0.01, ** p<0.05, * p<0.1			

Note: The table presents the results of 2SLS regressions, which were conducted to examine the relationship between continuous adoption (Three years) and various factors associated with Yield (1), Consumption (2), and quantity sold (3). The regressions employed Random Effect (RE) specifications, and robust standard errors are reported in brackets. Two-sided t-tests were employed for the statistical tests, and p-values are indicated within square brackets. Coefficients marked with an asterisk (*) signify statistical significance at predetermined levels of significance (*** p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.

1.5 Cross country analysis

Table S11: 2SLS estimates of the relationship between adoption and commercialization and yield across countries

variables	Ghana			Mali			Nigeria		
	Yield	Consumption	Sales value	Yield	Consumption	Sales value	Yield	Consumption	Sales value
Adoption dummy	379.921*** (147.299) [0.010]	154.917 (386.300) [0.688]	0.934 (0.999) [0.350]	36.417 (67.499) [0.590]	3.920 (276.291) [0.989]	0.156 (0.720) [0.829]	376.238*** (25.809) [0.000]	326.944*** (77.817) [0.000]	0.047*** (0.011) [0.000]
Age of household head (years)	10.835 (17.731) [0.541]	11.925 (37.728) [0.752]	0.009 (0.098) [0.926]	2.087 (15.271) [0.891]	-27.131 (46.140) [0.557]	0.305** (0.120) [0.011]	-3.271 (8.938) [0.714]	37.415* (20.347) [0.066]	-0.004 (0.003) [0.210]
Sex of household head (dummy, male=1)	-61.230** (29.154) [0.036]			40.096 (27.632) [0.147]			20.564 (48.953) [0.674]		
Education level (Number of years)	0.036 (2.877) [0.990]			-2.163 (2.391) [0.366]			3.166* (1.747) [0.070]		
Household size (number of persons)	0.585 (4.547) [0.898]	-3.491 (8.785) [0.691]	0.024 (0.023) [0.284]	1.976* (1.032) [0.056]	-0.273 (3.145) [0.931]	0.006 (0.008) [0.460]	0.016 (2.300) [0.995]	-23.908*** (5.228) [0.000]	0.003*** (0.001) [0.000]
Farmers group membership (dummy)	6.302 (17.974) [0.726]	-14.137 (35.238) [0.688]	0.539*** (0.091) [0.000]	-3.090 (10.207) [0.762]	-35.600 (30.863) [0.249]	0.010 (0.080) [0.905]	-1.294 (14.137) [0.927]	78.951** (32.153) [0.014]	0.008* (0.004) [0.060]
Training on agriculture (dummy)	41.600 (47.250) [0.379]	-37.802 (91.163) [0.678]	0.115 (0.236) [0.627]	29.363 (19.662) [0.135]	71.667 (59.561) [0.229]	-0.558*** (0.155) [0.000]	25.704 (32.492) [0.429]	6.443 (73.830) [0.930]	-0.005 (0.010) [0.599]
Training on groundnut farming (dummy)	6.240 (15.577) [0.689]	-24.021 (29.981) [0.423]	-0.064 (0.078) [0.411]	1.657 (10.355) [0.873]	13.627 (31.243) [0.663]	-0.374*** (0.081) [0.000]	-2.704 (11.289) [0.811]	104.530*** (25.648) [0.000]	0.003 (0.004) [0.472]
Public agricultural extension service (number of visits)	0.476 (7.916) [0.952]	-52.543*** (15.281) [0.001]	-0.007 (0.040) [0.863]	0.818 (6.670) [0.902]	7.267 (20.873) [0.728]	-0.009 (0.054) [0.867]	-0.223 (6.118) [0.971]	83.734*** (13.874) [0.000]	0.001 (0.002) [0.458]
Private agricultural extension service (number of visits)	-4.263 (10.725) [0.691]	-34.192 (21.666) [0.115]	0.044 (0.056) [0.433]	10.796 (7.477) [0.149]	33.269 (23.968) [0.165]	0.053 (0.062) [0.395]	-0.868 (11.114) [0.938]	-36.540 (25.397) [0.150]	0.002 (0.003) [0.519]
Cash credit for groundnut farming (dummy)	119.032 (92.150) [0.196]	190.479 (179.190) [0.288]	-0.183 (0.463) [0.693]	49.252 (43.001) [0.252]	213.972 (133.006) [0.108]	-0.646* (0.347) [0.063]	-96.654 (59.790) [0.106]	-70.031 (136.902) [0.609]	0.034* (0.019) [0.074]
Credit in kind for groundnut farming (dummy)	-57.439 (64.879) [0.376]	51.755 (126.936) [0.683]	-1.611*** (0.328) [0.000]	48.422 (40.497) [0.232]	109.702 (122.310) [0.370]	0.249 (0.319) [0.435]	-30.079 (37.306) [0.420]	-58.335 (84.634) [0.491]	0.074*** (0.012) [0.000]
Distance to the nearest urban market (km)	2.750 (2.519) [0.275]	4.297 (7.631) [0.573]	0.113*** (0.020) [0.000]	-0.081 (0.539) [0.880]	3.583 (2.727) [0.189]	-0.023*** (0.007) [0.001]	-0.041 (0.549) [0.940]	0.658 (1.340) [0.624]	-0.000** (0.000) [0.031]
Distance the nearest village market (km)	-0.371 (3.150) [0.906]	6.343 (8.867) [0.474]	-0.013 (0.023) [0.575]	-2.758*** (0.884) [0.002]	-2.965 (3.944) [0.452]	-0.018* (0.010) [0.084]	0.564 (2.840) [0.843]	-6.280 (9.324) [0.501]	0.003** (0.001) [0.040]
Crop rotation (dummy)	52.243 (38.965)	189.254** (79.682)	-0.259 (0.206)	-19.076 (24.486)	-102.821 (75.257)	0.593*** (0.196)	-8.740 (26.837)	101.439 (61.802)	-0.009 (0.008)

Table S11: 2SLS estimates of the relationship between adoption and commercialization and yield across countries (*continued*)

variables	Yield	Consumption	Sales value	Yield	Consumption	Sales value	Yield	Consumption	Sales value
Mixed Crops (dummy)	[0.180] 3.469 (35.432) [0.922]	[0.018] 185.109*** (68.250) [0.007]	[0.209] -1.173*** (0.177) [0.000]	[0.436] -13.518 (18.699) [0.470]	[0.172] 70.688 (56.364) [0.210]	[0.003] -0.086 (0.147) [0.559]	[0.745] 6.356 (23.262) [0.785]	[0.101] 124.526** (52.898) [0.019]	[0.314] 0.032*** (0.007) [0.000]
Labor force (man.day)	0.420 (3.724) [0.910]	-17.061** (7.625) [0.025]	0.083*** (0.020) [0.000]	-0.815 (1.708) [0.634]	-10.076* (5.201) [0.053]	0.048*** (0.014) [0.000]	-1.814 (1.575) [0.249]	-1.984 (3.584) [0.580]	0.002*** (0.000) [0.000]
Unit selling price (USDkg)	-237.000 (180.874) [0.190]	-721.133* (413.285) [0.081]	0.285 (1.069) [0.790]	123.920 (142.336) [0.384]	-92.826 (521.062) [0.859]	-1.312 (1.358) [0.334]	120.147 (95.949) [0.210]	-218.466 (246.713) [0.376]	0.021 (0.034) [0.545]
Seed cost (USDha)	-0.637 (0.987) [0.519]	-3.085 (2.125) [0.146]	0.025*** (0.005) [0.000]	0.213 (0.409) [0.603]	0.171 (1.243) [0.891]	0.001 (0.003) [0.712]	-0.379 (0.755) [0.616]	-6.068*** (1.715) [0.000]	0.001*** (0.000) [0.001]
Fertilizer cost (USDha)	-4.598 (3.842) [0.231]	-4.762 (9.522) [0.617]	0.000 (0.025) [0.990]	-0.272 (0.678) [0.689]	-7.616*** (2.340) [0.001]	0.016*** (0.006) [0.008]	-0.055 (0.323) [0.866]	-0.055 (0.738) [0.000]	0.000 (0.000) [0.344]
Pesticide cost (USDha)	-1.032 (2.706) [0.703]	0.639 (5.248) [0.903]	-0.034** (0.014) [0.012]	1.097 (3.549) [0.333]	2.932 (0.009) [0.409]	0.007 (0.009) [0.447]	0.130 (0.928) [0.889]	-1.656 (2.134) [0.438]	-0.000 (0.000) [0.622]
Labor cost (USDha)	-0.465 (0.396) [0.240]	-1.213 (0.778) [0.119]	0.002 (0.002) [0.326]	-0.249 (0.275) [0.367]	0.686 (0.834) [0.411]	0.002 (0.002) [0.434]	-0.005 (0.282) [0.985]	-0.942 (0.648) [0.146]	0.000 (0.000) [0.104]
Groundnut area (ha)	3.858 (14.086) [0.784]	374.767*** (27.147) [0.000]	-0.092 (0.070) [0.192]	10.579* (5.695) [0.063]	338.827*** (17.181) [0.000]	0.283*** (0.045) [0.000]	-3.431 (9.833) [0.727]	380.566*** (22.397) [0.000]	-0.004 (0.003) [0.242]
Off-farm income (dummy)	59.648 (94.453) [0.528]	9.799 (181.819) [0.957]	-0.977** (0.470) [0.038]	5.396 (67.896) [0.937]	-95.190 (204.691) [0.642]	-0.559 (0.534) [0.294]	-51.022* (27.937) [0.068]	-126.930** (63.674) [0.046]	-0.001 (0.009) [0.951]
Dependency ratio	-2.013 (14.110) [0.887]	39.761 (27.090) [0.142]	-0.071 (0.070) [0.308]	-4.460 (8.003) [0.577]	13.217 (24.154) [0.584]	-0.139** (0.063) [0.027]	-2.709 (7.012) [0.699]	-16.735 (15.949) [0.294]	0.008*** (0.002) [0.000]
Clay soil (dummy)	29.747 (32.359) [0.358]	35.638 (84.400) [0.673]	0.007 (0.218) [0.974]	5.276 (18.778) [0.779]	2.513 (79.547) [0.975]	-0.397* (0.207) [0.056]	-3.748 (21.723) [0.863]	-184.403** (73.064) [0.012]	-0.008 (0.010) [0.413]
Sandy-clay soil (dummy)	7.325 (26.595) [0.783]	13.669 (70.846) [0.847]	0.064 (0.183) [0.727]	-0.860 (15.925) [0.957]	-88.687 (66.068) [0.179]	0.115 (0.172) [0.502]	-6.272 (16.916) [0.711]	-93.552* (54.409) [0.086]	-0.000 (0.007) [0.971]
Silty soil (dummy)	59.965* (33.349) [0.072]	126.467 (94.579) [0.181]	0.005 (0.245) [0.985]	15.449 (18.523) [0.404]	63.653 (78.008) [0.415]	-0.091 (0.203) [0.653]	-1.606 (21.510) [0.940]	-90.246 (70.628) [0.201]	-0.010 (0.010) [0.305]
Constant	976.699*** (160.862) [0.000]	-213.074 (1,758.803) [0.904]	2.079 (4.549) [0.648]	393.419*** (126.579) [0.002]	959.988 (2,434.762) [0.693]	-7.352 (6.346) [0.247]	544.008*** (128.372) [0.000]	-1,882.723* (1,070.511) [0.079]	0.992*** (0.147) [0.000]
Observations	1,494	1,494	1,494	2,520	2,520	2,520	4,590	4,590	4,590
Number of id	498	498	498	840	840	840	1,530	1,530	1,530
District FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table S11: 2SLS estimates of the relationship between adoption and commercialization and yield across countries (*continued*)

variables	Yield	Consumption	Sales value	Yield	Consumption	Sales value	Yield	Consumption	Sales value
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Standard errors in brackets									
*** p<0.01, ** p<0.05, * p<0.1									

Note: The table presents the results of 2SLS regressions, which examine the relationship between adoption decision and various factors associated with Yield (1), Consumption (2), and Sales value (3) across the three study countries. The regressions employed Random Effect (RE) specifications for the yield variable, while Fixed Effect (FE) specifications were used for the Sales value and consumption variables. Robust standard errors are reported in brackets. Two-sided t-tests were employed for the statistical tests, and p-values are indicated within square brackets. Coefficients marked with an asterisk (*) signify statistical significance at predetermined levels of significance (*** p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.

Table S12: 2SLS estimates of the relationship between adoption and commercialization, production and yield simultaneously Production, consumption and commercialization

variables	(1)	(2)	(3)
	Market participation	Quantity sold	Sales value
Total quantity of groundnut harvested	0.000*** (0.000) [0.000]	0.000*** (0.000) [0.000]	0.000*** (0.000) [0.000]
Household groundnut consumption	-0.000*** (0.000) [0.000]	-0.001*** (0.000) [0.000]	-0.001*** (0.000) [0.000]
Age of household head (years)	-0.001 (0.000) [0.119]	0.012 (0.023) [0.604]	0.003 (0.021) [0.867]
Sex of household head (dummy, male=1)	-0.013 (0.020) [0.521]		
Education level (Number of years)	0.001 (0.001) [0.312]		
Household size (number of persons)	0.000 (0.001) [0.485]	0.020*** (0.005) [0.000]	0.020*** (0.004) [0.000]
Farmers group membership (dummy)	0.024*** (0.004) [0.000]	0.146*** (0.033) [0.000]	0.128*** (0.030) [0.000]
Training on agriculture (dummy)	-0.051*** (0.009) [0.000]	-0.275*** (0.074) [0.000]	-0.259*** (0.068) [0.000]
Training on groundnut farming (dummy)	-0.021*** (0.003) [0.000]	-0.154*** (0.022) [0.000]	-0.136*** (0.020) [0.000]
Public agricultural extension service (number of visits)	0.004* (0.002) [0.052]	0.003 (0.016) [0.849]	-0.004 (0.014) [0.771]
Private agricultural extension service (number of visits)	0.004 (0.003) [0.206]	0.051** (0.022) [0.022]	0.032 (0.021) [0.122]
Cash credit for groundnut farming (dummy)	0.004 (0.020) [0.822]	-0.075 (0.149) [0.614]	-0.118 (0.137) [0.389]
Credit in kind for groundnut farming (dummy)	-0.028** (0.013) [0.036]	-0.038 (0.104) [0.717]	-0.039 (0.096) [0.681]
Distance to the nearest urban market (km)	-0.001*** (0.000) [0.000]	-0.002 (0.002) [0.257]	-0.002 (0.002) [0.336]
Distance the nearest village market (km)	-0.003*** (0.001) [0.000]	-0.012* (0.006) [0.053]	-0.011** (0.006) [0.045]
Crop rotation (dummy)	-0.001 (0.009) [0.936]	-0.094 (0.069) [0.173]	-0.059 (0.063) [0.356]
Mixed Crops (dummy)	0.010 (0.007) [0.156]	0.010 (0.058) [0.858]	0.006 (0.053) [0.909]
Labor force (man.day)	0.002*** (0.001) [0.003]	0.023*** (0.004) [0.000]	0.023*** (0.004) [0.000]
Unit selling price (USDkg)	0.012 (0.049) [0.805]	0.796*** (0.222) [0.000]	1.244*** (0.322) [0.000]
Seed cost (USDha)	0.001*** (0.000) [0.000]	0.010*** (0.001) [0.000]	0.008*** (0.001) [0.000]
Fertilizer cost (USDha)	-0.000 (0.000) [0.405]	-0.001 (0.001) [0.438]	-0.001 (0.001) [0.218]

Table S12: 2SLS estimates of the relationship between adoption and commercialization, production and yield simultaneously Production, consumption and commercialization (*continued*)

variables	Market participation	Quantity sold	Sales value
Pesticide cost (USDha)	-0.001*** (0.000) [0.004]	-0.003 (0.003) [0.217]	-0.005* (0.003) [0.061]
Labor cost (USDha)	0.000*** (0.000) [0.000]	0.002** (0.001) [0.031]	0.002** (0.001) [0.026]
Groundnut area (ha)	0.013*** (0.004) [0.000]	0.176*** (0.028) [0.000]	0.187*** (0.026) [0.000]
Off-farm income (dummy)	-0.032*** (0.012) [0.008]	-0.074 (0.094) [0.431]	-0.065 (0.086) [0.448]
Dependency ratio	0.001 (0.003) [0.689]	0.014 (0.021) [0.513]	0.014 (0.019) [0.454]
Clay soil (dummy)	-0.015 (0.011) [0.144]	-0.222*** (0.083) [0.008]	-0.206*** (0.076) [0.007]
Sandy-clay soil (dummy)	0.002 (0.008) [0.830]	0.000 (0.065) [0.998]	-0.001 (0.060) [0.993]
Silty soil (dummy)	-0.001 (0.011) [0.952]	-0.052 (0.083) [0.527]	-0.056 (0.076) [0.458]
Constant	0.950*** (0.052) [0.000]	4.123*** (1.177) [0.000]	4.856*** (1.082) [0.000]
Observations	8,604	8,604	8,604
R-squared		0.172	
Number of id	2,868	2,868	2,868
District FE	YES	YES	YES
Year FE	YES	YES	YES
Standard errors in brackets			
*** p<0.01, ** p<0.05, * p<0.1			

Note: The table presents the results of 2SLS regressions, which examine the relationship between production and consumption of Groundnuts and various factors associated with Market participation (1), quantity sold (2), and Sales value (3). Robust standard errors are reported in brackets. Two-sided t-tests were employed for the statistical tests, and p-values are indicated within square brackets. Coefficients marked with an asterisk (*) signify statistical significance at predetermined levels of significance (*** p<0.01, ** p<0.05, * p<0.1). To account for potential unobserved heterogeneity, all regressions include a comprehensive set of district fixed effects.