**Rural Economics**

 **and Development**

**Contract Farming in Uganda: Its Role in the Commercialization of Smallholder Agriculture and Sustainable Development of the Sorghum, Sunflower**

**and Rice Value Chains**

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# Abstract

The use of contract farming has greatly expanded in Uganda mainly due to the promotional efforts of agribusinesses. The motivation of this study was to examine the role of contract farming in the commercialization of smallholder agriculture and sustainable development of agro-chains in Uganda by using sunflower, sorghum, and rice contract schemes as case studies. Three separate surveys of randomly selected 246 sorghum, 197 sunflower, and 242 rice contract participant and non-participant farmers were conducted. Primary data was collected using standardized questionnaires on respective farmer socio-economics, crop partial budgets, and contract participation. Data was then analyzed using a Heckman two-step method to control for selection bias in farmer contract participation. Using the probit regression model in the first step, it was generally found that farmer contract participation was positively associated with group membership in all studied schemes. In the second stage, General Least Squares estimates showed that the inverse mills ratio significantly and positively affected the profits obtained by sorghum and sunflower farmers. Profits were significantly higher for contracted than non-contracted farmers by 16% (sorghum) and 12% (sunflower). Farm size, access to extension, and age of farmer were other factors that influenced farmer profits. Effectiveness of contract farming in boosting participation and profitability of smallholders could be enhanced through promotion of farmer groups to enhance their bargaining power and delivery of critical inputs.

**Key words**: *Contract farming, smallholders, farmer groups, profit, commercial agriculture, agribusinesses, lead firms, Heckman, Probit*.

**Introduction**

Contract farming has positively contributed to modernization of agriculture, enhancement of farmer productivity and income in developing countries. Numerous case studies involving various agricultural commodities (e.g. tea, sugarcane, cotton, oil palm, oilseeds, rice, cassava) reviewed or done in several developing countries in Africa, Asia, Central and Latin America have shown that smallholder farmers have variably benefited from contract farming through the access to production inputs, output markets, market development, rural development, and other intangible benefits (Fawole and Thomas, 2012; Masakure and Henson, 2005; Eaton and Shepherd, 2001; Key and Runsten, 1999; Porter and Howard, 1997; Glover, 1987; and Glover, 1983).

According to Eaton and Shepherd (2001), contract farming is defined as an “agreement between farmers and processing and/or marketing firms for the production and supply of agricultural products under

forward agreements, frequently at predetermined prices.” Various typologies of contract farming chemes exist. Baumann (2000) classify contract farming into three types: out-grower schemes, nucleus estate - out-grower schemes, and multipartite arrangements. Eaton and Shepherd (2001) provide a much richer categorization of contract farming schemes based on the product, the resources of the sponsor, and the intensity of the relationship between the farmer and sponsor. They identify five types or models of contract farming, namely: centralized, nucleus estate, multipartite, informal, and intermediary models.

 The emergence and expansion of contract farming throughout the world is well documented in some studies (Baumann, 2000 and Runsten and Key, 1996). Several factors have been attributed to the rise of contract farming and these factors seem to vary between developed and developing countries. In developed countries, agribusinesses are economically motivated and enter into contracts with farmers in order to obtain assured supply of produce for processing (Runsten and Key, 1996). This could have been the case for multinational food processors that moved into Latin America in the 1940s although Baumann (2000) argues that contract farming emergence in developing countries was sparked off by other motives. Baumann (2000) forwards two factors that led to the emergence of contract farming in developing countries. First, after independence, foreign agribusinesses owning plantations are said to have adopted contract farming because they faced “nationalist pressures, threats of expropriation and new conditions of profitability.” Runsten and Key (1996) also concur with this point as they observed that some agribusiness firms that were involved in plantation agriculture in Latin America, such as the banana producers, took on contracting as a “means of defusing nationalistic criticism of their operations.” Second, some out-grower schemes that have emerged in developing countries have been sponsored by their respective states/governments, private companies, and/or international aid or lending agencies, such as International Monetary Fund and the World Bank, in order to “revive flagging export markets.” This category of out-grower schemes appears to include most of the out-grower schemes that have recently surfaced in developing countries. Examples of out-grower schemes across Asia, Latin America and Africa that have been supported by international aid agencies include palm oil, cocoa and rubber contract schemes.

 The rise of smallholder participation in contract farming in developing countries is attributed to the failure of traditional spot agricultural markets to cope up with the changing agricultural and food systems in developing countries (Singh and Asokan, 2005). Agro-processors and marketers are increasingly avoiding traditional spot markets and opting for more direct market channels such as market and production contracts, full ownership or vertical integration (FAO, online). Besides industrialization process, the liberalization and globalization of agricultural markets, have in some cases led to crowding out of smallholder producers in developing countries by foreign competition (Elepu, 2009). This implies that without contractual arrangements between producers and agribusinesses, it is increasingly becoming difficult for smallholder farmers to access better paying markets.

 In Uganda, contract farming has been traditionally restricted to plantation crops (sugarcane and tea) where out-growers have been supplementing production of large processing agribusiness lead firms such as Kakira Sugar Works, Sugar Corporation of Uganda Limited, Kinyara Sugar Works, and Kasaku Tea Estate. However, other agribusiness lead firms such as Nile Breweries, Uganda Breweries, Dunavant, Esco, Outspan Enterprises Limited, Mukwano Industries, Bee Natural Products, Ugachick, and some co-operative unions have also extended contracts to smallholder farmers to ensure a continuous supply of agricultural produce. Hence, the use of contract farming has spread to other agricultural commodities, namely: barley, sorghum, sunflower, organic products (cotton, coffee, sesame, vanilla, cocoa etc.), oilseeds, rice, honey, and poultry. Some of these contract farming schemes have been credited for playing a key role in increasing the profitability of crop farming, reducing marketing risks, and above all opening up new markets for non traditional cash crops both at domestic and international levels (Wiegratz et al., 2007; Tulip and Ton, 2002).

 Given the benefits accruing to smallholder farmers from engaging in contract farming, it can be argued that it is crucial in the commercialization of smallholder agriculture and hence, poverty reduction in Uganda. However, smallholder farmers have reportedly experienced some contractual problems in dealing with large agribusiness firms, resulting in smallholder farmers giving up contract farming. Agribusinesses have as well encountered some contractual problems when dealing with some smallholder farmers that could have led to the exclusion of the latter from contract farming. In general, these contractual problems have been largely attributed to the failure of one of the parties to the contract, either agribusiness firm or smallholder farmer, to honour agreed-upon contracts (Wiegratz et al., 2007; Elepu and Nalukenge, 2007).

 It can be argued that the above contractual problems might have been aggravated by the existence of inadequate contractual laws or the weak enforcement of contractual laws prevailing in Uganda. Hence, there is need to enact, implement, and enforce favourable contractual laws and policies to support both smallholder farmers and agribusiness firms in their contractual production and marketing arrangements. Additionally, there is also need to identify suitable policies that have the potential to increase the participation of smallholder farmers in contract farming if agricultural commercialization and poverty reduction is to be achieved in Uganda.

 Therefore, the main objective of this study was to examine the effect of contract farming participation on the profitability of smallholder agriculture in Uganda by using sunflower, sorghum, and rice contract schemes as case studies. In this study, smallholder farmers are defined as farmers who grow less than 2 hectares (5 acres) of selected crops. Findings from this study will assist policy makers to formulate appropriate policies related to contract farming that are critically important in the advancement of commercial smallholder agriculture in Uganda.

**2. The nature of sorghum, sunflower, and rice contract farming schemes in Uganda**

The sorghum contract scheme follows a multipartite model involving Nile Breweries Limited (NBL), Government of Uganda, National Agricultural Advisory Services (NAADS), National Agricultural Research Organization (NARO) and smallholder farmers in eastern Uganda. This contract farming scheme started in 2002 to obtain sweet sorghum (*Epuripur*) developed by NARO for making affordable non-malt beer, Eagle Lager. With an annual demand of 6,000 metric tons, NBL sources sorghum locally thereby attracting excise tax deductions from the Government of Uganda. Consequently, Eagle Lager has become one of NBL’s best selling brands due to its lower price that appeals mostly to low-end consumers in rural areas. Nile Breweries through its agent, Afro-Kai, a grain marketing company, enters into written or formal seasonal contracts with only the relevant district farmers associations which then mobilize farmers in their domains to produce sorghum. Afro-Kai distributes sorghum seed, assembles and transports grain to NBL. Extension service provision to contracted farmers is done by NAADS.

 Similarly, the sunflower contract farming scheme follows a multipartite model in which Mukwano Industries Limited, national agricultural research and extension systems, and smallholder farmers in northern Uganda. Mukwano Industries Limited began the sunflower contract farming scheme in 2003 to procure sunflower for the production of edible vegetable oil for sale to domestic and regional markets. Before the scheme, Mukwano procured sunflower from the spot market. But, with the entry of a new big player, Mt. Meru Millers and other small players into the edible vegetable oil processing, the competition for sunflower seed has increased. To meet its enormous oil mill annual capacity of 100,000 metric tonnes of sunflower seed, Mukwano started the contract scheme. Under the contract scheme, Mukwano imports high yielding hybrid sunflower seed from South Africa for distribution to participating farmers after conducting adaptability trials at the relevant local agricultural research station. The contracts Mukwano Industries signs with sunflower farmers are formal or written and are seasonal. Through its agents located in participating farming communities, sunflower seed is distributed to farmers and later, specified sunflower output is collected from them. These agents sometimes offer extension services to participants and thereby, supplementing the public extension system.

In contrast, the rice contract farming scheme follows a centralized model as Tilda (Uganda) Limited supplements its own estate production with output from out-growers. In 2004, Tilda began the rice contract scheme to increase its own production to meet the rising and huge market demand for rice, both domestically and regionally. Tilda has 4,000 hectares of arable land capable of producing up to approximately 20,000 - 25,000 metric tons of rice per year. However, Tilda has installed an ultra-modern rice milling and processing facility with a capacity to process 40,000 metric tonnes of rice per year implying that the total capacity is being underutilized. Through an out-growers’ scheme, Tilda enters into formal contracts with neighbouring smallholder farmers in eastern Uganda on a seasonal basis. A few of those out-growers use Tilda’s land while the rest of them have their own land for rice production. Contract participating rice farmers rely on mainly outside sources for seed and extension except for those within the estate. After production, it is the duty of participants to transport rice paddy to the mill that acts as a point of sale.

**3. Methodology**

***3.1 Analytical methods***

Data was analyzed using a Heckman two-step selection model. In the first step, the binary probit model was used to determine the factors that influenced the likelihood of a farmer’s participation in contract farming. Following Greene (2000), the probit function assumes a simple utility function:

 **U** =  **U**(***Par***t***, Nonpart***, **β; e**)…………(1)

Where **U** is the farmer’s utility function over profit assumed to be monotone increasing in the arguments, strictly concave and is thrice differentiable everywhere. ***Part*** is participation in contract farming and ***Nonpart*** is the non-participation in contract farming. **β** is a vector of parameters of attributes of the choice and farmer such as, age of farmer, size of the household, level of education etc.

 Assuming a random utility model, the farmer has two choices; either to participate in contract farming or not based on their risk preferences or transaction costs (Rehber, 2007). Denoting the utility derived from participation in contract farming as **UP**, and that of non-participation as **UNP**, then the *i*th farmer will choose to engage in contract farming if and only if **UP** > **UNP**. Denoting the latent (unobservable) random variable as **yi\*** = [**UP -UNP**] > 0, then the observable random variable **yi** is determined as:

 **yi** = 1 if **yi\***> 0

**yi** = 0 if **yi\*** < 0 …………..(2)

Given that **yi\*= βiXi\*+ ui\***, then the probability that **yi** = 1 is given as **Pi = Prob[ui\*> - βiXi] = P(βiXi),** which is the cumulative density function (cdf). The probit model is then derived by letting **P(βiXi)** be the cdf of a standard normal random variable. The observed probit used to estimate participation function is specified as:

 **yi = β0 + βiXi + ei; i = 1,…., n** ……(3)

Where **yi** is the dependent variable which takes a value of 1 if the farmer participates in contract farming and a value of 0 if the farmer does not. ***Xi*** is a vector of the following explanatory variables:

*X1* = Sex of farmer (1= male; 0 = female)

*X2* = Age of farmer (years)

*X3* = Education level of farmer (1= tertiary, 1= secondary, 1= primary, 0= none)

*X4* = Household size (number of persons)

*X5* =Farm size (acres)

*X6* = Access to extension (1= yes; 0 = none)

*X7* = Access to credit (1= yes, 0= none)

*X8* = Group membership (1= yes, 0= none)

*β0*= Intercept

*βi* **=** Parameters to be estimated

*ei* is the error term

 In the second step, the dependent variable was profit measured by the gross margin in Ush per acre and its determinants were estimated using the Generalized Least Squares (GLS) method that is more suitable than Ordinary Least Squares (OLS) in situations of heterogeneity (Greene, 2000). Profit was regressed on the inverse mills ratio, **λ**, derived from the probit model to control for selection bias in farmer participation in contract farming. Other explanatory variables such as sex, age and education of farmer were included in the model as shown below:

 **yj** = **β0** + **βjXj** + **γλ**+ **uj** …………….(4)

Where **yj** is gross margin in Ush per acre. **Xj** is a vector of explanatory variables including:

*X1* = Sex of farmer (1= male; 0 = female)

*X2* = Age of farmer (years)

*X3* = Education level of farmer (1= tertiary, 1= secondary, 1= primary, 0= none)

*X4* = Household size (number of persons)

*X5* = Farm size (acres)

*X6* = Access to extension (1= yes; 0 = none)

*X7* = Access to credit (1= yes, 0= none)

*β0* = Constant factor or intercept

*βj* and *γ* are the parameters to be estimated

**λ** is the inverse mills ratio added to cater for sample selection bias and

***uj*** is an error term

***3.2 Data collection methods***

This study was conducted in the following areas because of the availability of the selected contract schemes: Soroti District (Sorghum), Apac District (Sunflower), and Bugiri District (Rice). For all the selected contract farming schemes, lists of participants and non-participants were first drawn to serve as sampling frames. For the sorghum contract farming scheme, a list of farmers belonging to Soroti District Farmers’ Association (SODIFA) was used to randomly select 130 participants and 116 non-participants making a total sample of 246 sorghum farmers. For the sunflower contract farming scheme, a total sample of 197 were randomly selected for the study; 143 participants from an available list from Mukwano and 54 non- participants from a list made with the help of employees from Appropriate Technology (Uganda) Limited. Lastly, for the rice contract farming scheme, a total sample of 242 rice farmers was randomly selected; 72 participants from list obtainable at Tilda and 170 non- participants from a list made with the assistance from local government agricultural extension workers.

 Primary data were collected from participants and non-participants using the survey method. A structured questionnaire adapted to specific contract schemes (sorghum, sunflower, and rice) was administered to both types of farmers to elicit information about their demographics, crop production and marketing systems, and contract partipation. More information about the operation and management of contract farming schemes was sought from agribusiness, local governments, and other stakeholders through informal interviews.

# 4. Results and discussion

# *4.1 Characteristics of contract participants and non-participants*

Across the studied contract farming schemes, there were no significant differences in characteristics (except for membership in farmers’ organization) between participants and non-participants. Generally, it was mostly lowly educated male farmers with 1.1 – 2.7 acres who were involved in contract farming schemes (Table 1). Contract participating sunflower and rice farmers tended to belong to some farmers’ organization than their counterparts and yet such a distinction was not present in the sorghum contract farming scheme. This implies that it was smallholder farmers who were participating in sorghum, sunflower, and rice contract farming schemes. The low participation of female farmers in these schemes could be related to the widespread nature of male-headed households or male dominance in cash crop production.

Unlike in other contract farming schemes, a majority of sorghum farmers appeared to be lacking adequate access to extension services and credit perhaps due to reliance on public extension provider, NAADS. Only 15% of the interviewed participants said they received extension service and, only 2% of them claimed they got some credit to grow sorghum. Access to extension (credit) by sunflower contract participants stood at 47% (2%) and this was mainly through efforts of Mukwano and its agents. In contrast, a majority (97%) of rice contract participants interviewed said they received extension services in the last season and especially from Tilda. In addition, a majority (85%) of the participants interviewed showed they accessed some form of credit meant for rice production (Table 1). This was a unique finding because rice contract participants belonged to Kibimba Savings and Credit Scheme (KISACS), which procured small agricultural loans for its members from the Centenary Rural Development Bank.

***4.2 Profitability of contract participants and non-participants***

Figure 1 shows that sorghum and rice production was profitable for both contract participants and non-participants. While it was more costly to grow rice than sorghum, average gross profits per acre for both types of farmers were higher for rice than sorghum, that is, Ush76,000 (US$46) versus Ush17,126 (US$10). Moreover, sorghum, non-participants made significantly more profits per acre than their counterparts [i.e. Ush84,000 (US$51) vs. Ush68,000 (US$41)]. In the case of sunflower, the average gross profits per acre for participants were positive (i.e. Ush20,456 or US$12) where as those for non-participants were negative (i.e. Ush-7,775 or US$-5) despite higher cost of hybrid seed used by the former. Mukwano had virtually complete control over the sunflower seed distribution system to participant farmers. However, farmers complained of the high price of imported hybrid sunflower seed which was sold at USh 7,000/kg (US$4.24/kg).

Higher profits obtained by participants than non-participants could be explained by lower prices received by the latter, who also had to sell their sorghum to Nile Breweries/agents under extra-contractual arrangements, usually below the contract price of Ush 300/kg (US$0.18/kg). The observed profit differential between participants and non-participants in the rice contract scheme could be related to the existing price differential as participants were required to deliver wet paddy rice to Tilda for a price of Ush 250/kg (US$0.15/kg) or Ush 500/kg (US$0.30/kg) for dried paddy rice while non-participants sold their dried rice on the spot market at an average price of Ush 600/kg (US$0.36/kg).

**Figure 1: Profitability of sorghum, sunflower and rice contract participants and non participants**

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**Note:** CFs = Contract participant farmers; NCFs = Non contract participant farmers; 1 US$ = Ush1650; Chi-square: Sorghum (9.076\*\*\*); Sunflower (8.831\*\*); and Rice (5.156\*\*).

Disparity in gross profits between participants and non-participants in the sunflower contract scheme could be related to the varietal yield difference since PAN (grown by participants) was superior to Sunfola (grown by non-participants) in terms of seed and oil yields.

***4.3 Factors affecting farmer participation in sorghum, sunflower and rice contracts***

To establish factors associated with farmer participation in sorghum, sunflower, and rice contracts, three separate probit regressions were run in the first step of Heckman two-step selection method. It was assumed there was one selection factor, group membership, that was associated with farmers’ contract participation and not their profits. Thus, group membership was included in the first step but not in the second step of Heckman. The adequacy of the models was demonstrated by Wald’s chi-square values and the following variables were generally found to significantly influence farmers’ participation in contract farming, namely: access to extension, access to credit, farm size and group membership (Table 2).

 Access to extension was positively associated with farmer participation in both sunflower and rice contract farming schemes and not in the sorghum contract farming scheme. While, farmer access to credit positively correlated with their participation in only the rice contract farming scheme. Unlike in the sorghum contract farming scheme, extension services were provided to sunflower and rice contract participants by the respective lead agribusinesses, Mukwano and Tilda. Tilda also provided credit services to its contract participants through the Kibimba Savings and Credit Scheme (KISACS). In the case of sorghum, extension services were largely being provided to farmers under the public arrangement.

 Group membership influenced farmer participation in all the three contract farming schemes. However, the direction of influence was positive for sorghum and sunflower contracts and negative for the rice contract. For example, farmers who were members of some group had a 7% (8%) probability of participating in sorghum (sunflower) contract farming than their counterparts. This may be due to the exposure of organized farmers to information about contract farming as they interact among themselves (Mugerwa, 2005). Another reason might be the bias of selecting organized than individual farmers as it may have been the case with sunflower and sorghum contract schemes.

 Similarly, the strong positive association between farm size and farmer participation in the sorghum contract farming scheme could also be indicating another source of selection bias. Farmers who had larger sorghum plots were more likely to participate in the sorghum contract than their counterparts. The marginal effect showed that a unit increase in sorghum area would increase the probability of farmer participation in contract farming by 0.3%.

***4.4 Factors affecting profitability contract participants and non-participants***

In the second step of the Heckman models, Generalized Least Squares (GLS) regressions were run to determine the factors affecting profits obtained by sorghum, sunflower, and rice contract participants and non-participants. Being cross-sectional data, the estimated linear profit models had poor fits but with interesting significant variables, such as inverse mills ratio, farm size and access to extension. Results showed that inverse mills ratio terms were all significant but positive in the cases of sorghum and sunflower contracts but negative when it came to the rice contract. This suggests the direction of correlation of error terms of contract participation and profit models. Thus, unobserved factors that make farmer participation in sorghum and sunflower contracts tended to influence their profits positively. The reverse was true of the rice farming schemes (Table 3).

 Across many developing countries, contract farming has been found to play an important role in the commercialization of smallholder agriculture through the provision of an assured market, high prices, critical inputs, knowledge on new agricultural technologies to farmers, and in improvement of production and supply chain efficiency as a whole (Masakure and Henson, 2005; Eaton and Shepherd, 2001; Key and Runsten, 1999; Porter and Howard, 1997; Runsten and Key, 1996; and Glover, 1989). However, the success of contract farming projects in developing countries has been staggering, with some of them succeeding and others failing. In some cases, contract farming has been criticized as being exploitative to smallholder farmers with low bargaining power against lead firms that tend to be monopsonies or oligopsonies (Baumann, 2000 and Runsten and Key, 1996). Moreover, the contracts issued by agribusinesses have been found to be lacking for they have been either informal or suit best agribusinesses (Baumann, 2000). Thus, there has been a call for smallholder farmers in developing countries participating in contract farming to be organized to boost their bargaining power against lead agribusinesses (Runsten and Key, 1996 and Coulter et al., 1999).

 Except for the rice contract farming scheme, other schemes were commended by farmers for providing them with an assured or reliable market. In the case of sorghum, NBL/Afro-kai was the sole buyer of sorghum at a price of USh 300/kg (US$0.18/kg). This was not the case for sunflower. Mukwano, the largest buyer, competed with other oil millers, both small and medium. Some of these oil millers offered better prices compared to Mukwano’s contract price of USh 350/kg (US$0.21/kg) since they had not invested in sunflower promotional activities, such as extension services. As for rice, the huge demand for it in the domestic market meant that non-participants could sell their dry paddy rice to other millers at prices higher than USh 500/kg (US$0.30/kg) offered by Tilda for wet paddy.

Farmer access to extension services positively and significantly influenced profitability of only sunflower production. As shown in Table 3 above, sunflower farmers with access to extension services obtained more profits than those without by 18%. Perhaps, this was brought about through increased farmer adoption of better agronomic practices and technologies, such as seed. Previously, the adoption of improved technologies for studied crops had been low owing to the lack of markets and other factors. For example, Elyanu et al. (2002) found that the rate of adoption of improved sorghum varieties was only 35% of the sorghum land area and that the likelihood of their adoption was 53%. However, there is need to improve farmers’ access to extension services to promote rapid adoption of modern production technologies, such as seed and fertilizer. According to the Uganda Bureau of Statistics (UBOS), only 6, 1, 3 and 3 percent of farming parcels planted with crops in Uganda used improved seed, fertilizers, manure, and herbicides/fungicides, respectively (UBOS, 2007). Moreover, the extension agent to farmer ratio under the traditional extension system in Uganda is about 1:5000 (Mubiru *et al*., 2004).

**Table 1: Characteristics of sorghum, sunflower, and rice contract participants and non-participants**

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristic**  | **Sorghum**  | **Sunflower** | **Rice** |
| **CFs** | **NCFs** | **Total** | **χ2 or****F-test** | **CFs** | **NCFs** | **Total** | **Χ2 or****F-test** | **CFs** | **NCFs** | **Total** | **χ2 or****F-test** |
| Sex (%) |  |  |  |  | 84.515.5 | 71.728.3 | 81.019.0 | 4.119\* | 69.630.4 | 86.813.2 | 81.818.2 | 9.763\*\* |
|  Male | 87.7 | 87.1 | 87.4 | 0.022 |
|  Female | 12.3 | 12.9 | 12.6 |  |
| Education (%) |  |  |  |  | 3.646.438.611.4 | 15.152.824.57.5 | 6.748.234.710.4 | 10.65\* | 26.847.922.52.8 | 17.663.018.21.2 | 20.356.819.51.7 | 5.242 |
|  Never | 8.8 | 13.3 | 10.9 |  |
|  Primary | 67.2 | 71.7 | 69.3 | 4.944 |
|  Secondary | 22.4 | 12.4 | 17.6 |  |
|  Tertiary | 1.6 | 2.6 | 2.2 |  |
| Occupation (%) |  |  |  |  | 97.12.9 | 94.35.7 | 96.43.6 | 0.864 | 97.22.8 | 98.21.8 | 97.92.1 | 0.237 |
|  Farming | 95.3 | 91.3 | 93.4 | 1.623 |
| Non farming | 4.7 | 8.7 | 6.6 |  |
| Group membership (%) | 27.8 | 24.3 | 26.2 | 0.362 | 48.9 | 9.4 | 38.0 | 25.4\*\* | 34.8 | 15.7 | 21.1 | 10.43\*\* |
| Access to extension (%) | 14.6 | 9.6 | 12.2 | 1.43 | 46.8 | 17.3 | 38.9 | 13.92\*\* | 97.1 | 20.0 | 43.0 | 119.35\*\* |
| Access to credit (%)  | 2.3 | 4.5 | 3.4 | 0.88 | 2.2 | 2.0 | 2.1 | 0.01 | 85.3 | 10.7 | 33.0 | 119.82\*\* |
| Age (Years) | 37.8 | 37.1 | 37.5 | 0.177 | 34.5 | 34.8 | 34.5 | 0.867 | 34.1 | 34.9 | 34.7 | 0.274 |
| Household size (No. of members) | 8.5 | 8.4 | 8.4 | 0.049 | 6.7 | 6.7 | 6.7 | 0.002 | 7.2 | 8.6 | 8.2 | 2.883 |
| Total land (Acres) | 8.3 | 6.8 | 7.6 | 2.787 | 6.8 | 5.6 | 6.5 | 0.425 | 2.1 | 1.9 | 2.0 | 1.101 |
| Crop land (Acres) | 2.3 | 1.5 | 1.9 | 9.35\*\* | 2.7 | 2.0 | 2.5 | 1.338 | 1.6 | 1.1 | 1.3 | 1.878 |

*Note: CFs = Contract participant farmers; NCFs = Non contract participant farmers; and significance levels: \*\* (1%) and \* (5%).*

**Table 2: Factors associated with farmer participation in sorghum, sunflower, and rice contracts**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Sorghum** | **Sunflower** | **Rice** |
| **Coeff.** | **dy/dx** | **Coeff.** | **dy/dx** | **Coeff.** | **dy/dx** |
| Constant  | -1.54\*(0.88) |  | -1.77\*(0.97) |  | -03.17(1.24) |  |
| Sex (male) | 0.45 (0.56) | .019 | 0.20 (.519) | .028 | 0.12 (0.68) | .041 |
| Age (years) | 0.01 (0.03) | .011 | -.002 (.019) | .091 | -0.07\* (0.04) | .093 |
| Education (primary) | -0.22 (0.56) | .008 | .781 (.725) | .018 | -0.73 (0.64) | .081 |
| Education (secondary) | 0.15 (0.68) | .016 | .124\* (.080) | .005 | 0.12 (0.09) | .053 |
| Education (tertiary) | -0.10 (0.13) | .038 | .109 (.093) | .007 | 0.10 (0.15) | .076 |
| Household Size | .021 (0.04) | .021 | - .029 (.053) | .032 | 0.06 (0.08) | .059 |
| Access to extension (yes) | 0.10 (0.55) | .073 | .119\*\*\* (.044) | .099 | 0.44 (0.10) | .061 |
| Access to credit (yes) | -0.83 (.920) | .004 | - | - | 0.26 (0.07) | .012 |
| Group membership (yes) | 0.28\*\*\*(.037) | .067 | .208\*\*\*(.058) | .084 | -0.13(0.06) | .028 |
| Farm size (acres) | .263\*\* (.105) | .003 | .064 (.139) | .066 | -0.33 (0.28) | .071 |
| Wald’s Chi2 | 471.31\*\*\* |  | 503.59\*\*\* |  | 588.25 |  |
| Loglikelihood | 1215.15\*\*\* |  | 1040.22\*\*\* |  | 898.33 |  |
| No. of observations | 246 |  | 197 |  | 0.24 |  |

*Note:**Standard errors are in parentheses; and significance level: \* 10%, \*\* 5%, \*\*\* 1%.*

This suggests that extension service delivery to farmers in general is still low. Public extension service delivery efforts need to be strengthened to supplement those of private companies and benefit non-participants as well.

 Farm size was also another variable that was significantly and positively influencing farmers’ profits across all contract farming schemes. For example, the associated coefficients to farm size for sorghum and rice contract farming schemes meant that an acre increase in total size of sorghum (rice) farm increased profits by about 13% (7%) as shown in Table 3. The existence of economies of scale seems not to be the plausible reason here because farmers did not commit all their available land to studied crops as shown in Table 1. However, it might be true that the size of farm was an indicator of wealth of farmer, especially in eastern Uganda, where sorghum and rice studies were done. Resource-poor farmers have been known to have difficulty in accessing some critical production inputs and thus, call for any efforts geared towards reducing farm-gate input prices (Crawford et al., 2003).

**Table 3: Determinants of sorghum, sunflower, and rice production profitability**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variables** | **Sorghum Coeff.** | **Sunflower Coeff.**  | **Rice Coeff.**  |
| Constant  | 1.795\*\*\*(0.634) | 1.162\*\*\*(0.214) | -1.253\*\*(0.555) |
| Sex (male) | 0.050 (0.676) | 0.210\*\* (0.089) | 0.020 (0.471) |
| Age (years) | -0.107 (0.383) | -0.311 (0.476) | 0.021 (0.157) |
| Education (primary) | 0.043 (0.373) | -0.069 (0.199) | 0.070 (0.051) |
| Education (secondary) | 0.000 (0.001) | -0.151 (0.885) | 0.028 (0.432) |
| Education (tertiary) | -0.003 (0.035) | -0.167 (0.292) | 0.047 (0.897) |
| Household Size | -0.023 (0.302) | -0.018 (0.213) | 0.093 (0.447) |
| Access to extension (yes) | 0.104 (0.608) | 0.178\*\* (0.091) | 0.036 (0.073) |
| Access to credit (yes) | -0.067 (0.924) | 0.018 (0.218) | 0.009 (0.101) |
| Farm size (acres) | 0.134\*\* (0.066) | 0.054\* (0.033) | 0.069\*\*\* (0.014) |
| Inverse mills ratio | 0.085\*\*\*(0.019) | 0.149\*\*\*(0.023) | -0.137\*\*\*(0.024) |
| Adjusted R-squared | 0.251 | 0.298 | 0.272 |
| F-value | 32.612\*\*\* | 55.575\*\*\* | 43.476\*\*\* |
| No. of observations | 246 | 197 | 242 |

*Note:**Standard error are in parentheses;**significance level: \* 10%; \*\* 5%; and \*\*\* 1%.*

The rest of the socio-economic factors of farmers were not significantly affecting their profitability except for sex of farmer in the case of sunflower contract farming scheme. Profits were higher for male than female farmers by 21% probably reflecting difference in farm productivity (Table 3). Being an important cash crop in the area, sunflower production could have been taken on more vigorously by male than female farmers.

**5. Conclusion**

Contract farming has significantly contributed to the profitability and commercialization of smallholder agriculture in Uganda, especially in the sorghum and sunflower sub-sectors. While agribusinesses have obtained assured supply of raw materials for their processing needs, smallholder farmers on the other hand have had access to critical inputs such as improved seeds and extension services, in addition to access to a guaranteed market for their produce. However, there are still some challenges in the organization and operation of the contract farming schemes. Thus, both agribusinesses and policy makers have separate roles to play to make sure contract farming is properly nurtured for the benefit of smallholder farmers in Uganda.

 Contracting agribusinesses or lead firms need to assist participants to procure the necessary inputs at reasonable prices or even on credit terms. They should discourage buying produce from non-participants as they will see no need or urgency to join the contract. It is also important for agribusinesses to provide extension services to participants to improve farm productivity and quality of produce. On their part, policy makers need to promote farmers’ groups for easy extension service delivery and to increase their bargaining power. Moreover, farmers need to be educated about the importance and benefits of contract farming and the need for them to participate in it. Provision of incentives to agribusinesses that are embracing and promoting contract farming is paramount, for example tax reductions on local produce procurement. Lastly, there is need to support research and development, and extension activities related to crops being promoted by contract farming so as to produce and avail affordable improved seeds to participants.

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