# STATUS OF SOYBEAN PRODUCTION AND IMPACT INDICATORS OF NEW SOYBEAN VARIETIES IN UGANDA

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# EXECUTIVE SUMMARY

Most farmers grow soybean during the first season compared to the second season, especially in Northern Uganda. Fertilizers are rearly applied. Over 77% of the farmers reported that they never applied fertilizer and have no experience with its application. Seed-bed preparation was the biggest challenge to soybean production according to 53% of the growers. Other major challenges were planting (46%) and weeding (51%). The major problems related to seed bed preparation was lack of labor (47%) and high labor cost (21%). Pod shattering was also reported as a problem due to delayed harvesting, which confirms the shortage of labor. This observation calls for investing in mechanization to reduce on drudgery and improve on timeliness of field operations.

Northern region is the highest producer of soybeans with best relative productivity mean yield of 730 kg per acre while West Nile reported the least yield of 100 kg per acre. Farmers in Eastern, Western and Central region had mean yields of 632, 282 and 259 kg per acre, respectively. With the exception of West Nile, the regions where the Oil Vegetable Project II (VODP II) is implemented had relatively better productivity.

Maksoy 1N is the most known soybean variety by 70% of the farmers, followed by Maksoy 3N which is known by 43% of the farmers. Maksoy 1N is known in all regions except in the Central where only Maksoy 3N was popular. Namsoy 4M was most popular in Eastern region while Maksoy 2N was most popular in West Nile region. The varieties Maksoy 4N and Maksoy 5N released in 2013 were not yet known by farmers, suggesting urgent need for promotion of these varieties. All seed companies bought their Breeders and/or Foundation seed from Makerere University.  Seed companies sell certified seed to farmers at prices ranging between 2500 – 4000 Ush per kg. All the available varieties were being promoted by at least one of the seed companies, with Maksoy 3N being the most popular.

Over 85% of the farmers sold soybean produced, while 92% of the farmers participated in soybean marketing. Mean farm gate soybean price ranged from 1155 – 1571 Ush per kg depending on region. Considering all the data collected, the price varied from 600 – 2500 Ush per kg. However, 59% of the farmers reported that price paid to them was low.

Soybean is mainly a cash crop for 62% of the respondents who indicated that they don't eat soybean at home. The exception was in West Nile where 100% of the respondents indicated that they consume soybean.  Soybean is mainly consumed as roasted snack, ground flour, cooked and fried.  About 47% respondents used soybean as source, flour (14%), soybean milk (11%) and beverages (5%).

The available processing capacity of the established soybean processing mills range from 2-300 tones per day. However they don't have enough materials to process and are experiencing a deficit of 5 -140 tones per day. This challenges calls for enhanced production of oil seeds to satisfy the demand created by the oil processing firms.

# 1.   INTRODUCTION

## 1.1   BACKGROUND

The agricultural sector is among the key drivers of Uganda's economic growth due to its contribution to employment, food security, livelihoods and foreign exchange. The sector accounts for 25% of the nation's Gross Domestic Product (GDP) and employs approximately 70% of the active labour force. Agricultural products also contribute to 80% of total exports.

According to the Global Hunger Index (GHI) 2015, a score of 27.6 means that Uganda is not yet food self-sufficient. Large segments of the population grapple with food insecurity and malnutrition. The number of undernourished has more than doubled over the past two decades (1990-2016). Prevalence of malnutrition is rampant among children and women of reproductive age. Notably, about 14.1% children under 5-years are underweight, 33.7% are stunted and 4.8% are affected by wasting.

Soybean (Glycine max L) is the world's most important vegetable oil crop, providing the cheapest source of protein for both human and livestock diets. Its protein content (40%) is unrivalled among crops, in addition to high content (20%) of quality edible oil.  Soybean protein contains all the essential amino acids; and contains significant amounts of minerals (Fe, Zn, Ca, Mg); the oil is 85% unsaturated comprised of linoleic and oleic acid shown to reduce the risk of heart disease. Therefore, soybean can boost the nutritional status of individuals and communities involved in its production and utilization.

Since 2002, the Soybean Breeding and Seed Systems Program with support from the Ministry of Agriculture, Animal Industry and Fisheries - Vegetable Oil Development Project (MAAIF - VODP), Alliance for a Green Revolution in Africa (AGRA) and Regional Universities Forum for Agricultural Development (RUFORUM) successfully bred, developed and released improved high yielding, early maturing and rust resistant soybean varieties. In chronology of release, the varieties are Maksoy 1N and Namsoy 4M (2004), Maksoy 2N (2008), Maksoy 3N (2010), Maksoy 4N and Maksoy 5N (2013). Concurrently, seed multiplication and dissemination and capacity strengthening have been implemented to increase soybean productivity, improve income from soybean, and encourage local production in order to combat protein malnutrition among smallholder households.

Anecdotal evidence from project reports indicate that the released varieties have led to higher crop yields and greater marketing opportunities among farmers and processors. However, actual impact of the released varieties on the livelihoods of key beneficiaries (smallholder farmers and processors) has not been established. Impact assessment can provide extremely useful feedback on the relevance of project interventions and designing remedial strategies to ensure greater program impact in the future. Therefore, this study was conducted to establish the impact of the newly released soybean varieties and research activities from 2002 to date.

## 2. RESEARCH METHODOLOGY

### 2.1 STUDY SITES

The study took place in selected districts in the northern, eastern, central and western regions of Uganda where significant program activities including training of farmers groups have been implemented. The districts covered were Arua and Yumbe in northwestern, Apac, Kole, Lira, and Oyam districts in the north, Jinja, Bugiri, Iganga, Budaka, Mayuge, Tororo and Busia districts in the east, Luwero district in the central and Kamwenge, Isingiro and Kasese in western Uganda (Figure 1).

### 2.2 SAMPLED HOUSEHOLDS

A total of 291 households were interviewed (Table 1). The number of households growing soybean was used to estimate the number of households interviewed. More samples were drawn from northern than any other region because it is the leading soybean producing region in the country. Samples were drawn using random procedures from membership lists of groups growing soybean availed by various organizations promoting soybean production and marketing.

### 2.3 DATA COLLECTION AND ANALYSIS

Data collection involved interviews with households, and key informant interviews and other stakeholders in soybean sub-sector including representatives from NGOs, for-profit companies including seed companies and soybean processors and CBOs to assess impact. Household interviews were based on a questionnaire that focused on selected household characteristics and assets, soybean production, marketing and consumption, other crops grown, and contribution of soybean to household income and food security. Descriptive statistics (means and frequencies) were used to expalin the findings of the study.

**Table 1. Sample size for the study**

| District | Number | Percentage |
|----------|--------|------------|
| Oyam | 55 | 18.9 |
| Kasese | 51 | 17.5 |
| Lira | 46 | 15.8 |
| Mayuge | 25 | 8.6 |
| Arua | 13 | 4.5 |
| Budaka | 13 | 4.5 |
| Kole | 12 | 4.1 |
| Kaliro | 11 | 3.8 |
| Yumbe | 11 | 3.8 |
| Isingiro | 11 | 3.8 |
| Bugiri | 9 | 3.1 |
| Kamwenge | 9 | 3.1 |
| Luweero | 8 | 2.7 |
| Tororo | 8 | 2.7 |
| Busia | 5 | 1.7 |
| Apac | 2 | 0.7 |
| Jinja | 1 | 0.3 |
| Iganga | 1 | 0.3 |
| Total | 291 | 100 |
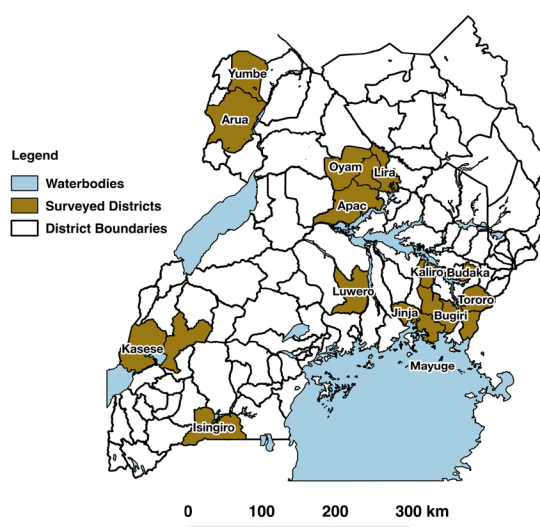


**Figure 1: Map of visited districts**

# 3. FINDINGS FROM THE STUDY

## 3.1 HOUSEHOLD CHARACTERISTICS AND SELECTED ASSETS
### 3.1.1 HOUSEHOLD CHARACTERISTICS

**Gender, Age and Marital status:** There were more males (67.4%) than females (32.6%) among the respondents. In 93% of the interviews, the respondents were either household heads or spouses to the household head. Those few outside this category were children (5%) and a relative (3%) to the household head. Of the households interviewed, 92% were male-headed. In terms of age, the average age was 46 (SD=13.4). Northern region had the highest mean age of 47.28 and central, the lowest at (44.75) (Table 2).

**Table 2: Age of household head (N=291)**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Northern | 47.28 | 14.46 | 23 | 87 |
| Western | 45.87 | 13.65 | 23 | 75 |
| West Nile | 46.79 | 11.62 | 25 | 67 |
| Eastern | 45.53 | 11.40 | 25 | 74 |
| Central | 44.75 | 15.87 | 23 | 72 |

**Marital status, household size and main occupation:** Most (83.3%) household heads were married. Up to 17.2% were polygamous marriages (Figure 2). The average size of the households was 7.4 (SD=3.4). The highest mean household size was observed in eastern region with 9.9 (SD=4.6) and the lowest in central with 4.9 (SD=2.6). The main occupation was predominantly farming (89.3%). Other types of occupation were salaried employment (5.5%), self-employment off farm (4.8%) and off-farm worker (0.3%).
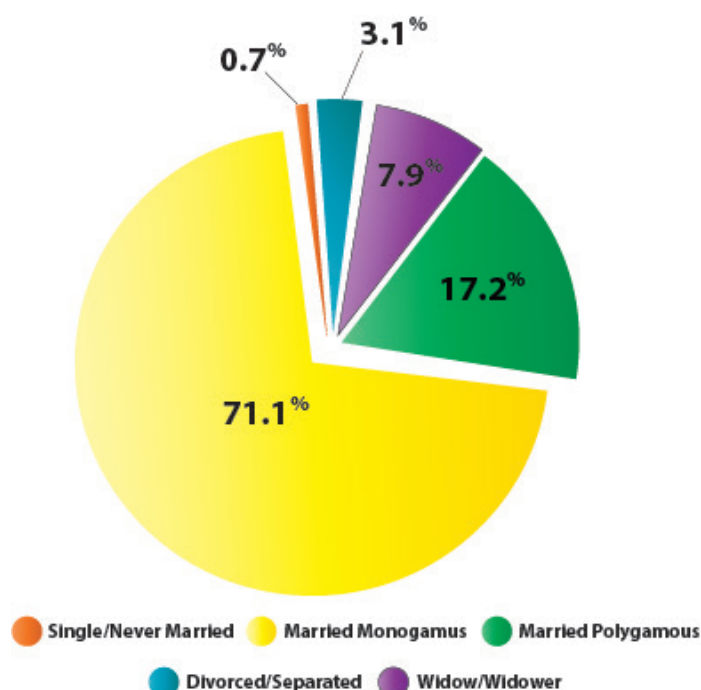


**Figure 2: Marital status of household heads**

**Educational levels:** The levels of education among household heads and their spouses were low (Tables 3 and 4). An overall mean of 7.9 (SD=3.4) for years in schooling indicates most households completed primary school (7 years), with fewer completing Ordinary level. The mean years in schooling were even lower for spouses, majority of who were women. For them, their mean was 6.5 (SD=3.0), indicating that majority did not complete primary school. The minimum year spent in schooling in all regions except eastern was one year of school only.

**Table 3: Education of the household head (Years in school)**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 7.76 | 3.28 | 2 | 15 |
| Western | 8.14 | 3.78 | 2 | 16 |
| West Nile | 8.25 | 3.57 | 3 | 15 |
| Eastern | 9.22 | 3.58 | 3 | 18 |
| Central | 6.12 | 2.80 | 2 | 10 |

**Table 4: Education of the household head spouse (Years in school)**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 5.92 | 2.54 | 1 | 15 |
| Western | 6.92 | 3.49 | 1 | 15 |
| West Nile | 5.36 | 2.77 | 1 | 13 |
| Eastern | 7.79 | 3.41 | 2 | 18 |
| Central | 6.29 | 3.73 | 1 | 11 |

## 3.1.2 SELECTED HOUSEHOLD ASSETS

**Type of housing:** In general, most households interviewed had poor housing with many (26.6%) having mud poles (Figure 3). Those with plastered brick walls were 33.4%. The roofing material consisted of iron sheets (61.4%) and grass thatch (38.6%). The floor material was probably the worst part of the housing. Majority (66.8%) had rammed earth as floor. The rest (33.2%) had cement floors. The average number of rooms was 3.4 (SD=1.6). West Nile had the fewest number of rooms of the main house, at 2.5 (SD=1.3). The region with the highest number of rooms is western, at 4.1 (SD=2.1).
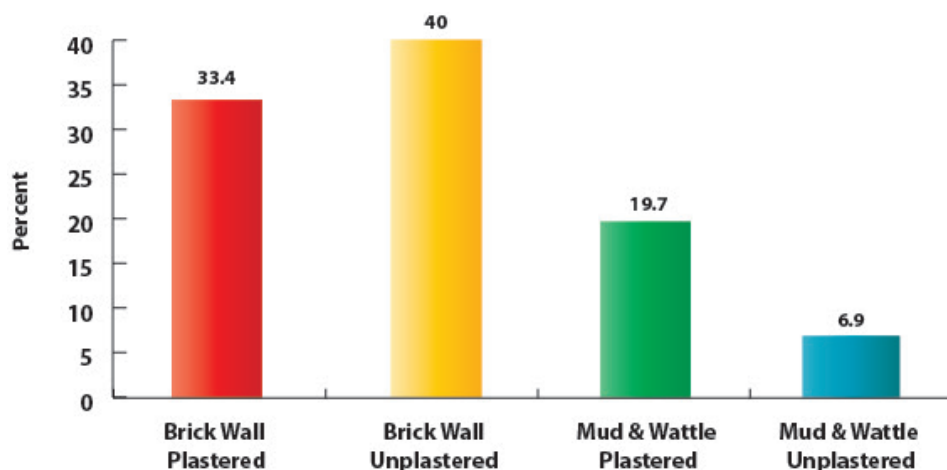


**Figure 3. Type of wall for the main house**

**Ownership, access and cultivated land:** The average amount of land owned in acres among households interviewed was 8.6 (SD=15.1) (Table 5). The high value of standard deviation shows the widespread disparity among households in land ownership. The highest average was observed in West Nile, mainly in Yumbe district, with 13.7 (SD=24.4) acres. The lowest average was found in the central at 5.25 (SD=2.7). In terms of the amount of land that could be accessed for cultivation, the mean size was 6.3 (SD=9.9). Land under cultivation at the time of the interview was 4.3 (SD=3.8).

**Table 5: Regional acres of land owned and accessed for crop production**

| Key charaacteristics | Northern Mean(SD) | Western Mean(SD) | West Nile Mean(SD) | Eastern Mean(SD) | Central Mean(SD) |
|---|---|---|---|---|---|
| Land owned (acres) | 5.84 (7.40) | 7.29 (24.71) | 13.73 (24.36) | 11.05 (16.09) | 5.25 (2.67) |
| Land accessed (acres) | 5.84 (7.40) | 6.53 (24.33) | 7.35 (5.47) | 7.57 (10.19) | 4.25 (1.98) |
| Land crop production (acres) | 4.06 (2.45) | 3.48 (4.10) | 4.60 (2.70) | 6.54 (8.12) | 2.69 (1.22) |

## 3.2    SOYBEAN PRODUCTION

**First season**

Soybean production in the first season (March-July) 2014: The proportion of households who grew soybeans in the first season of 2014 is shown in Figure 4. This was the main growing season because almost all households were able to grow the crop. In the central, all those interviewed grew the crop in the first season. In all regions except eastern, over 91% grew soybeans in the first season. All the farmers interviewed in central were contract seed growers which explains the high percentage recorded.
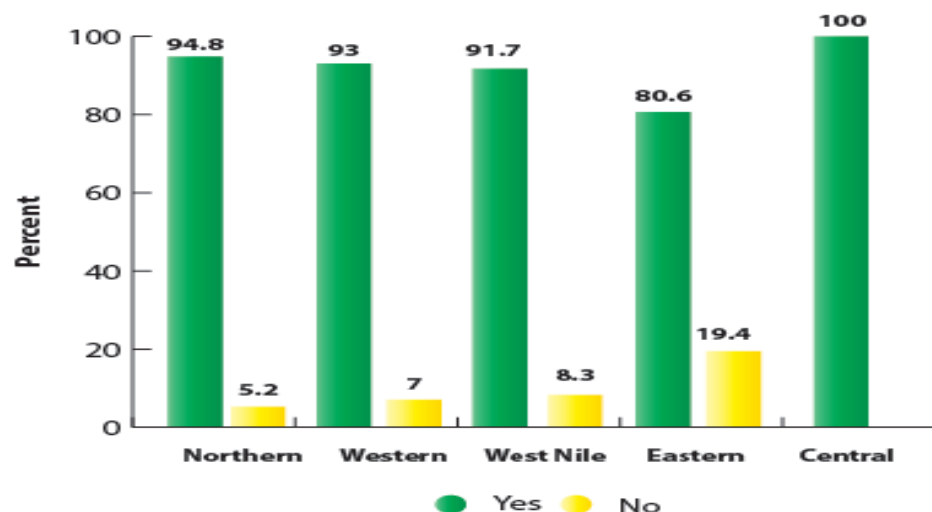


**Figure 4: Proportion of households that grew soybeans in the first season 2014**

The most commonly grown variety was Maksoy 1N at 42.7%. As in the second season, Maksoy 3N, came second with 31.8% households growing it. The other varieties grown include Maksoy 2N (13.6%), local variety (6.6%), Namsoy 4N (3.5%) and Nam 2 (1.7%). In terms of the amount of land under soybean cultivation in this season, the overall mean average was 1.09 (SD=0.62) acres. There was slightly more land under cultivation in this than the second season. The region with most land under soybeans among households was northern with 1.67 acres (Table 6). West Nile had the least amount of land under soybean cultivation at 0.58 acres though slightly more than in the second season.

**Table 6: Total size of acres grown in season 1**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Northern | 1.67 | 1.04 | 0.25 | 5.00 |
| Western | 1.02 | 0.52 | 0.25 | 3.00 |
| West Nile | 0.58 | 0.44 | 0.25 | 2.00 |
| Eastern | 1.44 | 0.82 | 0.25 | 3.00 |
| Central | 0.76 | 0.28 | 0.33 | 1.00 |

## Second season

Soybean production in second season (August-December) 2014: The proportion of all the households that grew soybean in the second season of 2014 is indicated in Figure 5. Most farmers in eastern (90.4%) and western (83.1%) grew the crop during this season. In northern, central and west Nile, few farmers grew the crop among those interviewed.
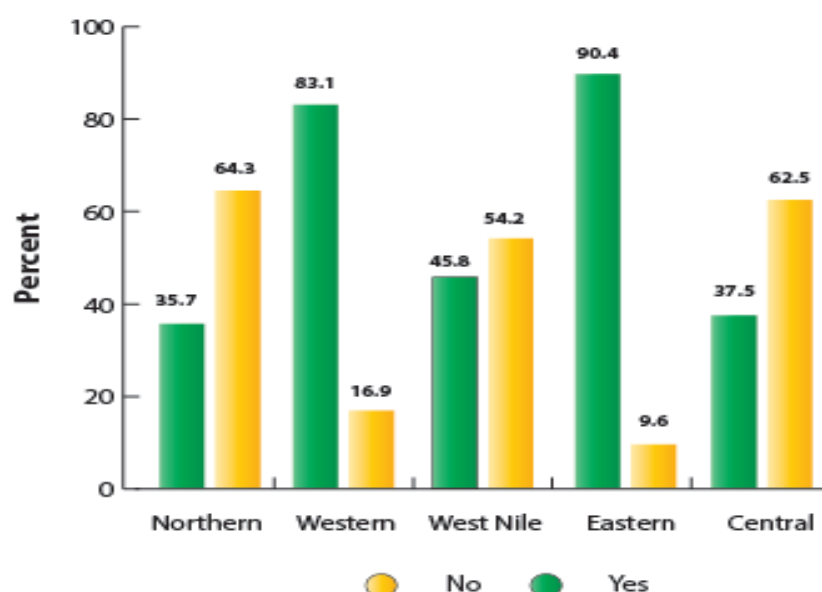


**Figure 5: Proportion of households that grew soybeans in the second season 2014**

In terms of the varieties grown, nearly half (43%) grew Maksoy 1N, followed by Maksoy 3N at 34%. The other varieties grown were: Maksoy 2N (13.9%), local variety (4.6%) and Namsoy 4N (3.6%). The total size of land under soybean cultivation in this season is indicated in Table 7. The overall mean land size in acres was 0.94 (SD=0.57). The biggest and smallest amount of land allocated to soybeans was in eastern and west Nile region at 1.58 and 0.45 acres respectively.

**Table 7: Total size of land under soybean in acres in season 2**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Northern | 0.92 | 0.79 | 0.06 | 3.00 |
| Western | 1.02 | 0.47 | 0.13 | 3.00 |
| West Nile | 0.45 | 0.20 | 0.25 | 0.75 |
| Eastern | 1.58 | 1.05 | 0.25 | 5.00 |
| Central | 0.75 | 0.35 | 0.50 | 1.00 |

**Land preparation:** There were three main ways of preparing land for soybean cultivation. These were manual using the hand hoe, animal traction and tractor. In west Nile and the central region, all those interviewed used the hand hoe for land preparation. Animal traction was prevalent in eastern, northern and western. Farmers in eastern used more animal traction (59.4%) than the hand hoe (35.9%). It was more or less equal for among soybean farmers in northern region, with slightly more (52.3%) using manual labor compared to animal traction (47.7). None of the farmers in West Nile used animal traction (Figure 6).
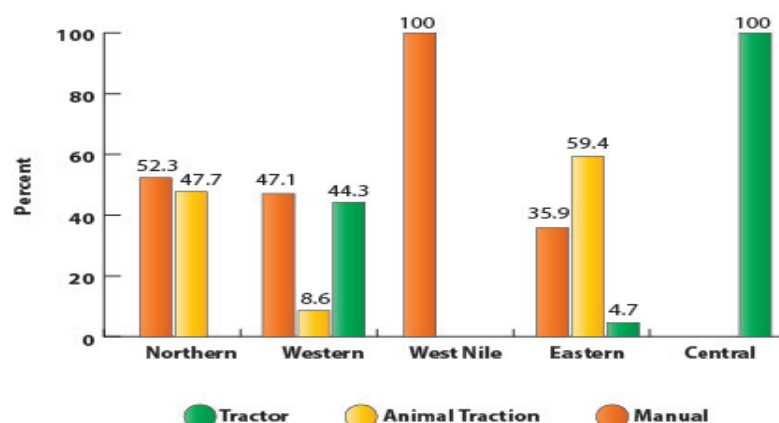


**Figure 6: How land was prepared for soybean cultivation**

In terms of sources of manual labor for land preparation, 41.3% of the households used both household and hired labor. About 34.5% depended on labor within the household. The rest sought assistance from self-help groups. A gender analysis in land preparation indicates that both men and women participated actively. However, in the eastern and western regions, in 37.5% and 19% of the households respectively, only men prepared the land (Figure 7).
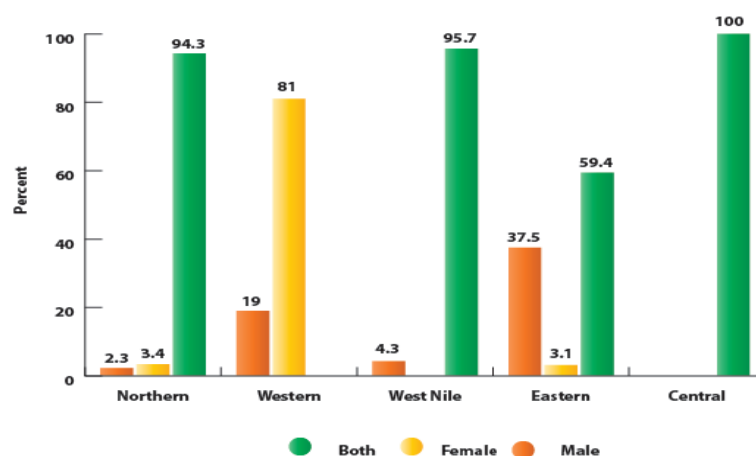


**Figure 7: Gender involvement in land preparation**

**Sources of soybean seed:** The source of seeds planted was mainly from the local market. Up to 27.4% of the housed purchased seed from the local market (Table 8). Some (17.1%) received soybean seeds from an NGO. Others (14.9%) got seeds from relatives, friends and in-laws. The Soybean Breeding Program, also featured among sources of soybean seeds, with 8.5% getting seeds directly from Makerere University.

**Table 8: Sources of soybean seed**

| Source of seeds | Percentage |
|---|---|
| Purchased from local market | 27.4 |
| NGO | 17.1 |
| Relatives/Friends/Neighbor | 14.9 |
| Makerere University | 8.5 |
| Exporter | 7.8 |
| Purchased from a stockiest | 7.1 |
| Farm saved seed | 5.7 |
| CBO | 5.7 |
| RECO | 2.5 |
| VODP | 1.8 |
| NAADS | 0.7 |
| NARO | 0.7 |

**Soybean planting:** The method of soybean planting was predominantly row planting. All those interviewed in northern and central regions practiced row planting. In western, eastern and west Nile very few farmers, 7.2%, 6.1% and 4.3% respectively, planted soybeans by broadcasting. Almost all farmers, 95.7%, planted manually using the hand hoe. The rest used planters pulled by oxen. As observed in planting, the main source of labor was both household and hired (51.7%), household only (39.2%) and hired labor only (9.1%). Various spacing between rows and between plants were used. In fact the question on what spacing was used elicited 42 different types of responses. This varied spacing was partly because of intercropping in a few cases. Although majority (82.3%) of the farmers grew soybeans as a sole a crop, 17.7% did intercropping. This practice was more prevalent in the central and eastern regions, where up 42.9% and 34.3% respectively, intercropped soybeans with other crops (Figure 8). Majority (81.4%) of those who intercropped grew soybeans with maize. Other crops used as intercrops included banana, beans, cassava and potatoes. Many (57.8%) cited the need for food security as the reason behind intercropping. Others (22%) mentioned the limited amount of land they had for farming and the need to have both food and income (20%).

**Weeding:** Majority of the farmers weeded soybeans two times. Less than 8%, except in central region weeded once (Table 9). There were also those who weeded on four different occasions in northern and western Uganda. Weeding was mostly done by both men and women in all the regions. In fewer cases, women were the only ones weeding in eastern (9.2%), West Nile (8.7%) and western (5.7%) regions. In West Nile, eastern and northern, a small proportion, 4.3%, 3.1% and 0.9% of
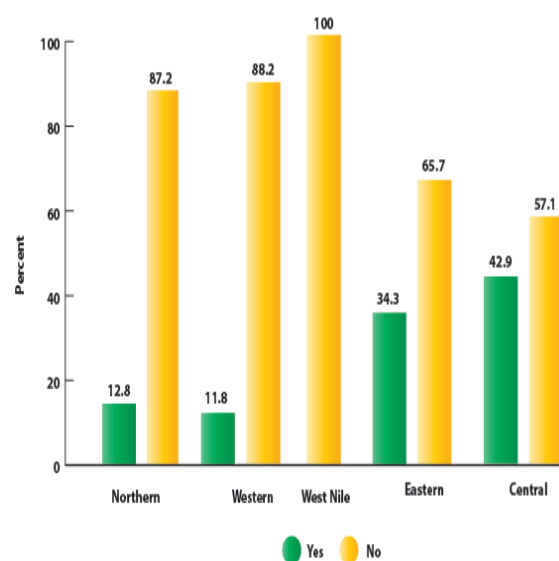


Figure 8: Intercropping soybeans

households respectively, had weeding done by men only. The source of labor for weeding was both household and hired (49.5%), household only (36%) and hired labor only (14.5%).

**Table 9: Number of times soybean was weeded before harvesting**

| Regions | Number of times of weeding (%) | | | |
|---|---|---|---|---|
| | Once | Twice | Thrice | Four times |
| Northern | 0.9 | 68.8 | 22.9 | 7.3 |
| Western | 7.1 | 62.9 | 28.6 | 1.4 |
| West Nile | 0 | 65.2 | 34.8 | 0 |
| Eastern | 7.7 | 81.5 | 10.8 | 0 |
| Central | 12.5 | 87.5 | 0 | 0 |

**Fertilizer application:** An overwhelming majority did not apply fertilizers (Table 10). No household applied any inorganic fertilizer in West Nile region. The western region had the highest proportion of those who applied inorganic fertilizers, at 23.1%, closely followed by eastern region at 19.2%. Among those who applied inorganic fertilizers in the western and eastern regions, 55.6% and 31.8% respectively said they usually applied inorganic fertilizers every season.

**Table 10: Application of inorganic fertilizers in soybeans by farmers**

| Region | Inorganic fertilizer application (%) | |
|---|---|---|
| | Yes | No |
| Northern | 7.0 | 93.0 |
| Western | 23.1 | 76.9 |
| West Nile | 0 | 100.0 |
| Eastern | 19.2 | 80.8 |
| Central | 12.5 | 87.5 |

**Table 11: Inorganic fertilizer application in the first season 2014**

| Region | Inorganic fertilizer (%) | |
|---|---|---|
| | Yes | No |
| Northern | 4.8 | 95.2 |
| Western | 12.1 | 87.9 |
| West Nile | 0 | 100.0 |
| Eastern | 16.3 | 83.7 |
| Central | 12.5 | 87.5 |

During the first season of 2014, the proportions of those who applied inorganic fertilizers are indicated in Table 11. The type of fertilizers applied were NPK and foliar spray in northern Uganda, DAP and foliar spray in western, foliar spray, SSP and TSP in central Uganda. These fertilizers were mainly sourced from a stockist in the northern, NGO, Reco and a CBO in western, stockist, local market and VODP in eastern and stockist in central Uganda.

When it comes to application of organic fertilizer, the trend was similar to that of inorganic fertilizers. Very few applied them (Table 12). West Nile, where no inorganic fertilizer was applied leads with a marginal 12.5% compared to the central where nobody applied any manure or compost. When asked about the use of rhizobium inoculants in soybeans, only 10 households said they used it. Their sources of the biological fertilizer were Mayuge District Farmers Association, NARO, Makerere University and an NGO called Millenium Villages.

**Table 12: Application of organic fertilizers in fields**

| Regions | Organic fertilizer application (%) | |
| --- | --- | --- |
| | Yes | No |
| Northern | 3.0 | 97.0 |
| Western | 7.7 | 92.3 |
| West Nile | 12.5 | 87.5 |
| Eastern | 4.8 | 95.2 |
| Central | 0 | 100 |

**Problems experienced in soybean production**: Problems experienced by farmers during land preparation, planting weeding and fertilizer application are summarized in Table 13. Land preparation presented a greater problem than the rest of the activities in growing soybeans. This problem was cited by 53.2% of all respondents. There were virtually no problems in fertilizer application with only 0.4% indicating that this indeed was a problem. Part of it is because very few applied fertilizers any way.

**Table 13: Problems experienced during production of soybeans**

| Activities | Problems Experienced | |
| --- | --- | --- |
| | Yes | No |
| Land preparation | 53.2 | 46.8 |
| Planting | 46.4 | 53.6 |
| Weeding | 51.1 | 48.9 |
| Fertilizer application | 0.4 | 99.6 |

The main problems in land preparation were lack of labor (46.6%), high labor cost (26%), dry soils (21.2%) and lack of farm implements (6.2%). In planting, the main problem was still lack of labor (48%). Other problems relate to labor high costs, drought and lack of farm implements. Similarly, the main problem in weeding was also related to access to labor, cited by 74.3% of all respondents (Figure 9). Other problems in weeding were rapid growth of weeds, drought and in some cases too much rain.



Figure 9: Problems experienced in weeding soybeans

3.5%  1.4%  20.8%  52.8%  21.5%

Lack of Labour  Labour Cost  Alot of Weeds  Alot of Rain  Drought
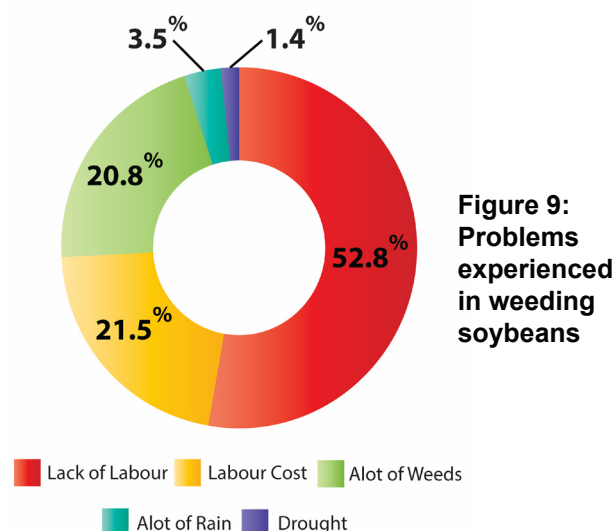
As far as fertilizer application was concerned, the majority of the respondents claimed that they did not have any problems related with fertilizer application because they never applied it in the soybean gardens. There were only two respondents who said that the process of applying fertilizers in their gardens was difficult. Other problems affecting soybean production mentioned by farmers are summarized in Table 14.

**Table 14: Other problems experienced by farmers in producing soybean**

| Problems experienced | Percentage |
|---|---|
| Extreme weather changes | 26.1 |
| Pests | 22.6 |
| Lack of labor | 12.9 |
| Weeds | 9.8 |
| Diseases | 9.1 |
| Lack of improved varieties | 6.6 |
| Low soil fertility | 5.2 |
| Lack of access to inputs | 5.2 |
| Vermin/rodents | 2.1 |
| Small land holding | 0.3 |

**Harvesting:** On how farmers tell when soybeans are ready for harvesting, most cited the time when the pods start drying, the plant dying and leaves have been shaded (Table 15).

**Table 15: How farmers tell when soybeans are ready for harvesting (%)**

| Region | Pods drying | Plant dries | Shading of leaves |
|---|---|---|---|
| Northern | 25.7 | 25.7 | 48.6 |
| Western | 20.0 | 30.0 | 50.0 |
| West Nile | 43.5 | 30.4 | 26.1 |
| Eastern | 27.0 | 17.5 | 55.6 |
| Central | 37.5 | 0 | 62.5 |

As for other operations, most labor for harvesting comes from households (Table 16). The gender involved in harvesting is mostly both men and women (91.2%). In some cases women (5.1%) and men (3.3%) harvested alone.

**Table 16: Type of labor used for harvesting soybean (%)**

| Region | Household labor | Household and hired labor | Hired labor |
|---|---|---|---|
| Northern | 48.1 | 46.3 | 5.6 |
| Western | 49.3 | 46.4 | 4.3 |
| West Nile | 82.6 | 17.4 | 0 |
| Eastern | 44.4 | 44.4 | 11.1 |
| Central | 37.5 | 62.5 | 0 |

Experience of shattering soybeans was reported by 35% of the households. Shattering occurred due to delayed harvesting (54.6%), type of variety planted (26.8%) and drought (18.6%). Details of shattering by all varieties in presented in table 17. Shattering was

most experienced by those who grew local variety (50%), followed by Nam 2 (50%) and Namsoy 4M (40%). Shattering was solely attributed to the type of variety. In Nam 4, it was mainly (50%) due to delayed harvesting. Up to 39.7% of those who grew Maksoy 1N experienced shattering, mainly caused by delayed harvesting (54.3%). Many (44.4%) of those who experienced shattering of Maksoy 2N attributed to the type of variety. Apparently, Maksoy 2N shatters more than the other recently released varieties.

Table 17: Shattering and its causes in soybean

| Variety | Experienced shattering | | Cause of soybean shattering | | |
|---|---|---|---|---|---|
| | Yes | No | Delayed harvesting | Variety | Drought |
| Maksoy 1N | 39.7 | 60.3 | 54.3 | 21.7 | 23.9 |
| Maksoy 2N | 27.8 | 72.2 | 44.4 | 44.4 | 11.1 |
| Maksoy 3N | 25 | 75 | 57.9 | 26.3 | 15.8 |
| Local variety | 50 | 50 | 44.4 | 44.4 | 11.1 |
| Namsoy 4M | 40 | 60 | 50 | 25 | 25 |
| Nam 2 | 50 | 50 | 0 | 100 | 0 |

Other problems experienced in harvesting were reported by 67.5% of the households. These were difficulty in transporting   soybeans from the gardens (34.3%), extremes in weather patterns(24.3%) and lack of labor (23.8%) (Figure 10). Asked the two most challenging operations in soybean production, farmers mentioned harvesting (32.6%), threshing (27.3%), weeding (25.5%) and planting (14.6%).

**Yield farmers obtained from soybeans:** The findings of the estimated yield of soybeans grown are indicated in Table 18. The yields were relatively lower than the potential yield. The overall mean yield was 400.68 kg/acre (SD=441.98) . There was wide variation in yield levels as indicated by the high value of standard deviation and differences between minimum and maximum values. The northern region was the highest producer with average yields of 728.7 kg. The lowest output was observed in west Nile with an average of only 100.4 kg/acre.

Table 18: Overall yield (kg/acre) in the first season in 2014

| Region | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Northern | 728.7 | 812.8 | 17 | 4080 |
| Western | 282.3 | 516.6 | 6 | 4000 |
| West Nile | 100.4 | 72.8 | 15 | 300 |
| Eastern | 632.6 | 612.3 | 6 | 3220 |
| Central | 259.4 | 195.4 | 70 | 625 |

Mean yields are shown in Table 19. As noted earlier, the yield levels were generally very low. Relatively, the northern region had the highest yield per acre 375.9 kg/acre (SD=250.5). West Nile had the lowest average yield per acre at 224.1 kg/acre (SD=162.8).
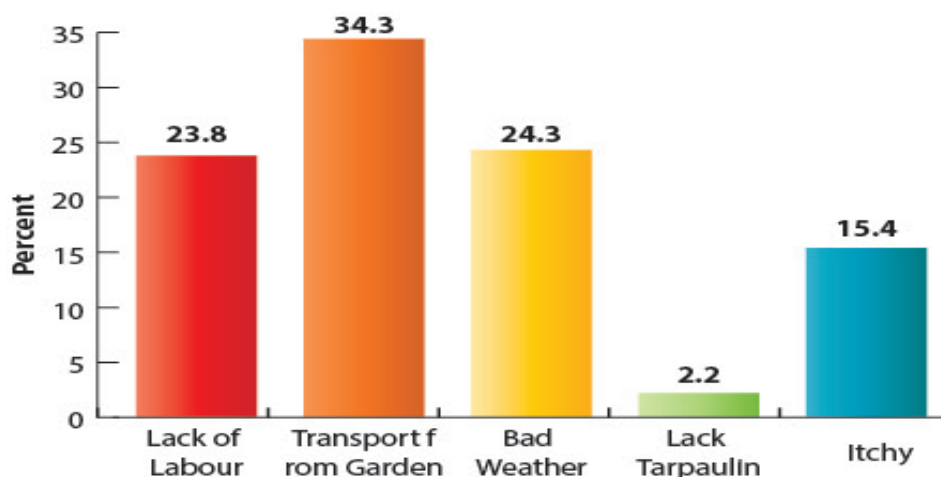
**Figure 10: Other problems apart from shattering experienced in harvesting soybeans**

**Table 19: Mean yield of soybeans in kg/acre in the first season 2014**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 375.9 | 250.5 | 16 | 1480 |
| Western | 303.9 | 257.6 | 35 | 1000 |
| West Nile | 224.1 | 162.8 | 50 | 800 |
| Eastern | 348.6 | 217.2 | 30 | 867 |
| Central | 318.5 | 224.7 | 70 | 625 |

In terms of how the harvested crop was used, on average 85.7% of the households sold it. Others gave some of it away to relatives and friends (17%), consumed at home (16.6%), and kept as seed (15.8%). Up to 12.6% on average was lost in post-harvest handling.

### 3.3  HARVESTING AND STORAGE

Farmers took on average 7.2 (SD=4.8) days between harvesting and threshing of soybeans, with a minimum of 1 day and a maximum of 21 days. The reasons for taking this length of time included: (1) Allowing time for uniform drying (29.2%), (2) Lack of labor (27.7%), (3) Complete harvesting all the soybeans, and (4) too much rain. There was also the issue of being too busy with other errands. All the farmers threshed soybeans by the crop with sticks. Before that, drying of the crop after harvesting takes place on carpets or tarpaulin in 57.1% of the households. Other farmers dried soybeans on bare ground (37.4%), surface smeared with cow dung (3.3%) and on rocks (1.8%).

There were problems faced in drying soybeans after harvesting. These were lack of clean and hard surface for drying (53.4%), too much rain (40.6%), domestic animals such as goats eating the crop (3%), theft (1.5%), pests (1%) and breakage of grains due to over drying (0.5%). Some problems were also experienced during storage. These included pests, especially rodents (63.6%), lack of storage space (29.5%) and theft (4.5%). Some other observations were darkening of seed color and moisture in the stores. The storage period was around one month before selling (Table 20).

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**Table 20: Storage period in months before sale of soybeans**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 0.58 | 0.55 | 0.01 | 3.00 |
| Western | 0.74 | 0.72 | 0.03 | 3.00 |
| West Nile | 1.73 | 0.88 | 0.01 | 3.00 |
| Eastern | 1.41 | 0.90 | 0.01 | 3.00 |
| Central | 0.38 | 0.39 | 0.03 | 1.00 |

## 3.4    VARIETAL KNOWLEDGE AND PREFERENCE

When asked to name all varieties known to them, the following were the responses recorded (Table 21). We asked them to name the most preferred variety. The most widely known variety was Maksoy 1N, cited by 69.8% of the households. This was followed by Maksoy 3N (42.5%) and Namsoy 4M.

**Table 21: Soybean varieties known by farmers (N=291)**

| Variety | Frequency | Percent |
|---------|-----------|---------|
| Maksoy 1N | 199 | 69.8 |
| Maksoy 3N | 121 | 42.5 |
| Namsoy 4M | 94 | 33.0 |
| Maksoy 2N | 90 | 31.6 |
| Local Variety | 27 | 9.5 |
| Nam 2 | 6 | 2.1 |
| Nam 1 | 2 | 0.7 |

**Percentages add up to more than 100 because of multiple responses. Each household mentioned all soybean varieties they knew

In comparing regional popularity of the varieties, we found that Maksoy 1N was most popular in all the regions except in central where Maksoy 3N predominated at 87.5% (Table 22). More local variety is grown in western Uganda than any other region. We established the most preferred soybean variety. The results are presented in Table 23. The most preferred were Maksoy 1N and Namsoy 4M, both cited by 27.5% of the

**Table 22: Varieties known by region**

| Region | Freq. | Scale | Maksoy 1N | Maksoy 2N | Maksoy 3N | Namsoy 4M | Nam 1 | Nam 2 | Local Variety |
|--------|-------|-------|-----------|-----------|-----------|-----------|-------|-------|---------------|
| Northern | 115 | Region | 75.7 | 30.4 | 40.0 | 46.1 | 0.9 | 5.2 | 8.7 |
| | | National | 30.5 | 12.3 | 16.1 | 18.6 | 0.4 | 2.1 | 3.5 |
| Western | 71 | Region | 65.7 | 23.9 | 17.9 | 32.8 | 1.5 | 0.0 | 16.4 |
| | | National | 15.4 | 5.6 | 4.2 | 7.7 | 0.4 | 0.0 | 3.9 |
| West Nile | 24 | Region | 70.8 | 29.2 | 66.7 | 20.8 | 0.0 | 0.0 | 8.3 |
| | | National | 6.0 | 2.5 | 5.6 | 1.8 | 0.0 | 0.0 | 0.7 |
| Eastern | 73 | Region | 70.4 | 42.3 | 56.3 | 19.7 | 0.0 | 0.0 | 4.2 |
| | | National | 17.5 | 10.5 | 14.0 | 4.9 | 0.0 | 0.0 | 1.1 |
| Central | 8 | Region | 12.5 | 25.0 | 87.5 | 0.0 | 0.0 | 0.0 | 12.5 |
| | | National | 0.4 | 0.7 | 2.5 | 0.0 | 0.0 | 0.0 | 0.4 |

households. Maksoy 1N is most preferred in western (47.5%). Maksoy 2N was the most preferred variety in west Nile region (39.1%). Namsoy 4M was the most liked in eastern Uganda (51.7%).  It is important to note that varieties Maksoy 1N and  Namsoy 4M were released in 2004 and have had greater time of promotion. However variety Maksoy 3N which was released in 2010 has received more acceptability than Maksoy 2N which was released in 2008. This may suggest that Maksoy 3N has a higher rate of adoption than Maksoy 2N.

**Table 23: Preferences for soybean varieties**

| Region | Scale | Most preferred soybean varieties in the different regions (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Maksoy 1N | Maksoy 2N | Maksoy 3N | Namsoy 4M | Nam 1 | Nam 2 | Local Variety |
| Northern | Region | 29.9 | 5.6 | 21.5 | 21.5 | 15.9 | 1.9 | - |
| | National | 13.7 | 2.6 | 9.9 | 9.9 | 7.3 | 0.9 | 1.7 |
| Western | Region | 47.5 | 12.5 | 12.5 | 20.0 | 2.5 | - | 5.0 |
| | National | 8.2 | 2.1 | 2.1 | 3.4 | 0.4 | - | 0.9 |
| West Nile | Regional | 13.0 | 39.1 | 30.4 | 8.7 | 4.3 | - | 4.3 |
| | National | 1.3 | 3.9 | 3.0 | 0.9 | 0.4 | - | 0.4 |
| Eastern | Region | 16.7 | 1.7 | 25.0 | 51.7 | 5.0 | - | - |
| | National | 4.3 | 0.4 | 6.4 | 13.3 | 1.3 | - | - |
| Central | Region | - | - | 100.0 | - | - | - | - |
| | National | - | - | 1.3 | - | - | - | - |
| Total | | 27.5 | 9.0 | 22.7 | 27.5 | 9.4 | 0.9 | 3.0 |

Soybean varieties were rated based on seven key attributes including drought tolerance, minimum shattering, high yielding, early maturity, big seed size, preferred color, and disease resistance (Table 24). For drought tolerance, Maksoy 1N was rated the best (3.66) followed by Maksoy 2N (3.48). In terms of minimum shattering, Maksoy 2N, Maksoy 3N and Maksoy 1N were rated as the best. High yields were Maksoy 3N, Maksoy 2N and Namsoy 4M. However, the Maksoy varieties 1N, 2N and 3N were the most early maturing. Maksoy 3N, 2N and Namsoy 4M were rated with the biggest seed (4.19, 4.09 and 4.04, respectively). Maksoy 2N had the farmer preferred color (4.05). Maksoy 2N, 1N and 3N were the most disease resistant. Overall, Maksoy 3N, 2N, 1N and Namsoy 4M were rated with the best attributes.

**Table 24: Mean rating for the seven different varieties**

| Variety | Overall rating | Drought tolerance | Minimum shattering | High yielding | Early maturity | Big seed size | Preferred color | Disease resistance |
|---|---|---|---|---|---|---|---|---|
| Maksoy 1N | 3.62 | 3.66 | 3.66 | 3.33 | 4.42 | 3.08 | 3.66 | 3.54 |
| Maksoy 2N | 3.69 | 3.48 | 3.80 | 3.89 | 3.49 | 4.09 | 4.05 | 3.58 |
| Maksoy 3N | 3.69 | 3.32 | 3.77 | 3.99 | 3.30 | 4.19 | 3.82 | 3.43 |
| Local variety | 2.97 | 2.80 | 2.77 | 3.10 | 2.81 | 2.94 | 3.14 | 3.21 |
| Namsoy 4M | 3.45 | 3.28 | 2.91 | 3.80 | 2.91 | 4.04 | 3.69 | 3.54 |
| Nam 1 | 3.00 | 3.25 | 3.00 | 3.25 | 2.75 | 2.50 | 3.50 | 2.75 |
| Nam 2 | 3.11 | 3.25 | 2.75 | 3.25 | 3.25 | 2.75 | 3.25 | 3.25 |

**Rating from 1 to 5, with 5 as the best for that particular attribute

### 3.5 SOYBEAN MARKETING

Almost all (92.4%) of those interviewed participated in marketing soybeans in the last 12 months preceding the interview. They sold the crop in the following places: (1) Community store (37.9%), (2) Farm gate/home (35.3%), (3) Rural market (21.9%), and (4) in the urban market. The prices received by farmers for their crop is displayed in Table 25. Highest average price of 1,517 Ush per kg was received in Eastern. Even though it is a leading soybean growing region, Northern registered the lowest average price of 1,155 Ush per kg. Soybean was mostly bought by wholesalers (34.5%), retailers (18.6%), people in the community for local consumption (17%), processers (12.9%), Community Based Organizations (10.6%) and exporters (6.1%).

**Table 25: Price per Kg received by farmers for their soybean**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 1155.28 | 182.36 | 600 | 2000 |
| Western | 1312.12 | 401.73 | 500 | 2500 |
| West Nile | 1350.00 | 468.48 | 500 | 2000 |
| Eastern | 1517.19 | 436.91 | 900 | 2500 |
| Central | 1500.00 | 0.000 | 1500 | 1500 |

In terms location of the markets, the average distance travelled to the nearest market was 5.7 km (SD=9.8). Farmers in Central region had the nearest markets of less than two kilometers. In the Eastern, farmers travelled on average 14 km to sell soybeans (Table 26).

**Table 26: Distaance (km) to the nearest market where farmers normally sold soybeans**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 2.18 | 2.88 | 0.03 | 18 |
| Western | 5.23 | 9.12 | 1 | 56 |
| West Nile | 5.21 | 4.43 | 1 | 16 |
| Eastern | 14.03 | 30.7 | 0.01 | 210 |
| Central | 1.93 | 2.02 | 0.25 | 5 |

The commons modes of transporting soybeans to the market are indicated in Table 27. Problems of transportation were most severe in West Nile because 35.7% of the household moving soybean to the market on foot. Bicycles were the dominant transport mode in Northern, while vehicle and motorcycles dominated in the Western.

**Table 27: Most common mode of transport to the market**

| Region | Mode of transport (%) | | | |
|--------|------|---------|------------|---------|
| | Foot | Bicycle | Motorcycle | Vehicle |
| Northern | 21.4 | 60.7 | 25.0 | 14.3 |
| Western | 21.4 | 5.7 | 40.8 | 50.0 |
| West Nile | 35.7 | 7.4 | 3.9 | - |
| Eastern | 21.4 | 23.0 | 26.3 | 35.7 |
| Central | - | 3.3 | 3.9 | - |

Of the problems experienced by farmers in marketing soybeans, 58.9% of the respondents acknowledged low prices as the most serious constraint (Figure 11). Meanwhile, about 12.1% and 11.2% identified high transportation costs and poor markets, respectively. Despite being mentioned by few (4.5%) households as a key limitation to marketing, poor road infrastructure is a serious constraints in rural Uganda.
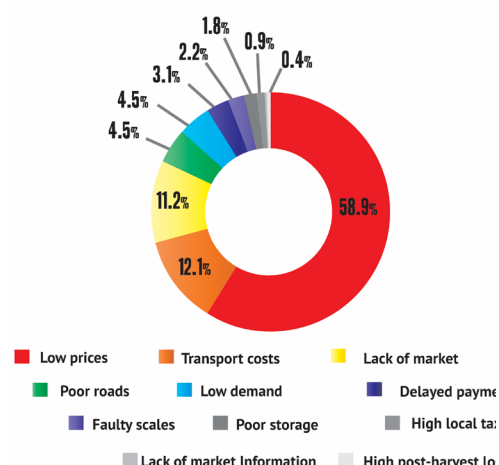
## 3.6    SOYBEAN CONSUMPTION

Soybean is mostly a cash crop in central and northern Uganda. Majority of the households growing the crops reported that they do not eat the crop at home (Table 28). All households growing soybeans in West Nile do eat the crop.



**Figure 11:  Main marketing constraints**

**Table 28: Frequency of soybean consumption at household level**

| Region | Consume soybean at home (%) | |
|---|---|---|
| | Yes | No |
| Northern | 37.7 | 62.3 |
| Western | 78.9 | 21.1 |
| West Nile | 100 | 0 |
| Eastern | 93.1 | 6.9 |
| Central | 37.5 | 62.5 |

About 45% of the households preferred particular varieties for home consumption: Maksoy 1N (37.7%), Maksoy 3N (35.2%), Maksoy 2N (19.7) and Namsoy 4M (7.4%). Varietal preference depended on softness when cooked (33%), sweetness (28.7%), availability (25.3%) and having large seeds (13%). Most (63.2%) prepared soybeans for consumption by roasting. Others by grinding (19.2%), cooked (9.3%) and fried (8.3) the grains. Based on the preparation methods, the crop was mostly eaten in form of snacks (47.1%), source/soup (23%), flour (14.2%), soy milk (10.7%) and as a hot beverage (5%). When it comes to how many times in a week, people eat soybeans, the responses indicate an average of 4.6 times. Frequency of consumption is highest in northern Uganda at 6.6 times and lowest in central with a mean of 2 times a week. West Nile and Eastern regions tie on 5.4 times a week. In the western region, the crop is eaten on average 3.4 times.

## 3.7    PRODUCTION OF OTHER CROPS

Figure 12 shows the main crops grown in the interviewed households. The respondents were asked to name in order of importance, five main crops grown in the household. The list reveals that among the top five crops grown in the households interviewed, soybeans was mentioned more times than any other crop by 18.1%. This is expected because our sampling targeted the main soybean producers. This was followed by beans (15.8%), maize (15.3%), cassava (12.1%) and groundnuts (8.9%).
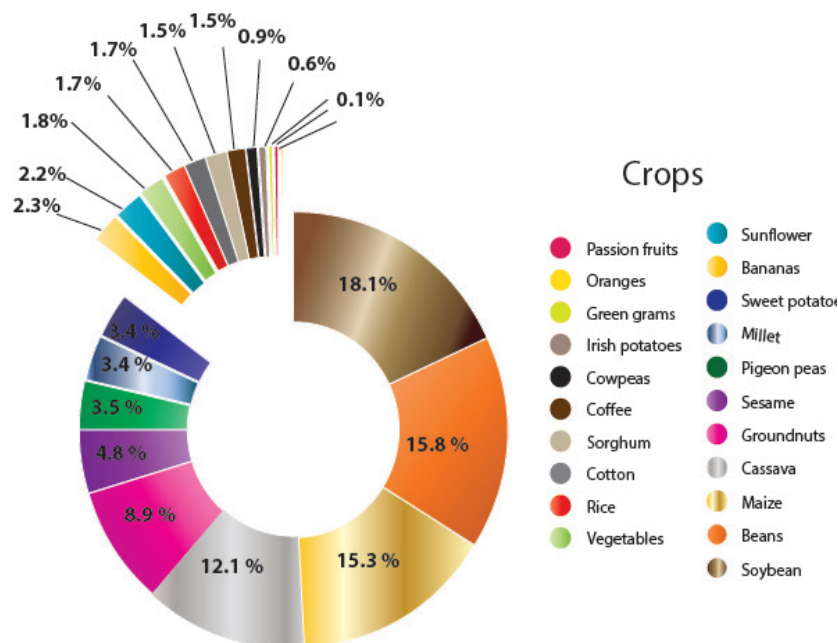
**Figure 12: Major crops grown by households 2014**

## 3.8    INCOME AND FOOD SECURITY
### Sources of household income

Figure 13 presents the main sources of household income as crop sales (68.6%), livestock sales (12.9%) and running own business (9.8%) (Figure 13). The contribution of soybeans to incomes from crop sales is summarized in Table 29. Overall, soybean contributed on average 43.2% of the total household income from crop sales. There were regional disparities though. Soybean contributed highest in Northern with 63%, while the lowest contribution was in West Nile with 31%.
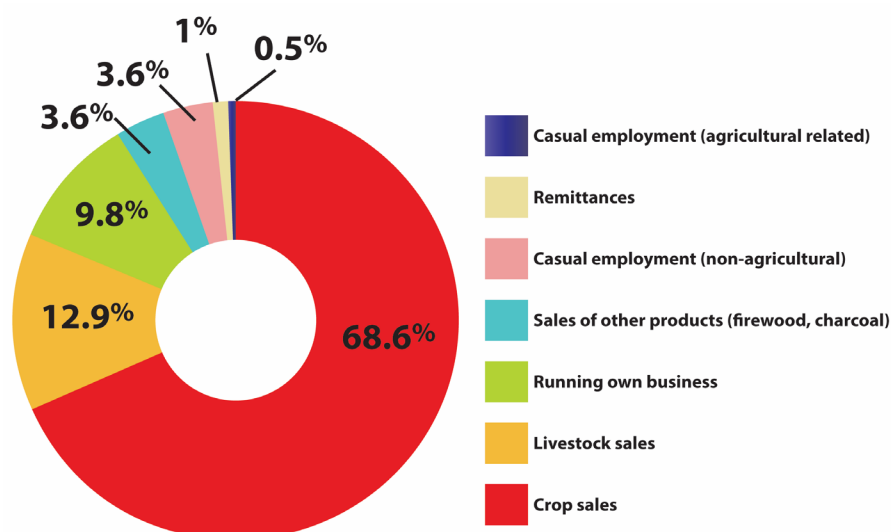


**Figure 13: Household sources of income**

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**Table 29: Percentage income generated from soybeans**

| Region | Mean | Std. Deviation | Minimum | Maximum |
|--------|------|----------------|---------|---------|
| Northern | 63 | 28.12 | 2 | 100 |
| Western | 44 | 23.51 | 1 | 80 |
| Eastern | 43 | 22.77 | 5 | 100 |
| Central | 35 | 20.18 | 10 | 70 |
| West Nile | 31 | 19.56 | 6 | 80 |

## Food security status

There were times when the households experienced food insecurity. Asked if there were months when the household did not have enough food in the past 12 months, 61.8% answered in the affirmative. The most difficult months were April to June in which 14.5%, 22.8% and 27.4% of the households respectively, did not have enough food to meet their needs (Figure 14).
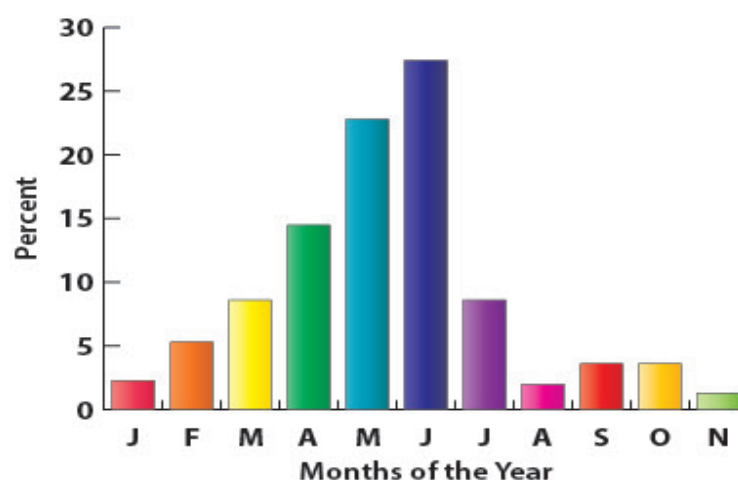


**Figure 14: Months of household food insecurity**

**Overall importance of soybean growing:** When asked if they believed soybean growing beneficial to their households, almost all (97.9%) answered in the affirmative. The main benefits highlighted were: source of income (68.5%), high nutritional value (30%), livestock feed (1%) and improvement of soil fertility (0.5%).

## 3.9    PERSPECTIVES OF STOCKISTS AND PROCESSORS

### Soybean processors

Most soybean processors handled reasonable tons of soybean. Establishing an accurate figure was difficult because some of the organizations considered this information private. However, Ugachick poultry breeders emerged the largest processor, purchasing 350 tons per season followed by SESACO Ltd with 300 tons (Table 31). The main products of processing are Soybean oil, Soybean cake/meal, Animal feeds (mash & pellets), Soy cup, CSB, Soy millet, brown butter, soymilk and soy Yoghurt. The source of the soybean was mainly within the country, northern and eastern regions being the main suppliers. In particular, some processers obtained soybeans from District Farmers' Associations, and cooperative societies.  A few of the companies cited DR Congo as another source of soybean.

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## Processing capacity

The plant capacity per day to process soybeans and other products is generally very high. All processers were operating at very low capacity because they could not get enough of the crop. For instance, A.K oils has an operational capacity of 200 metric tons per day but its actual daily production is less than 60 tons. Mukwano's A.K oils and Mt. Meru's processing plants in Lira have each a capacity in excess of 200 metric tons per day but they handle far less than that because of the limited access to quality grains. However, the other smaller processors have a plant processing capacities ranging between 7 and 20 tons. However, like in the case of the large processors, the small ones also operate below capacity at between 2 and 15 tons.

## Preferred varieties

These were Maksoy 1N, 2N and 3N because of the high yield, High oil content, large sized seed and the high protein content (44-46%). The other crops processed together with soybean were maize, sunflower, cotton seed and palm. Maize and byproducts sunflower and cotton seed were used for formulating animal feeds (Table 30). A main challenge faced by processors was limited supply of soybean as a raw material for their processing operations.

**Table 30: Key characteristics of leading processors**

| Key characteristics | Name of company | | | | | |
|---|---|---|---|---|---|---|
| | A.K Oils | Mt. Meru | Ugachick | Kayebe | RECO | SESACO |
| Purchased soybean (x1000 tons/6months) | 60 | 25 | 350 | 2-3 | - | 300 |
| Processing capacity (x1000 tons/day) | 200 | 300 | 20 | 8-10 | 7 | - |
| Actual production (x1000 tons/day) | <60 | <180 | 12-15 | 2-3 | 3.5 | 300 |
| Gap/Deficit | 140 | 120 | 5-8 | - | - | - |
| Products from soybean | Soybean oil, Soybean cake/meal | Soybean oil, Soybean cake/meal | Animal feeds (mash/pellets) | Baby soya + Nkejje, Soybean sauce | Fortified corn soya blend | Soycup, CSB, Soy millet, brown butter, Soymilk, Yoghurt |
| Most preferred soybean varieties | Maksoy 3N | High oil content variety | Large seeded varieties | Large seeded varieties | Maksoy1 | Maksoy N1 Maksoy N2 |
| Other crops processed | Sunflower | Sunflower | Maize, rice, sunflower, wheat & cotton | Millet, maize, rice & beans | Ground nuts, maize | Millet, maize, groundnuts |
| Most important oil crop processed | Sun flower | Soybean | Soybean | Soybean | Soybean Groundnuts | Soybean |

## Seed companies and stockists

All the seed companies interviewed acquired their soybean seed from Makerere University at 5,000 Ush and 10,000 Ush for foundation and breeders seed, respectively. About 67% of seed companies ranked Maksoy 3N as the best due to its high yield, absence of shattering, early maturity and big seed size. The second and third ranked varieties were Maksoy 2N and Maksoy 1N, respectively. Maksoy 2N was preferred due to its early maturity, big seed size and high demand by farmers and NGOs. However, its only shortcoming being that it has non uniform drying.

## Relationship between seed companies, stockist and farmers

Many of the seed companies sell soybean seed to buyers (farmers) at prices ranging between 2,500/- and 4,000/- per kilo. These companies indicated that they make 2.5%-30% of annual sales from soybean. Two of the three seed companies also have contracts with their clients who include input dealers and farmers who are seed multipliers. All seed companies indicated that they interact with seed breeders for at least once a year while they also interact with Government seed inspectors for at least once a season. The main challenges facing the seed companies included; poor seed germination, unavailable inoculum, high prices that discourage stockists and farmers. Other challenges include high seed cost versus grain cost ratio and low yields in some seasons. The seed companies gave the following advice to soybean breeders, government and farmers for improvement of soybean subsector:

### (a)     Soybean breeders

In order to improve the soybean sub-sector, seed companies advised that breeders should ensure timely availability of foundation and breeder seeds, and also improve on extension services by providing updated recommendations and agronomic practice guides.

### (b)     Government seed inspectors

The Government seed inspectors should ensure timely inspection of seed fields to ensure the best seed purity. Seed companies also advised that the seed inspectors should increase the frequency of soybean fields' inspection.

### (c)     Farmers

Farmers were advised to place their seed orders in advance to ensure timely delivery by the company/stockiest and that they should incoporate soybean in their diets to improve on health and nutrition at household level.

**Table 31: Key seed company/stockist characteristics**

| Key characteristics | Pearl Seeds | NASECO | Victoria Seeds |
|---|---|---|---|
| Seed Source | MAK | MAK | MAK |
| Price of soybean seed (Ush/kg) | 5,000 | 5,000-10,000 | 6,000 |
| Soybean variety ranked 1 | Maksoy 3N | Maksoy 2N | Maksoy 3N |
| Soybean variety ranked 2 | Maksoy 2N | Namsoy 4M | Maksoy 2N |
| Soybean variety ranked 3 | Maksoy 1N | - | Maksoy 1N |
| Percentage annual sales | 2.5% | Minimal | 30% |
| Selling price of soybean seed | 3,000 | 2,500-3,000 | 4,000 |
| Company has contract with clients | Yes | No | Yes |
| Challenge 1 | Unavailable inoculum | Seed germination loss | Low storage capacity |
| Challenge 2 | Low yields | Seed cost vs. grain cost ratio | Unpredictable market |
| Challenge 3 | Lack of planting technology | Added value seed vs. grain | High prices discourage farmers/stockists |
| Do you interact with seed breeders? | Yes, once a year | Yes, sometimes | Yes , monthly |
| Do you interact with Government seed inspectors? | Yes, once a season | Yes | Yes, once a season |

# 4.  CONCLUSIONS AND RECOMMENDATIONS

## 4.1 Conclusions

The main conclusions from this study are:

(1)   Maksoy 1N is the most known variety at 69.8% followed by Maksoy 3N at 42.5% depending on acreage.

(2)   Maksoy 1N and Namsoy 4M were most preferred (27.5%) followed by Maksoy 3N preferred by 22.7% of the farmers.

(3)   Maksoy 3N was the most preferred variety by seed companies.

(4)   Local market and NGOs are the major source of seed at 27.% and 17.1%, respectively.

(5)   Majority (82.3%) of the farmers grew soybeans as a sole a crop.

(6)   Western region had the highest (23.1%) proportion of farmers who applied inorganic fertilizers followed by Eastern region with 19.2%.

(7)   Average yield ranged from 100 kg/acre in West Nile and 700 kg/acre in Northern Uganda.

(8)   Main problems in land preparation were lack of labor (46.6%) and high labor cost (26%), while access to labor was cited by 74.3% respondents as the main problem in weeding.

(10)  Low soybean prices were considered a challenged by 58% of the respondents

(11)  Soybean contributed on average 43.2% of the total household income from crop sales especially in northern Uganda where 63% of this comes from soybean sales.

## 4.2 Recommendations

(1)   Promote the use of fertilizers to enhance productivity and profit through training farmers in fertilizer application and other recommended agronomic practices.

(2)   Sensitize the rural people on the benefits of incorporating soybean in their diets to improve on health and nutrition at household level.

(3)   Provide platforms for frequent interactions between plant breeders, seed companies and stockists.

(4)   Government should inspection of seed multiplication fields should be more regular to ensure better seed  quality.

(5)   Investment in mechanization in soybean production process (i.e. seed preparation and planting) to reduce drudgery and ensure timeliness of field operations.

(6)   Urgent promotion of varieties Maksoy 4N and Maksoy 5N released in 2013 but not yet known by farmers.

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